Co-funded by the European Union

D3.4 EUreka3D-XR toolbox beta version

Due date: 31/10/2025

Dissemination level: Public

Authors:

Eirini Kaldeli, Leonidas Mavrotas (NTUA)
Marco Pappalardo, Simona Arriva, Marco Falciglia, Gian Paolo Donnarumma, Francesco Generali, Angelo Belfiore (Swing:It)
Nadia Magnenat-Thalmann, Nedjma Cadi, Thiago Freitas (MIRALab)

HISTORY OF CHANGES			
Version	Date	Author or Reviewer	Comments
0.1	29/09/2025	Eirini Kaldeli (NTUA)	Template
0.2	14/10/2025	All WP3 contributors	Complete draft
0.3	20/10/2025	Eirini Kaledeli, All WP3 contributors	First version ready for review
0.4	27/10/2025	Ilaria Fava, Ignacio Lamata Martinez (EGI), Valentina Bachi (PHC)	Peer review
0.5	29/10/2025	All WP3 contributors	Final version
1.0	31/10/2025	Valentina Bachi (PHC)	Submitted version

TABLE OF CONTENTS

EXECUTIVE SUMMARY 3

1. INTRODUCTION 4

2. AR TOUR BUILDER (NTUA) 6

2.1 Overview 6

2.2 Backend capabilities 7

2.2.1 Database schema 7

2.3 UI capabilities 9

3. AR TOUR EXPERIENCE (NTUA) 11

3.1 Overview 11

3.2 Basic capabilities and testing outcomes 12

3.2.1 Testing at the Bibracte archaeological site 13

4. AI 3D BUILDER (SWING:IT) 15

4.1 Overview 15

4.2 Basic capabilities and workflows 16

5. 3D XR STUDIO (SWING:IT) 17

5.1 Overview 17

5.2 Basic capabilities and workflows 18

6. AVATAR BUILDER (MIRALAB) 19

6.1 Overview 19

6.2 Basic capabilities and testing outcomes 21

6.2.1 Basic capabilities 21

6.2.2 Testing outcomes 22

CONCLUSIONS 24

EXECUTIVE SUMMARY

This document accompanies the Deliverable 3.4 “Toolbox Beta version“ in order to provide documentation on the status (testing phase) of the tools that make up the EUreka3D-XR toolbox, namely:

Tool name	Main purpose	Pilot scenario	Link to main demonstration material
AR Tour Builder	Create AR tours where cultural heritage objects can be located on the map	Bibracte	Guide for workflow in using the tools: https://eureka3d.eu/wp-content/uploads/2025/10/EUreka3DXR_ARTourBuilderAndExperienceWorkflows.pdf
AR Tour Experience	Allow site visitors to access the AR tour	Bibracte	Demo video for Bibracte’s tour: https://www.youtube.com/watch?v=z4JbvSN5_sM
AI 3D Builder	Reconstruct 3D models of lost heritage from archival materials	Girona	Demo video/tutorial: https://www.youtube.com/watch?v=BqZFpM2HX0s
3D XR Studio	Position and share the 3D models on an AR experience	Girona	Guide for workflow in using the tools: https://eureka3d.eu/wp-content/uploads/2025/10/EUreka3DXR_3DXRStudio.pdf Demo video/tutorials: web component - https://www.youtube.com/watch?v=s2TqBQKFEUs app component - https://www.youtube.com/watch?v=f80IrrFyM34
Avatar Builder	Create animated and speaking 3D models of human characters	Cyprus	Demo video/tutorial: https://www.youtube.com/watch?v=C41Hs9EUxYY Demo video for Saint Neophytos’ avatar: https://www.youtube.com/watch?v=mAGz92ijjvE

For each tool, an overview is provided by the software developer, with descriptions and links to access the prototype and related software or resources. Additionally, screencasts, screenshots or videos are provided to offer a glimpse of how the tools appear to users and demonstrate how they function. Complementary information about capabilities and outcomes are also provided.

The five tools are tested in three pilot scenarios, set in different locations in Europe. Feedback collection and evaluation, both internal and external, are supporting the iterative development.

1. INTRODUCTION

This deliverable presents the beta version (testing phase) of the five tools that comprise the EUreka3D-XR toolbox, namely:

- **AR Tour Builder**: A web application for specifying AR tours by associating cultural heritage objects stored in online repositories, including 3D objects, with locations on a map (developed by NTUA)
- **AR Tour Experience**: A mobile app that allows visitors to experience AR tours by visualising 3D digital objects within the physical environment and access several types of information associated with certain locations (developed by NTUA)
- **AI 3D Builder**: A 3D Modelling software pipeline that uses AI and digital photo archives (developed by Swing:It)
- **3D XR Studio**: A web tool for creating AR experiences, using a range of predefined layouts for UX and UI (developed by Swing:It)
- **Avatar Builder**: A framework that guides users in creating, animating, and preparing avatars for multiple visualisation platforms (developed by MIRALab)

The beta version of the tools implements the technical requirements defined in *D3.1 Technical requirements*[1] and the scenarios' needs as specified in *D2.1 Pilot Specification and planning*[2].

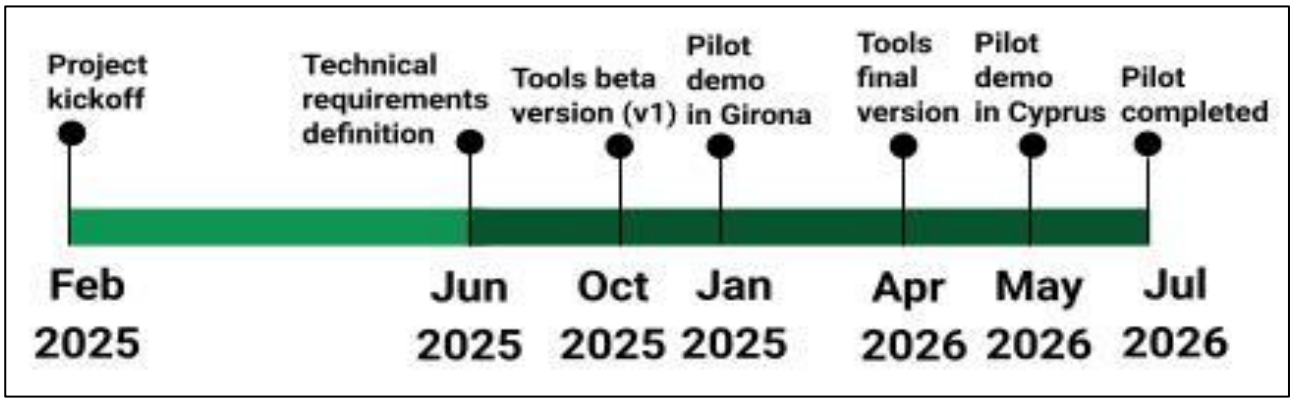


Fig. 1.1: General planning and main milestones for the development of the tools

While each tool is tested in a specific pilot scenario within the project lifetime, all tools are designed in a generic way in order to allow reuse across various application scenarios. The tools' functionalities have been co-designed through the collaboration between technical partners and partners from the cultural heritage sector, taking the needs of the pilot scenarios as the starting point. The tools are being developed iteratively based on the outcome of testing and feedback collection, which, among other, includes advice from the EUreka3D-XR Advisory Board of experts[3]. The Advisory Board provided initial feedback during a dedicated meeting held on 8 July 2025, as well as further insights during a focus group on tool assessment organized on 31 October 2025.

