



Open Educational Resource

On the shoulders of the Celts

*How yesterday's inventions
have made today's digital world possible*

Topic: Archaeology, Art History, History
of Science and Technology, Digital
Technologies

Ages: 11 years old and above

Game Conceptors

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Preface

The EUREKA3D-XR project (European Union's REKOnstructed 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)¹ 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 for educational activities, 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. This dual expertise – scientific and educational – has, for over twenty years, informed the design of outreach programmes and educational resources.

In this context, the EUREKA3D-XR project provided an opportunity to approach digital technology from an original angle: that of its history, based on objects on display at the Bibracte Museum. Understanding digital technology in general, and immersive technologies in particular, requires an understanding of the innovations that made them possible. Digital tools did not appear overnight; they are the culmination of a long succession of inventions, improvements and knowledge transfer spanning more than two millennia.



This Open Educational Resource provides all the materials needed to create, adapt and facilitate the construction game 'On the Shoulders of the Celts'. In keeping with the principles of Open Educational Resources, it has been designed to be freely reused, modified and expanded according to the needs of each school, heritage institution or science centre.

We hope that this resource will help your audiences gain a better understanding of the history of technology, by demonstrating that every invention builds on those that came before it and that today's digital technology is, above all, the result of a long human journey.

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 To understand what Extended Reality is we invite you to read the article "XR in Cultural Heritage: AR, MR, and VR Explained": <https://pro.europeana.eu/post/xr-in-cultural-heritage-ar-mr-and-vr-explained>

1. Introduction to the educational resource

1.1 Practical information

Topics:	Archaeology, Art History, History of Sciences and Technology, Digital Technologies
Age group:	11+ with guidance; 12–13+ independently.
Educational Programme:	History, Languages and Cultures of Antiquity, Arts History, Sciences, Technology
Time:	Game creation: 3–6 hours / Game play: 20–40 minutes
Materials & Tools:	Wood or card, scissors, glue, magnets, thin steel rods.
Skills Developed:	- Observe, analyse and interpret images. - Ask questions, reflect on them, formulate hypotheses, test and justify them. - Organise information, place it in a historical context and establish links between different pieces of information. - Identify continuities, developments and breaks in the history of technology. - Cooperate, share information and develop a collective understanding. - Develop a critical perspective on digital technologies and their uses.
Learning objectives:	To help students understand the principles of 3D scanning and Extended Reality by placing them within the long history of knowledge and technology. To show that today's digital technologies are the result of a succession of inventions, improvements and knowledge transfer.

1.2 Guidance for teachers and educators

The game 'On the Shoulders of the Celts' invites participants to piece together the timeline of the innovations that gradually led to digital technologies. Using a game mat organised into areas of knowledge and pieces to be assembled representing inventions or techniques, players work together to build a timeline, from the Iron Age to the Digital Age. In doing so, they highlight the continuities, developments and interactions between knowledge, techniques and inventions.

1.2.1 Facilitating the activities

The game is based primarily on observation, cooperation and reasoning. Participants do not memorise a pre-determined timeline, but construct it themselves through observation, hypotheses and discussion. That way, mistakes become opportunities to debate, compare points of view and understand the links between different innovations. The role of the teacher or educator is primarily to guide this reflection, encourage discussion and provide clues where necessary.

It may be beneficial to bring together complementary skills, for example by forming pairs comprising a history and a technology teacher, a cultural and a science educator, or a teacher and a heritage professional.

1.2.2 Adapting the resource

The construction game is fully adaptable. You can modify the name of the game, the game mat, the subject areas, the components to be assembled, the rules or even the visuals, particularly to incorporate the collections of your museum or those of a partner institution.

