



## Open Educational Resource

### *Exploring Cultural Heritage in a New Way*

*How to use 3D and Extended Reality in the Classroom*

|            |                                                                                                                 |
|------------|-----------------------------------------------------------------------------------------------------------------|
| Topics:    | Archaeology, Cultural Heritage,<br>History of Arts, History of Sciences<br>and Technology, Digital Technologies |
| Age group: | 11-14 years, 14-18 years                                                                                        |

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## Preface

The EUreka3D-XR project (European Union's REKconstructed content in 3D to produce XR experiences), funded by the Digital Europe Programme (2025–2026), aims to facilitate the reuse of digitised 3D cultural heritage collections. In addition to developing free and open-source tools for creating Extended Reality (XR) experiences, the project has produced training resources to support their adoption by heritage professionals. It has also led to the creation of two Open Educational Resources (OERs), including this one, with the aim of promoting the understanding and use of 3D digitisation, Extended Reality, the knowledge underpinning these technologies and, more broadly, digital literacy among teachers, educators, the general public and younger generations.

This resource was developed by Bibracte, a public institution bringing together an archaeological site, a museum and a European research centre dedicated to the study of the Iron Age. Every year, Bibracte welcomes several thousand school pupils, nearly eight hundred archaeology students and researchers, as well as numerous education and heritage professionals through the training activities organised within the PREAC Archaeological Heritage network. For several years, the institution has also been experimenting with the use of digital technologies in archaeology for research, mediation and training purposes. This expertise has informed the development of educational activities and teaching resources.



This OER builds on both the practical experience gained by Bibracte through projects involving a wide range of audiences and on a needs analysis carried out among teachers during previous European projects. It addresses several recurring challenges, including finding suitable educational resources, using 3D and immersive technologies in educational settings, and gaining a better understanding of the legal issues related to the reuse of digital content. It therefore provides methodological guidance together with three ready-to-use educational activities for introducing learners to 3D models and Extended Reality.

Designed according to the principles of Open Educational Resources (OERs), this publication may be freely reused, adapted and enriched by schools, heritage institutions, science centres and other educational organisations.

We hope it will help you develop educational activities in which 3D and Extended Reality become genuine tools for observing, understanding and interpreting cultural heritage, while encouraging young people to develop a critical, creative and responsible approach to digital technologies.

For more information about the EUreka3D-XR project and access to all available resources, please visit: <https://eureka3d.eu/eureka3d-xr/>

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# 1. About this OER

## 1.1 Practical information

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topics:                | Archaeology, Cultural Heritage, History of Art, History of Science and Technology, Digital Technologies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Age group:             | 11-14 years, 14-18 years                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Educational Programme: | History, Geography, Classical Languages and Civilisations, History of Art, Science, Technology                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Time:                  | 45 min, 2 h or several days, depending on the activities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Materials & Tools:     | Computers and, depending on the activities, Android smartphones or tablets compatible with ARCore.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Skills Developed:      | <ul style="list-style-type: none"> <li>- Observe, analyse and interpret different representations of cultural heritage (images, 3D models and immersive environments).</li> <li>- Understand the principles underlying heritage reconstructions.</li> <li>- Explore the concepts of scale, perspective and viewpoint.</li> <li>- Ask questions, formulate hypotheses, test them and justify their conclusions.</li> <li>- Search for information and digital resources from cultural institutions and online repositories.</li> <li>- Organise information, place it in its historical and geographical context, and establish connections between sources.</li> <li>- Work collaboratively, share information and build collective interpretations.</li> <li>- Develop a critical understanding of digital technologies and their uses.</li> </ul> |
| Learning objectives:   | Discover how 3D digitisation and Extended Reality can help observe, understand and enhance cultural heritage. Experiment with these technologies through practical activities in order to develop both digital heritage literacy and a critical understanding of their uses.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## 1.2 Guidance for Teachers

### 1.2.1 Introducing the environmental impact of 3D and Extended Reality

3D digitisation and Extended Reality technologies offer new opportunities to study, preserve and showcase cultural heritage. However, they rely on digital equipment, intensive computing processes, data storage in data centres and the transfer of sometimes very large digital files. All these stages consume electricity, require cooling systems (often involving significant water consumption) and contribute to the environmental footprint of digital technologies.