[1] Available at: https://eureka3d.eu/wp-content/uploads/2025/07/EUreka3D-XR-D3.1-Technical-Requirements.pdf
[2] Available at: https://eureka3d.eu/wp-content/uploads/2025/07/EUreka3D-XR-D2.1-Pilot-specification-and-planning.pdf
[3] https://eureka3d.eu/advisory-board/

Both the scenarios and the respective tools were presented publicly in their initial stage of development on various occasions, such as the Europeana Aggregators Forums in Spring and Autumn 2025 and the "Reimagining cultural heritage in 3D and XR" capacity building event held in Brussels on 26/9/2025. A demo event in Girona on 29/1/2026 is the next milestone that will present the prototypes to stakeholder communities.

The document is structured as follows. Sections 2-6 provide an overview of each tool, including essential information about its license, development status, etc., as well as links to further material that demonstrate the functionalities of each tool. Section 7 concludes with some lessons learnt and next steps.
The diagram below depicts the overall schedule for the toolset releases and respective milestones.

2. AR TOUR BUILDER (NTUA)

2.1 Overview

AR Tour Builder	
Short Description	The AR Tour Builder is a web application that supports the design **of AR tours by associating 3D objects and other types of content (e.g. images, audio, text) to specific locations on a map**. The builder is intended for CH professionals and other stakeholders who wish to prepare engaging experiences for their on-site visitors. The platform offers asset management capabilities that allow users to pin content selected from online platforms such as Europeana, the EUreka3D Data Hub or CH organisations' own repositories. The user can specify multiple tours (e.g. short and longer tours, tours addressed to children, etc.) for the same geographical area, organised under Projects. Each tour consists of a set of georeferenced Points of Interests, each of which can encompass a set of various types of media assets as well as contextual information. The builder supports the creation of multilingual tours, where both the content and tour-specific information can come in multiple languages. The tours can then be accessed on-site via the companion AR Tour Experience mobile app, which presents the curated multimodal content based on the user's geolocation. The focus is on outdoor experiences, enabling rich engagement with cultural sites through AR overlays, images, videos, audio, and textual content.
Developed by:	NTUA
Main achievements so far	Features implemented as part of v1 (beta version) include: - API functionalities supporting: user and user group management (sign in, sign up, etc.); asset management (creation, editing, deletion); project, tour and Points Of Interest management - Setup of a Django web framework and a Postgres database - Partly functional User Interface: all pages designed but not integrated with the backend (ongoing implementation)
Next steps	Features planned for v2 (intermediate release by Jan 2026): - Fully functional User Interface, integrated with the backend - Backend/API refinement (schema updates, fixes, etc.) - Interoperation with established platforms: Support for searching and selecting Europeana assets - Possibility to position other maps (e.g. LIDAR, historical maps) on top of OpenStreet maps will be considered - Integration with EGI Check-in - Integrated testing with the AR tour explorer and iterative improvements
Available on:	Latest version of source code on Github: https://github.com/EUreka3D-XR/AR-Tour-Builder API (documented in Swagger): https://eureka.ails.ece.ntua.gr/api/docs/ Tentative web tool version available on: https://eureka.ails.ece.ntua.gr/

Licence:	Apache 2.0
Accompanying material:	Guide for workflow in using the tools: https://eureka3d.eu/wp-content/uploads/2025/10/EUreka3DXR_ARTourBuilderAndExperienceWorkflows.pdf

2.2 Backend capabilities

The backend has been built using the Django web framework[4]. All capabilities offered by the AR Tour Builder are exposed via a well-defined API, accessible to any authorised third-party application. The following sets of functionalities have been implemented and are fully functional:

- User management: User authentication, account management, and user-related operations, including login, signup, and user listing.
- User groups: Manage user groups and group membership for collaborative projects.
- Project: Create and manage tours with group-based permissions and metadata.
- Assets: Manage media assets (images, videos, audio) with automatic thumbnail generation and metadata. Supports creation of projects or POIs with source asset selection.
- Tours: Build and manage interactive tours with customizable routes, content, and multilingual support.
- Points Of Interest: Manage Points of Interest (POIs) with rich metadata, coordinates, and multilingual content.

2.2.1 Database schema

A Postgres database has been set up, and all structures representing the various elements (users, user groups, projects, tours, assets, maps, POIs and their sub-elements) have been defined and implemented. The Entity Relational diagram of the database schema can be seen in the following Figures 2.1 and 2.2.