2. How to use this educational resource

2.1 Game components

2.1.1 The game mat

- Illustration showing the succession of techniques and inventions across five periods:
 - The Iron Age and Antiquity: a Gallic woman with a loom,
 - The Middle Ages: a monk with a book,
 - The Early Modern Period (16th-18th centuries): an explorer with a sextant,
 - The Modern Period (19th century to the present): an inventor with a light bulb,
 - The Digital Age: a young woman with a Virtual Reality headset.
- 6 boxes, the themes of which correspond to the following major fields of knowledge:
 - Writing numbers,
 - Counting, measuring, quantifying,
 - Calculating,
 - Replicating and automating,
 - Processing information,
 - Representing the world.

2.1.2 Cubes and rectangular prisms

- The images on the cards depict techniques and inventions corresponding to the five periods and six fields. The images used are under a free licence and are all available online. A guide, organised by field and period, provides a brief description, credits, source and URL for each image.
- 23 cubes, each corresponding to a period and a field.
- 3 rectangular prisms, each representing the height of several cubes, where there has been no technical development within a single field across several periods:
 - Writing numbers in the Iron Age, Antiquity and the Middle Ages (equivalent to 2 cubes), as Roman numerals were used at that time,
 - Writing numbers from the modern period to the digital age (equivalent to 3 cubes), as Arabic numerals are predominantly used,
 - Calculating in the Iron Age, Antiquity and the Middle Ages (equivalent to 2 cubes), as calculations were performed using tokens and abaci.

2.1.3 Connecting elements

- 8 flat, powerful magnets, of the disc-type neodymium magnet variety
- 4 thin steel rods, similar to galvanised tension wire

These represent cross-connections between certain fields for the same periods, illustrating how knowledge, techniques and inventions flow from one field to another. 4 x 2 identical images are reproduced on two cubes each and identified by a coloured frame:

- Ancient counting tokens used for both counting and calculation,
- A medieval mechanical clock used to measure time and representing a form of automation,
- The printing press of the modern era, which enables the mass production of identical copies and the dissemination of information,
- A contemporary machine for counting and calculating.

2.2 Making the game components

The templates for the cubes and the game mat were designed for cubes measuring 6.5 cm per side and an A2-sized game mat. The columns are spaced 15 cm apart to allow for the use of metal rods representing the links between the areas of knowledge.

The templates for the cardboard cubes, wooden cubes and game mat, together with the information sheets for the visuals, are available online and can be downloaded from the following page: <https://www.bibracte.fr/en/construction-game-appendices-annexes-du-jeu-de-construction>

2.2.1 The cubes and connecting elements

They can be made from card for a lightweight version or from wood for a more durable option.

- Cardboard cubes:
 - Print the template²,
 - Cut out the templates,
 - Stick the magnets to the back of the sides marked with a coloured border, ensuring you get the polarity correct so that they stick properly to the metal rods.
 - Glue the flaps to form the cubes,
 - Glue the cubes corresponding to the three parallelepipeds together.
- The wooden cubes and parallelepipeds:
 - Make the cubes and parallelepipeds yourself or have them made (see template), or buy ready-made pieces (gluing the cubes together as needed to form the parallelepipeds),
 - Ensure that they have smooth, even surfaces to help the graphics adhere properly,
 - Carve a small recess into the faces that will hold the magnets and stick the magnets,
 - Print the templates (the same as for cardboard cubes),
 - Cut out all the graphics for each face, removing the flaps,
 - Attach the visuals directly to the faces of the cubes using an adhesive suitable for paper and wood or permanent double-sided tape, paying particular attention to the edges and corners.

² This template reuses the Europeana Story Dice model: <https://www.europeana.eu/en/stories/six-ways-to-play-with-europeana-story-dice>

- The steel rods
 - Preferably use galvanised steel wire with a diameter of approximately 3 mm,
 - Cut the galvanised tension wire with wire cutters to produce 4 sections of 10 cm long,
 - Deburr the ends after cutting to avoid any risk of injury,
 - Straighten them if necessary.