This provides an opportunity to question the relevance of different uses. Do 3D models and Extended Reality genuinely provide added value compared with a photograph, a plan, a video or a physical model? In which situations are these technologies essential, and when would other forms of representation be sufficient?

Conversely, many heritage applications fully justify the use of 3D digitisation. It can preserve an accurate digital record of sites and artefacts threatened by conflict, natural disasters or erosion; enable the study of fragile objects without handling them; facilitate knowledge sharing between researchers; improve the accessibility of collections and heritage sites; and contribute to the fight against the illicit trafficking of cultural property by supporting the identification of stolen artefacts through reference 3D models.

These issues can be explored with learners using concrete examples, encouraging them to compare different modes of representation and identify situations in which 3D and immersive technologies provide genuine added value. Such discussions contribute both to digital citizenship education and to raising awareness of digital sustainability.

The activities proposed in this resource make use of technologies whose environmental footprint can be significant. Their use should therefore remain proportionate to the educational objectives and provide an opportunity to develop learners' critical thinking about digital technologies and their environmental impact.

### **1.2.2 Understanding Extended Reality and Explaining It to Your Audiences**

No particular expertise in digital technologies is required to use this resource. The proposed activities have been designed for teachers, educators and facilitators to implement, either individually or as part of a team.

If you would like to deepen your understanding of Extended Reality (XR), Augmented Reality (AR), Mixed Reality (MR) and Virtual Reality (VR) before carrying out the proposed activities, we recommend reading the article "XR in Cultural Heritage: AR, MR and VR Explained", available at: <https://pro.europeana.eu/post/xr-in-cultural-heritage-ar-mr-and-vr-explained>

A diagram illustrating the Reality–Virtuality Continuum is provided in Appendix 1. You may use it to introduce the concept of Extended Reality to your learners.

### **1.2.3 Recommended Learning Sequence**

We recommend beginning with the construction game “On the Shoulders of the Celts”, whose Open Educational Resource is available at:

<https://eureka3d.eu/wp-content/uploads/2026/09/On-the-shoulders-of-the-Celts.pdf>. The game provides an effective introduction to the activities presented in this resource by placing 3D digitisation and Extended Reality within the long history of techniques for replicating objects and representing the world.

Each of the three activities can be introduced through one or more themes from the game. The guidance provided in the following pages will help you select the most appropriate elements or, if you choose not to use the game, simply reuse the historical examples and concepts it presents.

## 2. How to use this educational resource

### 2.1 Exploring Cultural Heritage through 3D Models

#### 2.1.1 Learning Objectives

Use 3D models to observe, manipulate and compare heritage objects and sites in order to improve understanding, reveal details that are difficult to perceive in a photograph, and encourage critical reflection on the benefits and limitations of 3D digitisation.

#### 2.1.2 Finding and Viewing 3D Models

- View 3D models online: Heritage 3D models can be explored directly online using the viewers integrated into the platforms that host them. This solution requires no software installation and provides easy access to both the models and their metadata, provided that a stable Internet connection is available.
- Download 3D models: When Internet access is limited or unreliable, it is preferable to download the models beforehand and open them using a 3D viewer installed on classroom computers. This allows activities to be carried out offline and ensures a smoother learning experience. Several free applications are suitable for this purpose, including MeshLab, available for Windows, macOS and Linux, and 3D Viewer, which is pre-installed on many Windows computers. These applications allow users to rotate, zoom, change viewpoints, switch between surface and wireframe rendering, take measurements and examine models in far greater detail than is possible with a simple photograph.