[4] https://www.djangoproject.com/

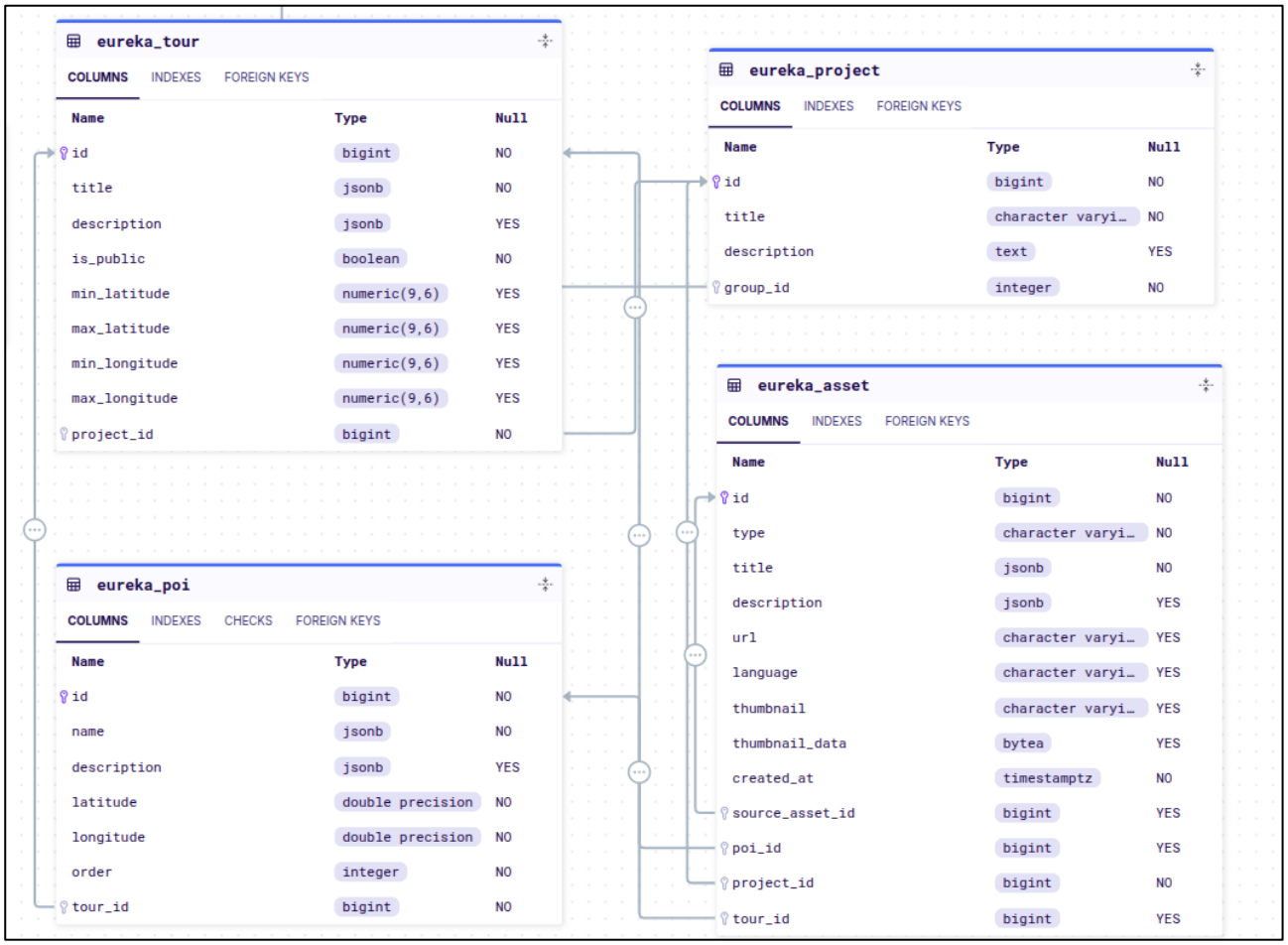


Fig. 2.1: ER Diagram presenting the main elements of the AR Tour Builder database: Project, Tour, POI and Asset.

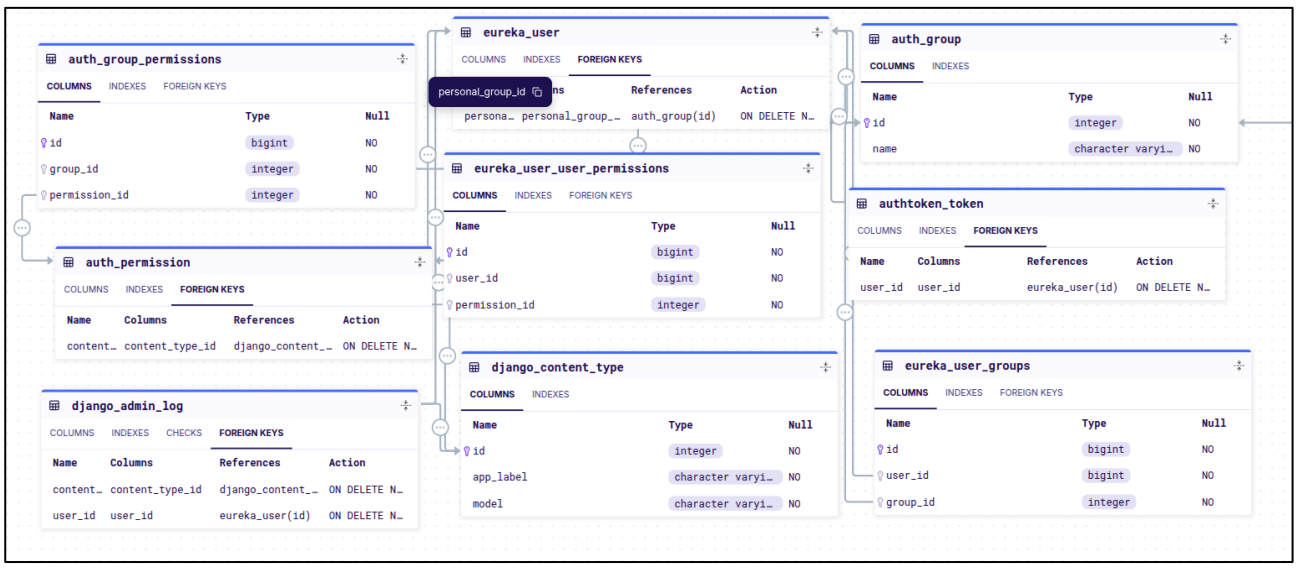


Fig. 2.2: ER Diagram underpinning the elements of the user management system.

2.3 UI capabilities

The implementation of the User Interface of the AR Tour Builder is still ongoing, since the focus during the first period of the project was on the development of the AR Tour Experience app and its interactions with the AR Tour Builder backend, allowing for its early testing at the Bibracte site and the collection of useful feedback. The pages supporting the entire workflow, from the library page and project/tour creation to assets population and POI editing, have been designed. Not all pages are fully functional yet, since the integration with the backend (API calls) is ongoing.

Below some indicative screenshots of the AR Tour Builder's pages are provided. As mentioned, a detailed overview of the basic workflow steps supported by the tool, along with the respective web pages is also available for users on EUreka3D-XR website[5].