2.2.2 The play mat

It is A2 size (59.4 x 42 cm). Depending on the materials and budget available, you can:

- Print it on card stock, spreading it across several A4 or A3 sheets (after splitting the file into 4 or 2 sub-files), at 100% scale (without automatic adjustment).
- Have it printed by a service provider on a more durable material, such as laminated vinyl.

Production tips

- Make a test cube before printing the whole thing.
- Check the print scale (100 per cent).
- Test the polarity of the magnets before permanently gluing them in place.
- Set aside a few blank cubes for future customisation.

2.2.3 Customising the game

- Changing the number of columns and themes: You can remove themes and add new ones (e.g. by duplicating the 'Replicating and Automating' theme).
- Modifying the visuals: You can add visuals from your heritage institution, from a partner institution of your school, or freely available on the internet (under a free licence).
- Modifying cross-curricular links: You can remove or add them, whilst ensuring they are positioned so that they can be easily represented (avoid diagonals between two non-adjacent columns).
- Modifying the game mat: You can change its size and layout and, if you wish, reuse the accompanying artwork.

These customisations allow you to adapt the game to other heritage or geographical contexts, or to other educational objectives. However, please ensure that there is overall consistency between the themes, the periods represented and the suggested links, in order to maintain the game's educational balance.

2.3 Running the game

2.3.1 The rules of the game

The player(s) must reconstruct the chronology of knowledge and techniques by placing each cube or rectangular prism in the correct column and at the correct chronological height: first the Iron Age and Antiquity, then the Middle Ages, the Early Modern Period, the Modern Period and, finally, the Digital Age.

The aim is to identify the different categories of innovation, to understand the relationships between them and to gradually reveal the historical development of the technologies that led to the digital age.

Detailed game rules are provided in the appendices. These can be handed out to participants or used as a guide by the facilitator, particularly when the game is presented at a stand or in a context where time for explanation is limited.

2.3.2 Adapting the game to the context and audience

- Adapting the game to the audience

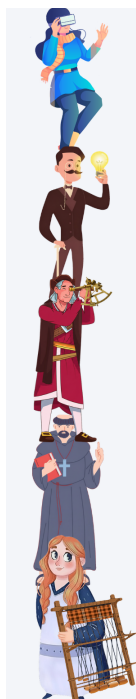
The game is flexible and can be used in various contexts (classroom activities, in a museum, at an exhibition stand, etc.) and with a range of audiences (pupils, young people outside school hours, families, adults). The way it is run can be adapted according to the educational objectives, the time available and the participants' level.

With a group of children, for example, it is possible to limit the game to three areas of knowledge or to present just one area initially, for which the column has been prepared in advance, and then gradually introduce the others. With teenagers or adults, the activity can be enriched by asking participants to name the objects depicted on the cubes, explain their function or justify their place in the timeline. The rules of the game can also be adapted or revised as required.

In the context of a school or museum activity, the information sheets for the visuals can be made available to participants, possibly after an initial observation phase. At a public event, they should accompany the game: they include the credits and information on the sources and licences of the visuals, some of which require attribution to the author.

- Explaining the game

The image on the left-hand side of the mat illustrates the gradual building up of knowledge: each character is carried by those who came before them, showing how today's technologies result from a long succession of innovations, exchanges and knowledge transfer. The objects represent key milestones in this history and provide a natural introduction to the game.



The Virtual Reality headset illustrates contemporary immersive technologies, which build on a long history of techniques for representing and experiencing the world.

The light bulb represents the major technical innovations of the industrial era and the growing role of electricity, which would later become essential to digital technologies.

The sextant evokes advances in measurement, calculation and navigation during the Early Modern Period, combining observation with the use of increasingly precise instruments.

The medieval monk's book symbolises the preservation, organisation and transmission of knowledge through writing and manuscript culture.

The Gallic loom serves as the central theme of the game: weaving geometric patterns requires memorising and sequencing a series of operations, including counting — a logic comparable to that of an algorithm. This principle was extended in the 19th century with the punched cards used in the Jacquard loom, which were later reused for the first computer programmes.