Platforms for viewing and downloading 3D models (non-exhaustive list):

| Platforme                  | Language          | Download | Cultural Heritage | Comments                                                                                                                  |
|----------------------------|-------------------|----------|-------------------|---------------------------------------------------------------------------------------------------------------------------|
| Europeana                  | EN, FR, DE, ES... | ✓*       | ✓✓✓               | Aggregates collections from thousands of European cultural heritage institutions.                                         |
| OpenHeritage <sup>3D</sup> | EN                | ✓        | ✓✓✓               | High-quality 3D models of endangered heritage sites from around the world, produced by the non-profit organisation CyArk. |
| MorphoSource               | EN                | ✓*       | ✓✓                | Primarily dedicated to scientific collections, with a smaller number of heritage models.                                  |
| Smithsonian 3D             | EN                | ✓        | ✓✓✓               | Digitised collections from the Smithsonian Institution.                                                                   |
| eCorpus                    | EN, FR            | ✓        | ✓✓✓               | French heritage collections, particularly archaeological sites and historic monuments.                                    |
| Sketchfab                  | EN                | ✓*       | ✓✓                | A very large repository, although content quality, licences and long-term availability vary.                              |

\* Depending on the rights associated with each model.

### 2.1.3 Introducing the Activity

To introduce this activity, you can use the pieces from the “On the Shoulders of the Celts” construction game dedicated to the theme “Replicating and Automating”. They illustrate how 3D digitisation and 3D printing are not technological breakthroughs appearing out of nowhere, but rather the latest developments in a long history of techniques for reproducing objects.

For younger learners, or if you wish to focus specifically on manufacturing techniques, this column can be simplified by concentrating exclusively on the theme Replicating. Simply replace the illustrations related to automation with other examples of replication techniques from different historical periods:

- Iron Age and Antiquity: moulds for ceramic production (roof tiles, oil lamps, figurines, etc.).
- Middle Ages: bell moulds, floor tile moulds, seal matrices.
- Early Modern Period: movable type for printing, engraved printing plates, moulds for buttons...
- Modern Period: cake moulds, plastic injection moulds, metal stamping presses.
- Digital Age: CAD models, computer-controlled laser cutting, 3D printing.

### 2.1.4 Implementation

Depending on the number of computers available, learners can work individually, in pairs or in small groups. Each group receives one or more links to 3D models to explore, or the models are downloaded onto the computers beforehand.

#### Suggested Activities:

- **Observe Differently:** Invite learners to freely explore a 3D model (rotate, zoom and change viewpoints) before providing any explanation. Ask them to identify as many details as possible, such as traces of wear, decoration, manufacturing techniques, inscriptions or repairs. Then compare these observations with those made from a single photograph of the same object.
- **Understanding the Object:** Encourage learners to formulate hypotheses about how the object was made, what it was used for or how it functioned. Ask them to identify the visible evidence supporting their ideas. They can also compare several objects from the same category (brooches, coins, pottery, etc.) to identify similarities and differences.
- **Making Connections:** Ask learners to relate an object to its archaeological context, historical period or original function. They can also compare an archaeological remain with a reconstruction to understand what each representation contributes to the interpretation of cultural heritage.
- **Presenting the Object:** Each learner, pair or group presents the 3D model they have explored, describing the object, explaining its presumed function, highlighting the observations they made and identifying any remaining questions. Other learners are invited to contribute additional observations or propose alternative interpretations.
- **Developing Critical Thinking:** Discuss the advantages of 3D digitisation. Which details are easier to observe than in a photograph? What new possibilities does a 3D model provide? Also encourage learners to identify its limitations. Which information remains easier to understand by observing the original object or visiting the archaeological site?

These activities can easily be adapted according to the available time, the age of the learners and the educational objectives. They may be carried out independently or combined into a longer

learning sequence. For younger learners, activities can focus on observing, describing and comparing objects. Older learners may investigate manufacturing techniques, compare different categories of artefacts or discuss the contribution of 3D digitisation to archaeological research and heritage interpretation. Teachers may also select 3D models related to the themes studied in class, making the activities easier to integrate into existing educational programmes.

## 2.2 Exploring Cultural Heritage through Extended Reality

### 2.2.1 Learning Objectives

Discover how Extended Reality can enhance the interpretation of cultural heritage, compare different immersive technologies, and encourage learners to reflect critically on their educational value and appropriate uses.