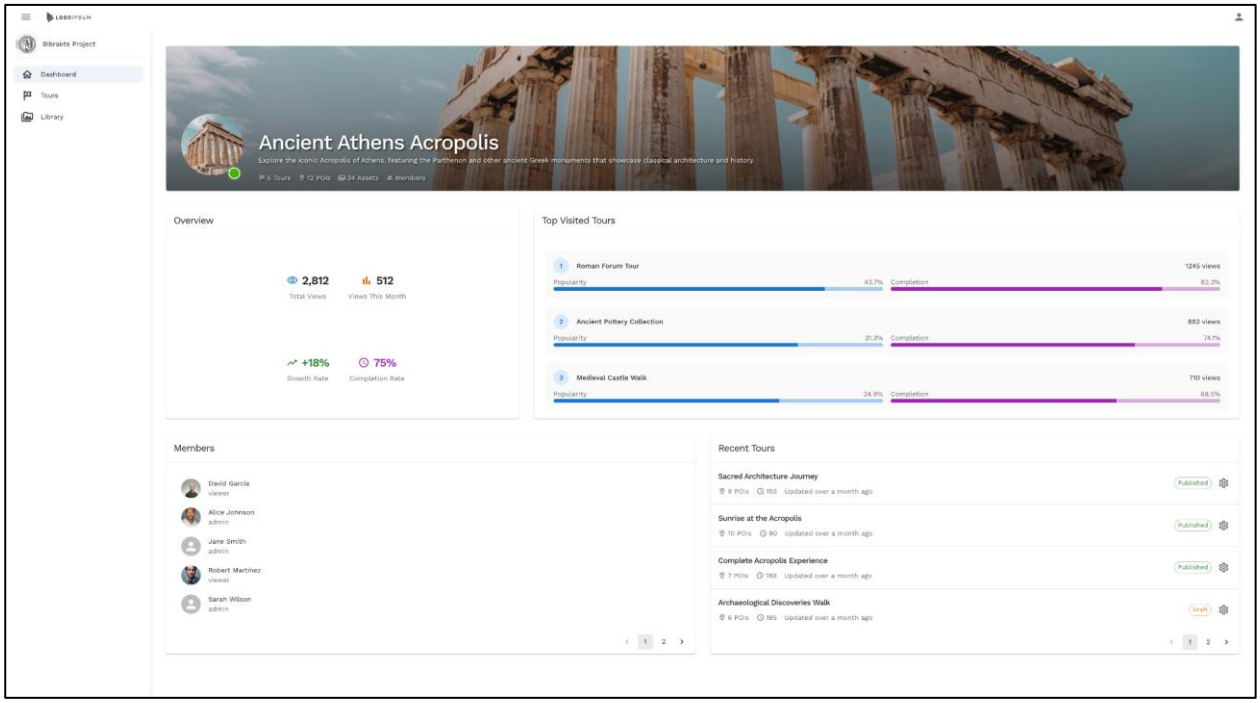


Fig. 2.3: Screenshot of a Project Dashboard Overview page

[5] Workflow: https://eureka3d.eu/wp-content/uploads/2025/10/EUreka3DXR_ARTourBuilderAndExperienceWorkflows.pdf

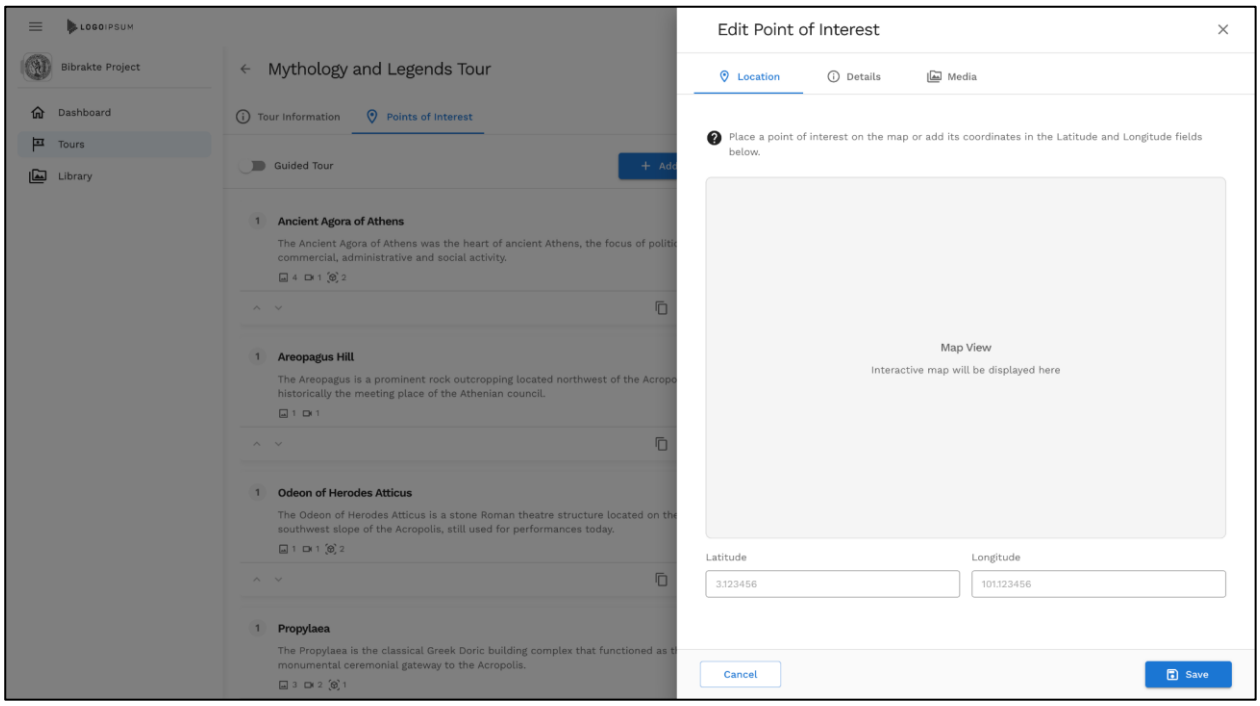


Fig. 2.4: Screenshot from the POI Editor Sidebar - POI's location information

3. AR TOUR EXPERIENCE (NTUA)

3.1 Overview

AR Tour Experience	
Short Description	The AR Tour Experience is a **mobile app that complements the AR Tour Builder tool and serves the tours designed via the AR Tour Builder to on-site visitors**. Through a clean and intuitive interface, visitors can browse and select tours available in their location based on their preferences. The app uses GPS to provide real-time navigation, detecting when users approach certain points of interest and prompting them to visualise the various types of content (3D models, images, video, audio and text) associated with them. The 3D models can be displayed either in a dedicated 3D viewer or overlaid on the physical environment, as captured by the mobile camera. These AR views can be used to enhance on-site points of interest with elements that are no longer visible or present on the location, such as backfilled excavations, virtual reconstructions, or artefacts currently exhibited in a museum. The app also supports tour progression tracking and offers practical features such as pre-downloadable content for low-connectivity environments. The application is implemented for Android devices.
Developed by:	NTUA
Main achievements so far	Features implemented as part of v1 (beta version) include: - Navigation pages for browsing projects and tours - Tour navigation on a map - Prompting based on GPS tracking - PoI page with various multimedia content - Dedicated visualisation pages for different types of assets (images, documents, links..) - 3D viewer for exploring 3D objects along with supporting audio - AR view for visualising 3D objects either anchored on a specific position based on georeferencing information or freely positioned - Multilingual support
Next steps	Features planned for v2 (intermediate release by Jan 2026): - Improvements and bug fixing in light of testing results at Bibracte, e.g. to deal with issue of underground structures necessarily appearing above ground, the AR mode will be revised so as to display 3D models when visitors approach them and hide them when they move away - Improvements in file management (smart caching) - Improvement in georeferencing 3d models in the AR experience - We will explore the possibility to visualise other maps (e.g. LIDAR, historical maps) on top
Available on	Latest version of source code on Github: https://github.com/EUreka3D-XR/AR-Tour-Builder-backend The first version of the mobile app is available upon request (available only for testing)
Licence	Apache 2.0