- Allow participants to develop their own strategy

There are several ways, whether individually or collectively, to familiarise oneself with the mechanics of the game and arrive at the final configuration of the columns. Experience has shown that participants often begin by identifying the objects and techniques represented. Some then group the cubes by field of knowledge before establishing the chronology, while others prefer to sort them by historical period first. These different strategies provide opportunities to exchange ideas, compare reasoning and develop hypotheses.

- Enhancing the playful aspect

To structure the progression of the game, the facilitator can arrange the cubes before the game begins in the shape of a pyramid or a giant cube. Participants will then have to gradually dismantle this structure by picking pieces at random before placing them in the correct position.

- Guiding the players' thinking

Throughout the activity, it is recommended to prioritise questioning and discussion amongst participants rather than immediately correcting mistakes. Hypotheses, hesitations and discussions are an integral part of the learning process and help to build collective reasoning.

- Wrapping up the game

Once the game is over, it is advisable to spend a few minutes summarising the session. This provides an opportunity to revisit the key links between innovations and to show how knowledge and techniques have gradually evolved over time. Putting things into perspective in this way reinforces the game's central message: digital technologies are the result of a long succession of inventions, exchanges and knowledge transfer.

3. Going Further

3.1 Did you know?



Micro-Folies is a network of digital museums based in France and abroad. It provides free access to thousands of digitised works from major heritage institutions. Its Digital Museum enables curated selections of artworks and heritage objects to be projected onto a large screen in very high definition, making it easy to explore collections that are often geographically dispersed or not permanently on display. Its Virtual Reality Space offers immersive heritage experiences, allowing visitors to discover archaeological sites, monuments and museum collections in new ways.

Official website: <https://www.lavillette.com/en/micro-folie/>

3.2 Additional activities

- **Customising the game**

Pupils adapt the game by replacing some or all of the illustrations to highlight a museum's collections, their local heritage or a topic covered in class. This activity can be carried out in partnership with a museum, a heritage organisation or a library.

- Research information on the museum's collections, local heritage or the chosen theme,
- Identify relevant illustrations from the museum's collections, local archives or those available online under a free licence,
- Select the most representative examples from each period,
- Create the new templates, then cut out and assemble the cubes.

- **Present the game to an audience**

Pupils take on the role of facilitators by leading a game session with another class, their families or an external audience.

- Divide the pupils into six groups corresponding to the six themes of the game.
- Within each group, explore the development of the techniques presented in greater depth in order to understand the key stages.
- Assign each pupil the task of presenting one or two pieces of the game.
- Prepare the presentation as a group (allocating speaking roles, demonstrations, answering questions).
- Run a game session during a meeting with another class, a school fete, European Museum Night or any other promotional event.

Appendix 1: Game Rules

 **Duration: 10–15 min**



Play individually, with your family or as a team



Challenge: Find the ancestors of digital technology

Your Mission

Build the columns by placing the cubes in chronological order.

Each column traces the development of a major family of knowledge and techniques:

- Writing Numbers
- Counting, Measuring and Quantifying
- Calculating
- Replicating and Automating
- Processing Information
- Representing the World

How to Play

1. Observe the cubes
 - Which objects or techniques do you recognise?
 - Which period do they belong to?
 - What developments in knowledge and techniques do they illustrate?
2. Build a column
 - Place the cubes from the oldest to the most recent: Iron Age and Antiquity → Middle Ages → Early Modern Period → Modern Period → Digital Age
3. Check your column
 - Do the techniques and inventions follow one another logically?
4. Start again
 - Try another column or build all six!

Additional Challenge

Some cubes from different columns have an identical face outlined in the same colour. When you find them, connect them using the metal rods. These links show how knowledge, techniques and inventions circulate between different fields and together contribute to the emergence of digital technology.

Key Takeaway

No invention emerges in isolation. Each discovery builds on those that came before it and inspires those that follow. Today's digital technologies are the result of more than two thousand years of innovation.