### 2.2.2 Finding Extended Reality Experiences

Extended Reality (XR) encompasses several immersive technologies, including Augmented Reality (AR), Mixed Reality (MR) and Virtual Reality (VR), with or without a headset. Today, many museums, heritage sites and cultural organisations offer immersive experiences that allow visitors to discover disappeared places, explore monuments that are difficult to access, or view reconstructions of artefacts, buildings and ancient landscapes. Unlike 3D models, there is currently no single directory listing all cultural heritage experiences in AR, MR and VR with headset. The resources below therefore provide a selection of platforms, applications and examples to help you discover these technologies:

| Experience                                                                                                             | Cost           | Comments and examples                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AR</b><br><br>Heritage Location-Based Mobile Applications<br><br>Non-Location-Based Educational Mobile Applications | Generally free | Primarily designed for on-site use (with a few exceptions). Most applications can be used independently on a smartphone or tablet. Downloading content in advance is often recommended to reduce mobile data usage. There is currently no directory of heritage AR applications. A web search or local tourism and heritage organisations will usually help identify applications available nearby.<br><br>The examples below have been selected for their geographical coverage or educational value:<br>- <a href="#">HistoPad®</a> : Heritage tours, mainly in France, tablet hire (EN, FR)<br>- <a href="#">Archistoire</a> : Heritage urban tours, France (EN, FR)<br>- <a href="#">Augmented Swiss Heritage</a> (EN, DE)<br>- <a href="#">Xplore – AR by TimeLooper</a> : Educational application (EN, ES, FR)<br>- <a href="#">Foxar</a> : Multilingual educational application<br>These 4 applications are available on Play Store and App Store. |
| <b>MR</b>                                                                                                              | Paid           | Mainly designed for on-site use. Mixed Reality applications remain relatively uncommon in the heritage sector and are currently limited to a small number of museums and experimental projects.<br>- <a href="#">Musée de la Libération de Paris</a> (EN, FR)<br>- <a href="#">LUDeum</a> (Belgique, France)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>VR online</b>                                                                                                       | Free           | Accessible remotely through a web browser. The resources listed here provide directories or curated selections of virtual heritage experiences.<br>- <a href="#">Cultural Heritage @home</a> (European Commission)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

|                                         |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Virtual Tours                           |                | <ul style="list-style-type: none"> <li>- <a href="#">10 Magnificent Virtual Tours in Europe</a></li> <li>- <a href="#">Historyview.org</a> (World)</li> <li>- <a href="#">University of South Florida</a> (USA, World)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| VR headset<br><br>Immersive Experiences | Generally paid | <p>Primarily designed for on-site use. Although some experiences can be downloaded and used remotely, most are available at the institutions that developed or host them, either as permanent installations or temporary exhibitions.</p> <p>These experiences are currently available mainly:</p> <ul style="list-style-type: none"> <li>- through the <a href="#">Micro-Folie network</a> (free of charge; more than 600 venues in France and abroad),</li> <li>- in selected museums (as the <a href="#">Museo Galileo</a> in Florence) and science centres, either permanently or as part of temporary events,</li> <li>- through European projects, such as <a href="#">VirtualArch</a>, which developed several experiences showcasing archaeological sites in Central Europe.</li> <li>- through producers of immersive experiences, such as <a href="#">Excurio</a>, whose travelling exhibitions are presented in shopping centres and other exhibition venues.</li> </ul> |

### 2.2.3 Introducing the Activity

To introduce this activity, you can use the pieces from the “On the Shoulders of the Celts” construction game dedicated to the theme “Representing the World”. They illustrate how immersive technologies are not a technological break with the past, but rather the latest stage in a long history of techniques for representing reality, from the trompe-l'œil wall paintings of Pompeii to today's virtual environments.

If you do not wish to use the game, you can simply select visual examples illustrating the following themes:

- Iron Age and Antiquity: sculptures, mosaics, wall paintings and ancient theatre, including representations of the real world, augmented representations such as Pompeian trompe-l'œil paintings, and imaginary or mythological subjects.
- Middle Ages: sculptures, murals, illuminated manuscripts, mystery plays and other theatrical forms, depicting real-world subjects, enhanced representations, religious or fantastical themes.
- Early Modern Period: sculpture, painting, engravings, theatre and magic lanterns, including realistic representations, trompe-l'œil effects and religious or imaginary scenes.
- Modern Period: paintings, pop-up books, scale models, stereoscopic images, lenticular images, historical re-enactments and cinema, including representations of reality, low-tech augmented reality devices (see Section 3.2), disappeared heritage and imaginary worlds

### 2.2.4 Implementation

Depending on the available equipment, the proposed activities can be carried out in the classroom, in a museum, at a heritage site or remotely. Learners may work individually, in pairs or in small groups.