Accompanying material	Guide for workflow in using the tools: https://eureka3d.eu/wp-content/uploads/2025/10/EUreka3DXR_ARTourBuilderAndExperienceWorkflows.pdf Demo video for Bibracte's tour: https://www.youtube.com/watch?v=z4JbvSN5_sM

3.2 Basic capabilities and testing outcomes

All the important functionalities of the AR Tour Experience mobile app as prescribed in *D3.1 Technical Requirements* document have been implemented and tested (see also next Section about the testing outcomes).

Below, we provide some indicative screenshots and photographs of the Bibracte tour, taken from the testing of the mobile app at the archaeological site. More shots from the Bibracte tour can also be found in the demo video[6]. A detailed overview of the basic workflow steps the app supports and the respective screens presented to the user is available and published on the project's website, as linked in the table above.

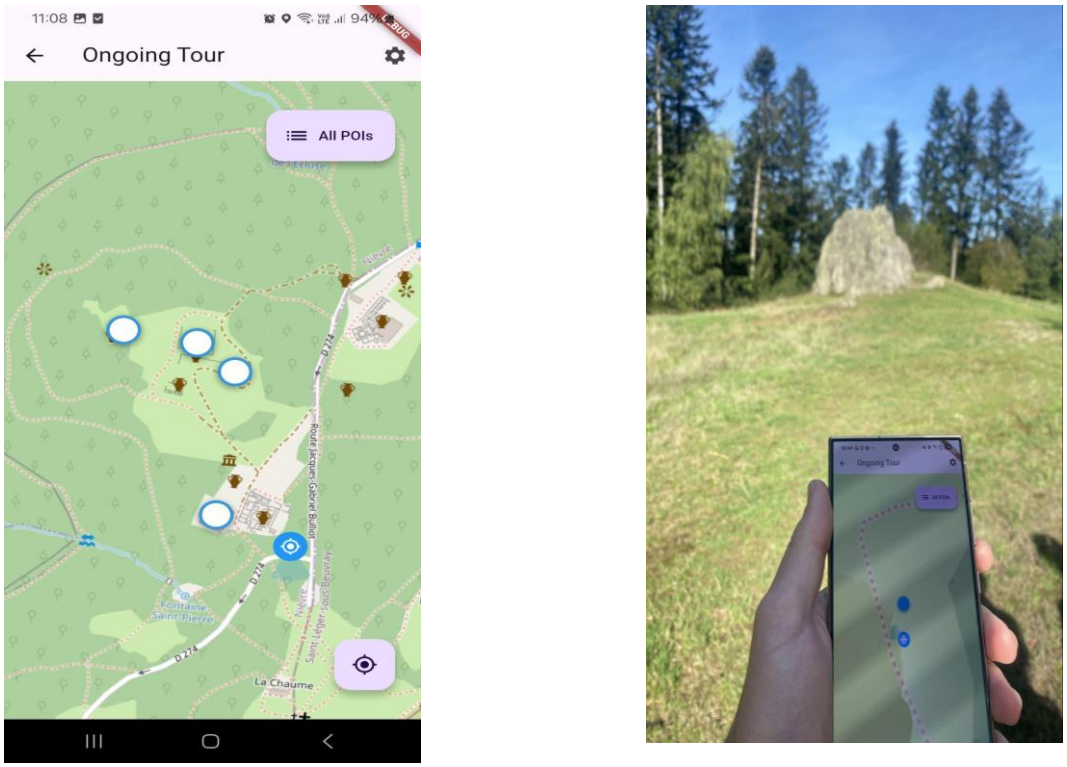


Fig. 3.1: Starting a tour: a) map view with POIs b) photograph from testing session at the Bibracte archaeological site.

[6] Demo video: https://youtu.be/z4JbvSN5_sM

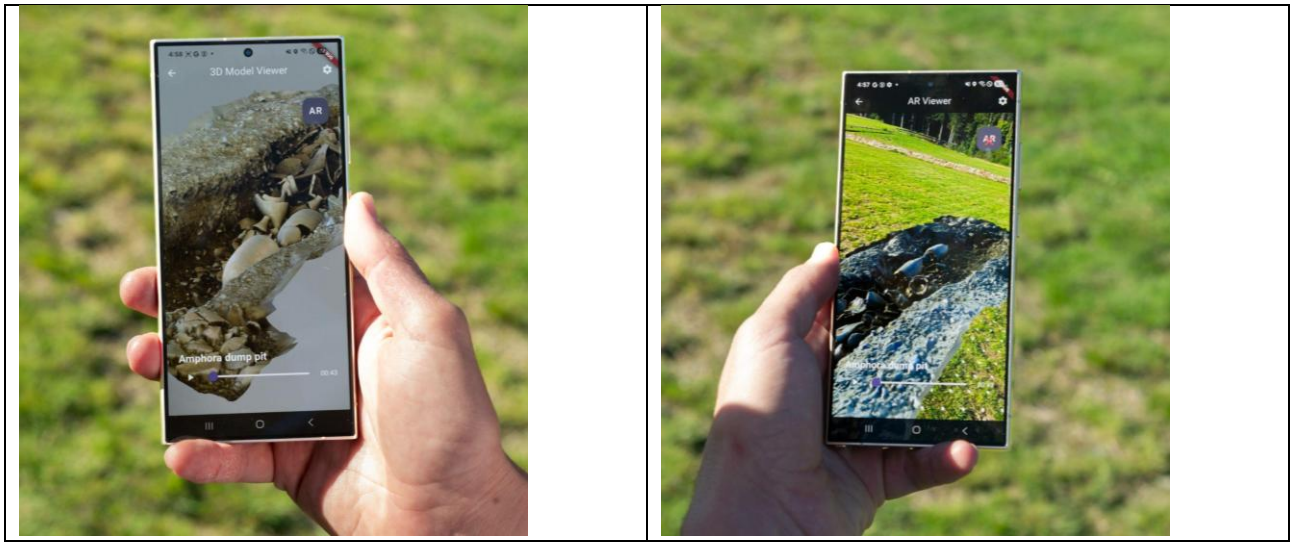


Fig. 3.2: Example of 3D models as they appear in Bibracte: a) 3D model with associated audio presented in 3D viewer. The possibility to switch to AR mode appears on the top left; b) 3D model in AR view.