#### Suggested Activities:

- Observing a Site in a Different Way: identify the architectural features, materials or organisation of a site made visible through the digital reconstruction.
- Comparing Representations: compare the immersive reconstruction with photographs, plans or the existing remains in order to distinguish between direct observation, interpretation and scientific hypothesis.
- Understanding Reconstruction Choices: identify which elements are based on established evidence and which result from scientific hypotheses. Discuss how the reconstruction influences our perception of the past.
- Presenting the Experience: ask learners to describe what they observed and explain what the immersive experience contributed compared with a traditional site visit or an illustration.
- Developing Critical Thinking: reflect on the benefits of Extended Reality (immersion, changes in scale, spatial understanding) as well as its limitations (visual fatigue, interpretation, lack of contact with the original remains, equipment costs, accessibility and environmental impact).

The proposed activities can easily be adapted according to the available time, the age of the learners and the educational objectives. They may be carried out independently or combined into a longer learning sequence. For younger learners, activities may focus on discovering different ways of representing cultural heritage and comparing their main characteristics. Older learners can explore more complex issues, such as the scientific validity of reconstructions, the role of interpretation in heritage mediation, accessibility, environmental sustainability or the educational value of immersive technologies.

After exploring an existing immersive heritage experience, learners can be invited to design their own Augmented Reality tour. They thus move from being users to becoming creators, selecting the locations, content and media they wish to share with future visitors.

## 2.3 Creating a Location-Based Augmented Reality Tour

### 2.3.1 Learning Objectives

Design a location-based Augmented Reality tour to promote local heritage while developing learners' digital skills and raising awareness of cultural mediation.

### 2.3.2 Introducing AR Tour Builder and AR Tour Experience

The **AR Tour Builder** and **AR Tour Experience** tools, developed within the **EUreka3D-XR** project, enable users to create location-based tours incorporating 3D models displayed in Augmented Reality through a dedicated mobile application.

The user guides for both tools are available at:

<https://eureka3d.eu/ar-tour-builder-and-experience/>

Using reasonably sized media files (3D models, images, videos, audio files or documents) also helps to limit the volume of data transferred and therefore contributes to the digital sustainability of these tools.

### 2.3.3 Introducing the Activity

To introduce this activity, you can use the pieces from the “On the Shoulders of the Celts” construction game dedicated to the theme “Representing the World”. They illustrate how displaying 3D models in Augmented Reality is not a technological breakthrough, but rather the latest stage in a long history of techniques for representing three-dimensional space, from sculpture and pop-up books to Augmented Reality 3D models (see Section 2.2.2 for suggested examples).

### 2.3.4 Implementation

#### 1. Choosing the Site for the Tour

This first phase can be carried out collectively in order to identify the most appropriate site in relation to the educational project, followed by the selection of each Point of Interest (POI). These are the places and features of interest (archaeological remains, buildings and so on) that will form the different stops along the tour, where they will be documented through texts and various media such as 3D models, images, videos, audio files and PDFs.

#### 2. Documenting the Points of Interest

This second phase can be carried out in small groups or in pairs, depending on the number of Points of Interest identified:

- Research the historical, scientific or cultural information required using a variety of sources (archives, libraries, museums, local residents, associations, etc.).
- Search for media to document each POI, using the same sources or online resources (see 2.1.2). Whenever possible, give preference to content released under open licences or explicitly allowing reuse (see Appendix 2), so that it can easily be downloaded and integrated into the application. Depending on the learners' age and level, the teacher may guide them in identifying the most appropriate licences.
- Where relevant, produce additional media to complement the existing documentation, such as audio recordings (descriptions of 3D models, interviews, commentaries, etc.), videos (interviews, demonstrations or experimental archaeology), maps, plans, explanatory diagrams or PDF documents.
- Write the introductory text for each POI and the descriptions of the different media.

#### 3. Checking the Legal Availability of the Media (Appendix 2)

When learners search for images, 3D models or other media themselves, the teacher should verify that they may legally be reused before they are integrated into the tour. This involves identifying the licences associated with the selected content, checking that they are compatible with the project and, where necessary, requesting permission from the rights holders to reuse protected works. Depending on the learners' age and level, this step can also provide an opportunity to introduce copyright, media literacy and open licences.

#### 4. Building the Tour

This stage can be carried out collectively in order to organise the Points of Interest in a coherent sequence and consider the route and overall duration of the tour. The introductory text presenting the site and the tour may also be drafted collectively at this stage.

### 5. Hosting the Media and Integrating the Content into AR Tour Builder

The media (images, 3D models, videos, audio files, PDF documents, etc.) must first be hosted on a platform providing a direct URL for each file so that they can be integrated into AR Tour Builder (explained in the technical documentation). As these operations generally require the creation of user accounts on both the hosting platform and AR Tour Builder, they are primarily the responsibility of the teacher. However, the different steps can be presented collectively (for example using a projector), and learners can occasionally carry out some of the operations themselves.

### 6. Testing and Improving the Tour

Before publishing the tour, it is advisable to test it under real conditions using one or more smartphones or tablets. Learners can then assess:

- the relevance of the selected Points of Interest;
- the clarity of the texts;
- the quality of the media;
- the positioning and readability of the Augmented Reality models;
- the overall visitor experience.

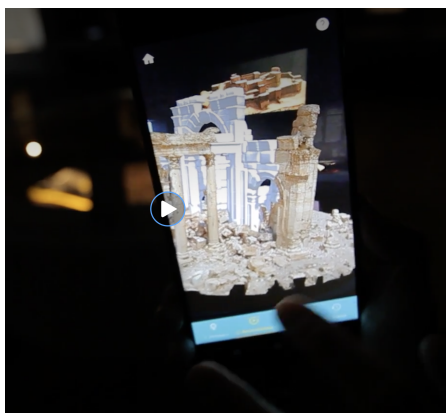
The tour can then be improved based on the observations and suggestions collected during this testing phase.

### 7. Presenting the Tour

Invite another class, families or local residents to discover the tour.

## 3. Going Further

### 3.1 Did You Know?



In 2015, several iconic monuments in Palmyra (Syria), a UNESCO World Heritage Site, were destroyed by ISIS. Thanks to thousands of photographs, photogrammetry and field surveys carried out before their destruction, international teams have produced highly accurate 3D models of the remains. Today, these models are used to document the destruction, prepare restoration projects, support scientific research and preserve a digital record of monuments that have, in some cases, disappeared completely.

UNESCO - Palmyra: <https://whc.unesco.org/en/list/23>

Palmyra in 3D: <https://experiments.withgoogle.com/palmyra>

## 3.2 Additional Activity: Building a Low-Tech AR Interpretation Panel



AR does not necessarily require a smartphone, a headset, or even electricity! Several heritage sites, including the city of Autun in France, use transparent panels displaying the reconstruction of partially disappeared monuments. When visitors stand at the correct viewpoint, the surviving remains visually align with the reconstruction, allowing them to visualise the monument as it once appeared.

Often referred to as low-tech AR, this simple, robust and energy-efficient interpretation device provides an effective way of introducing concepts such as viewpoint, perspective and archaeological reconstructions.

### 3.2.1 Learning Objectives

Design and build a low-tech Augmented Reality interpretation panel that enables visitors to visualise the original appearance of a heritage site by aligning a transparent reconstruction with the surviving remains.

### 3.2.3 Principle

Based on a drawn reconstruction of a monument for which remains are still visible, learners create a low-tech AR interpretation panel. Depending on their age, the resources available and possible partnerships (vocational schools, Fab Labs, makerspaces, etc.), the final installation may be temporary and lightweight or designed as a more permanent feature.

### 3.3.3 Implementation

#### 1. Selecting the Monument and Its Graphic Reconstruction

The choice of monument depends on the extent of the surviving remains (neither too extensive nor too limited), its proximity to the school or cultural institution, and the availability of a reliable graphic reconstruction. This reconstruction can be obtained from archives, libraries or heritage institutions. It should be scientifically reliable and accurately proportioned.