3.2.1 Testing at the Bibracte archaeological site

A first prototype of the mobile app was tested during a dedicated visit at the Bibracte archaeological site on September 17–18, 2025. The aim was to assess the smoothness of navigation, the relevance of geolocated content, and the immersive quality of the 3D models and to identify potential shortcomings and guide future adaptations and improvements.

Initial trials confirm the good responsiveness of the interactive map, which smoothly displays points of interest based on the visitor's location. Supplementary media (images, PDFs, videos) were easily accessible, although the interactive quizzes still depend on Wi-Fi coverage. Regarding the display of 3D objects, the view modes were, in general, functional, allowing visitors to zoom, rotate, and explore associated information, including audio files. The AR experience—tested mainly on an amphora dump pit—produced a high-quality result: the model, well anchored to the ground, allows users to move around it and observe details as if they were really there.

Three main issues have been identified:

a) AR visualisation of 3D models that include underground parts: Parts of such 3D object models appear "floating" above the ground, which is problematic for their proper understanding (see Figure 3.3). The approach to overcome this limitation is to display models when visitors approach them and hide them when they move away.

b) Fixed anchoring of 3D models of immovable heritage (e.g. backfilled excavations, missing parts of buildings): Such 3D models require precise georeferencing information to allow for their exact position and accurate orientation. The necessary georeferencing information needs to be added to the 3D model's metadata in the Tour Builder.

c) Some 3D objects are available in formats not supported by the tool (which supports GLB or GLTF) and need to be transformed accordingly.

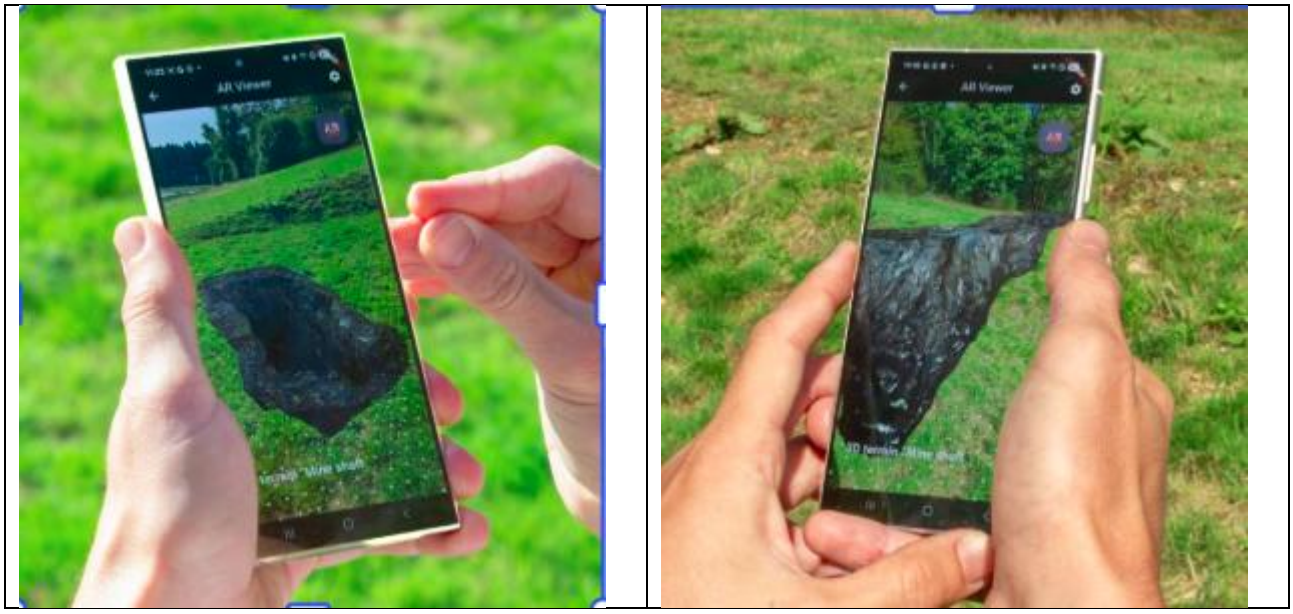


Fig. 3.3. a) Entrance of the mine shaft seen from above. b) Complete structure of the mine shaft seen from the sides.

4. AI 3D BUILDER (SWING:IT)

4.1 Overview

AI 3D Builder	
Short Description	The AI 3D Builder is designed **to transform two-dimensional images into complete, usable three-dimensional models**. Its main goal is to drastically reduce the time required to create 3D assets by automating a process that traditionally demands expertise in modelling, texturing, and rendering. At the heart of this pipeline lies Trellis, a system based on an AI architecture that employs Structured Latents (SLAT) representation, enabling the system to capture visual characteristics and implicit spatial relationships to reconstruct three-dimensional shapes coherently and realistically.
Developed by:	Swing:IT
Main achievements so far	Features implemented as part of v1 (beta version) include: ● Image upload via web interface ● Configuration of generation and optimisation parameters ● Execution of Trellis AI engine ● Export of generated models in GLB format, compatible with most 3D viewers and rendering engines ● Refinement through manual post-processing steps involving mesh simplification and texture cleanup ● Dedicated GPU backend with a communication API system ● Functional user interface and temporary storage for data during processing ● Integration with EUreka3D Data Hub for storage and content distribution
Available on	Source code on Git Repository: https://github.com/EUreka3D-XR/AI-3D-Builder Web Service: ai3dbuilder.eureka3dxr.fedcloud.eu
Next steps	Features planned for v2 (release by Jan 2026): ● Trellis model tuning for more precise control over balance between visual quality and processing time Improved workload management and shorter waiting times
Accompanying material	Demo video/tutorial: https://www.youtube.com/watch?v=BqZFpM2HX0s

4.2 Basic capabilities and workflows

Technologies and Framework: The AI pipeline is built around **Trellis**, using Structured Latents (SLAT) representation. Trellis runs on **GPUs** with at least **16 GB of VRAM** for optimal performance. The backend architecture includes: REST API layer, job orchestration module, temporary storage for intermediate files, and data encryption system.

User Interface: Web-based interface allowing users to upload images and configure generation parameters including Quality/Detail, Guidance Strength, and Simplification Parameters. Communication with the backend via REST API calls.

Output: Primary output is GLB file (glTF family format), designed for web and augmented reality. Also supports Radiance Fields and Gaussian Representations for research contexts.

Integrations: Compatible with EUreka3D Data Hub. Generated models can then be transferred to the 3D XR Studio for reuse in building immersive experiences.