#### 2. Adapting the Reconstruction

- Distinguish the surviving remains from the reconstructed parts of the monument.
- Display the reconstruction in a light colour or with reduced opacity so that visitors can see the actual remains through the transparent panel.

#### 3. Printing the Transparent Panel

- Temporary installation: print the reconstruction on transparent film in A2 landscape format (59.4 × 42 cm). If necessary, divide the file into two (A3) or four (A4) sections and print at 100% scale (without automatic resizing).
- Permanent installation: print the reconstruction on a transparent plexiglass or polycarbonate panel, ideally measuring approximately 60 × 40 cm.

#### **4. Building the Structure**

- Temporary installation: use a cardboard frame or a lightweight wooden frame.
- Permanent installation: use a sturdy wooden or metal frame fitted with a support allowing it to stand freely or be fixed into the ground.
- Ground installation of a permanent installation: in addition to obtaining permission from the landowner, technical support may be required to ensure the stability of the structure. Particular attention should also be paid to its positioning so that visitors can correctly align the reconstruction with the surviving remains.

#### **5. Presenting the Installation to the Public**

- Test the installation beforehand to determine the optimal position for aligning the reconstruction with the archaeological remains.
- Depending on the intended audience (other school classes, the general public, etc.), choose the most appropriate date and promote the event.
- On the day of the event, place the panel in its designated position. If using a lightweight installation, it can be held by two learners, who may take turns throughout the activity. Visitors are then invited to stand in front of the panel and visually align the reconstruction with the surviving remains. Learners may also provide an oral presentation of the monument or site and, in the case of a permanent installation, include this information on the panel itself.