5. 3D XR STUDIO (SWING:IT)

5.1 Overview

3D XR Studio	
Short Description	The 3D XR Studio is a **web-based authoring tool** that allows users to create immersive experiences in **Extended Reality (XR)** and **Augmented Reality (AR)**. It enables users to combine different types of multimedia content (3D models, images, videos, audio, and text) into interactive scenes, creating narrative paths and virtual environments that can be explored via mobile devices or AR/XR headsets. Specifically designed for cultural heritage professionals with an intuitive, no-code interface.
Developed by:	Swing:IT
Main achievements so far	Features implemented as part of v1 (beta version) include: ● Web editor for area selection, 3D model upload, and scene positioning (rotation, scaling) ● Creation of guided tours with multiple stages ● POIs (Points of Interest) enriched with audio, video, images, and text ● RESTful APIs (NodeJS and MariaDB) managing projects, geographic areas, models, and media ● Mobile module with Placement Without Anchors functionality ● Occlusion planes for realistic virtual-real environment interactions ● Administrative tools for object transformation and manipulation ● Mini-map for orientation and guided tour visualisation ● Interactive POIs with multimedia content ● Multilingual content support
Available on	Source code on Git Repository: https://github.com/EUreka3D-XR/3D-XR-Studio Web Service: 3dstudioxr.eureka3dxr.fedcloud.eu
Next steps	Features planned for v2 (release by Jan 2026): ● SSO Integration (EGI Check-in) for authentication and access management ● User Experience (UX) Refinement in web editor ● Performance and stability optimisations for APIs
Accompanying material	Guide for workflow in using the tools: https://eureka3d.eu/wp-content/uploads/2025/10/EUreka3DXR_3DXRStudio.pdf Video showcasing 3D XR Studio operation: https://www.youtube.com/watch?v=BoME1m1-lnw

5.2 Basic capabilities and workflows

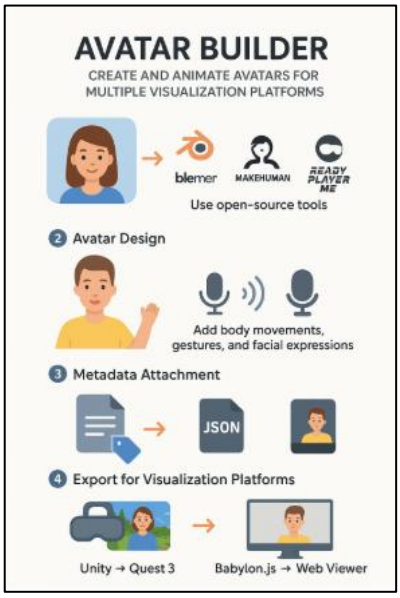
Technologies: Hybrid architecture with a Web component for editing/design and a Mobile component for in-situ visualisation. Backend based on RESTful API (NodeJS and MariaDB). Innovative Placement Without Anchors approach using coordinates and virtual geometric references.

Application Type: Hybrid web and mobile system providing a cohesive workflow: design on web, validate on-site, refine online, and distribute for public access.

Integrations: Fully integrated into EUreka3D-XR project workflow. Curators access via EGI Check-in. Compatible with EUreka3D Data Hub for asset management. Part of an interoperable chain supporting the complete life cycle of digital cultural assets.

6. AVATAR BUILDER (MIRALAB)

6.1 Overview

Avatar Builder	
Short Description	The use of virtual humans in cultural heritage offers significant advantages for interpretation, education, and audience engagement. By embodying historical or fictional personas, virtual humans can serve as interactive mediators bridging the gap between visitors and cultural content. To effectively support the creation and deployment of virtual humans in cultural heritage contexts, a structured and accessible production process is essential. Developing expressive and platform-compatible avatars typically requires technical expertise in 3D modelling, animation, and software integration, skills that are often beyond the reach of curators or heritage professionals. The Avatar Builder addresses this challenge providing a **process framework that guides users in creating, animating, and preparing avatars for multiple visualisation platforms** (Fig. 6.1). By leveraging open-source, accessible software, the tool makes avatar production possible for non-experts while ensuring compatibility with immersive VR/MR environments and web-based 3D viewers.  Fig. 6.1: Visual process guide Complementing this framework, we have also developed the **EUreka3D-XR Web Viewer**. This web-based application enables the **visualisation and sharing of 3D content, ranging from static objects to fully animated avatars with synchronised audio**. The viewer provides a lightweight and accessible way to explore these creations directly through the EUreka3D-XR Data Hub: once a 3D file or animation is uploaded, users can visualise it online simply by providing its file ID. This seamless integration facilitates easy deployment, collaborative review, and public dissemination, allowing researchers, museum professionals, and other stakeholders to interact with cultural heritage assets and their digital representations within an intuitive browser-based environment.
Developed by:	MIRALab
Main achievements so far	• Defined an open pipeline for avatar creation with free and easy tools. • Enabled avatars to be cross-platform compatible (Unity + WebGL/Babylon.js). • Developed the first version of the EUreka3D-XR Web Viewer. To date, we have conducted a series of evaluations and comparative tests among existing open-source tools to identify the most effective workflow for creating and deploying 3D avatars. The primary objective was to establish a fully open-source, user-friendly, and accessible pipeline. Through these tests, we developed and validated a process that guides users from avatar creation and animation to export and integration within visualisation platforms such as Unity (for Quest 3 immersive applications) and Babylon.js (for web-based visualisation). This workflow ensures that individuals without advanced technical expertise

	can efficiently produce, animate, and deploy interactive avatars across multiple platforms using freely available tools. In parallel, we have developed the EUreka3D-XR Web Viewer to visualize both static and animated 3D models, including several key functionalities: ● Animation controls for play, pause, and reset; ● Speed adjustment to slow down or accelerate the animation; ● Timeline slider to navigate to specific moments in the animation; ● Audio synchronisation ensuring alignment between motion and sound; ● Background customisation with different colour options; ● Lighting and environment controls to adapt the scene's ambience.
Next steps	● Integration of an accessible solution for facial animation and text-to-speech (TTS) generation ● Create training materials (tutorials, workshops, guides) for non-technical users. ● Develop ready-to-use avatar templates (starter packs). ● Extension of the EUreka3D-XR Web Viewer with enhanced navigation, content management, and visualisation features. One remaining aspect currently under investigation is the integration of an accessible solution for facial animation and text-to-speech (TTS) generation. The goal is to identify an open-source tool or workflow that allows non-technical users to generate speech from text or audio input easily and automatically produce corresponding facial animations. At present, this step remains technically demanding for users without prior experience in 3D animation or programming. However, developing a clear, step-by-step tutorial and guided interface could significantly lower the learning curve and enable curators or other non-specialists to create expressive, speech-enabled avatars within the proposed pipeline independently. In parallel, several enhancements to the EUreka3D-XR Web Viewer are planned to expand its functionality and improve user experience. These include: ● Scene switching, allowing users to jump between different 3D scenes (GLB files), each containing distinct animations, through a dropdown menu; ● Support for narration-only modes, enabling the playback of audio descriptions even when visualised objects are static (without animation); ● Extended format compatibility, including handling of additional 3D formats such as .ply; ● Support for multi-file packages, where multiple animation files can be stored within a single .zip entry in the Data Hub; ● Improved data management and visualisation, ensuring seamless interaction with the EUreka3D Data Hub and better organisation of assets and associated metadata. These developments will make the web viewer a more comprehensive and flexible visualisation tool, capable of presenting complex narrative scenes, multiple animation sequences, and detailed cultural heritage objects within a single, accessible online interface.
Available on	First version of a Step-by-step User Guide video with instructions for creating, animating and exporting avatar for Web visualisation: https://www.youtube.com/watch?v=C41Hs9EUxYY Source Code for EUreka3D-XR web based 3D viewer, to be used for animated and static 3D models: https://github.com/EUreka3D-XR/WebAnimationViewer

Licence	• The process itself → Open / Creative Commons methodology • Avatars and assets → depend on the open-source tools and models used • Web Viewer Source Code: Released under the MIT License and publicly available for reuse and adaptation.
Accompanying material	Demo video for Saint Neophytos' avatar: https://www.youtube.com/watch?v=mAGz92ijjvE Demo example for the EUreka3D-XR Web-based 3D Viewer, allowing users to visualise and interact with both static and animated 3D content directly in a web browser. It can be accessed here. Work in progress for additional resources: • Complete user guide document about creation/customisation and animation of Virtual Humans • Sample avatars • Metadata templates (JSON schema). • Best practices for exporting avatars on different visualisation platforms (Unity, Babylon.js)

6.2 Basic capabilities and testing outcomes

6.2.1 Basic capabilities

- Avatar Creation
  - Use open-source tools (Blender, MakeHuman).
  - Customise appearance, clothing, and features.

- Animation & Voice
  - Add body movements, gestures (MIxamo tools), and facial expressions.
  - Integrate voice (recorded audio or TTS).
  - Apply lip-syncing tools (e.g., Rhubarb Lip Sync for Blender).

- Metadata Enrichment
  - Attach metadata (role, ID, scenario context).
  - Save metadata in open formats (JSON, CSV).

- Export for Visualisation Platforms
  - Export to GLTF/GLB (for Babylon.js Web Viewer).
  - Export to FBX/Unity package (for Quest 3/Unity).

6.2.2 Testing outcomes

Saint Neophytos scenario:

The produced avatars have been successfully tested across both VR and web-based visualisation environments. In the VR application, users can experience an immersive reconstruction of the world of Saint Neophytos in Paphos, where the saint's avatar appears inside the Enkleistra (the hermit's cave) and delivers narratives on various aspects of his life and spiritual practices at the site.

Fig. 6.2: Trying the headset in Brussels, 26/9/2025

This first version of the immersive demo was presented in Brussels on 26/9/2025, during the capacity building event "Reimagining cultural heritage in 3D and XR", showcasing the potential of the developed workflow for cultural heritage storytelling (Fig. 6.2).

A recorded video sequence[7] captured using the Meta Quest 3 headset documents an immersive virtual reality (VR) experience featuring Saint Neophytos narrating stories about his life and the Enkleistra. It provides both visual and auditory insight into the narrative and spatial design of the VR environment, allowing for an in-depth examination of user engagement, storytelling techniques, and the integration of historical or cultural content within immersive media.

Web Version (tests performed):

- **3D asset formats**: Verified loading and visualisation of GLB (with and without animation) and OBJ (with texture files) models. Examples in Figures 6.3, 6.4, 6.5, and 6.6.
- **Content types:** Confirmed correct handling of static objects and animated scenes (single-file GLB with embedded animations).
- **Audio assets:** Tested MP3 narration files linked to animated avatars; validated user-triggered playback to comply with browser autoplay policies.
- **Data access & integration:** Deployed a local Node.js server to proxy requests and integrate with the EUreka3D Data Hub. Using file IDs, the viewer successfully fetched and rendered GLB/OBJ models and retrieved MP3 audio from the Data Hub.
- **Packaging scenarios:** Tested both single-file uploads (e.g., single GLB) and ZIP packages containing multiple files stored in the Data Hub; confirmed retrieval via the Node proxy.

[7] Demo video: https://www.youtube.com/watch?v=mAGz92ijjvE

Fig. 6.3: Static object (.glb) extracted from .zip file

Fig. 6.4: Static object (.obj) with texture files.

Fig.6.5: Static object (.glb) obtained from the EUreka3D Data Hub directly in the original format

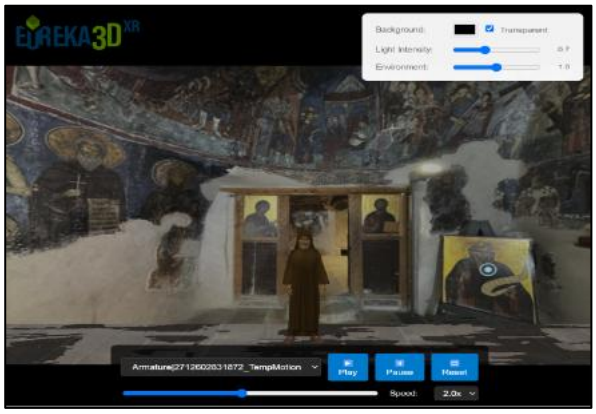


Fig. 6.6: Animation in the viewer with synchronised audio and playback controls.

CONCLUSIONS

This document accompanies the delivery of *D3.4 Toolbox beta version*; it describes the five tools and provides access to the prototypes and other information. The beta version of the tools has been released, and demonstration videos and other types of material have been prepared, showcasing the basic capabilities of the tools.

Already implemented features as well as the additional features planned for the next version of the tools have been specified. Early tests at the pilot sites confirm that the tools meet the defined user and technical specifications. At the same time, early testing allowed us to identify certain shortcomings and directions for improvements to be incorporated in the upcoming versions of the tools. Advice about the tools and scenarios was also collected from the experts of EUreka3D-XR Advisory Board.

A more mature, openly available version of the tools will be demonstrated at a public event to be organised in Girona on 29 January 2026. The final version of the tools will be documented in the subsequent deliverable *D3.5 EUreka3D-XR toolbox final release* (due by M15).