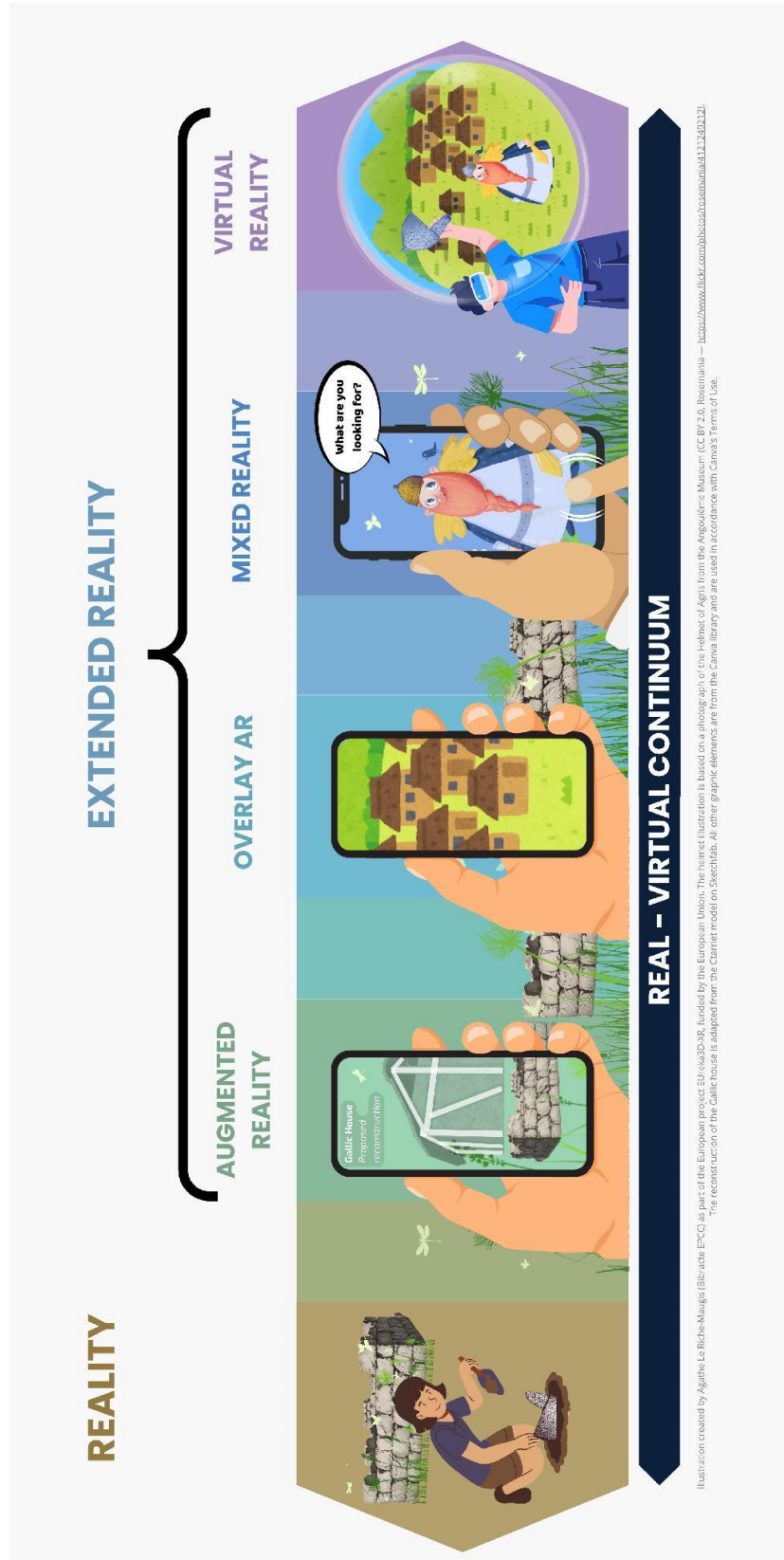
#### **6. Extensions**

Learners can compare their low-tech ARlity panel with a smartphone-based AR application and discuss the advantages and limitations of each approach in terms of:

- production cost,
- ease of maintenance,
- accessibility,
- robustness,
- energy consumption,
- quality of the visitor experience.

## APPENDIX 1: Understanding the Reality–Virtuality Continuum

The diagram below illustrates how AR, MR and VR are positioned along the Reality–Virtuality Continuum. It is an educational adaptation of the model proposed by Paul Milgram and Fumio Kishino (1994).



## APPENDIX 2: Reusing Media Legally

The media (images, 3D models, videos, audio files and PDF documents) used to create a location-based tour with AR Tour Builder, or more generally any content intended for publication or public dissemination, cannot always be reused freely.

Before using content found online or reproduced from a publication, it is important to identify the rights associated with it and verify that its use is authorised for your project. Open licences, particularly **Creative Commons licences**, facilitate reuse by clearly specifying the conditions under which works may be used.

When learners take part in searching for media, this verification can also become an opportunity to introduce copyright, media literacy and open licences.

The table below summarises the main situations you are likely to encounter.

| Licence / Legal status | Author attribution required (BY)                                                                  | Modification prohibited (ND) | Adaptations must be shared under the same licence (SA) | Commercial use prohibited (NC) |
|------------------------|---------------------------------------------------------------------------------------------------|------------------------------|--------------------------------------------------------|--------------------------------|
| Public Domain Ø*       |                                                                                                   |                              |                                                        |                                |
| CC 0**                 |                                                                                                   |                              |                                                        |                                |
| CC BY                  | ✓                                                                                                 |                              |                                                        |                                |
| CC BY-SA               | ✓                                                                                                 |                              | ✓                                                      |                                |
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| CC BY-NC-SA            | ✓                                                                                                 |                              | ✓                                                      | ✓                              |
| CC BY-ND               | ✓                                                                                                 | ✓                            | Not applicable                                         |                                |
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\* The work is no longer protected by copyright, or copyright never applied.

\*\* The author has voluntarily dedicated the work to the public domain (or as close to it as legally possible).

### Please Note

In many countries, copyright law provides educational exceptions allowing the use of protected works under certain conditions. However, these exceptions vary from one country to another and generally apply only to activities carried out within the classroom or another secure educational environment. They do not necessarily apply to productions intended for public dissemination, such as websites, exhibitions or location-based tours. It is therefore recommended that you check the legislation applicable in your country before publishing or making learners' productions publicly available.

### Special Case: Learners' Productions

When learners create content as part of an educational project, additional rules may apply, particularly regarding image rights and the publication of their work.