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ICBE 2026

MAY 08th-09th, 2026
POLIS University, Tiranë

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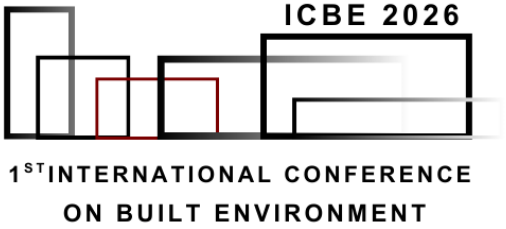
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1st International Conference on Built Environment

ICBE 2026

Conference Theme and Rationale

The 1st International Conference on Built Environment (ICBE 2026) was conceived as an international and interdisciplinary forum for advancing knowledge, critical discussion, and innovation across architecture, urban planning, engineering, construction, materials, design, and the wider built environment. Organized by POLIS University in collaboration with the National Agency for Scientific Research and Innovation in Albania (AKKSHI), the Academy of Sciences of Albania and the University of Ferrara in Italy, the conference brought together academics, researchers, practitioners, students, and industry representatives to exchange research findings, professional experience, and emerging perspectives on the transformation of contemporary cities and territories.

The conference theme reflected the increasingly complex challenges shaping the built environment, with particular attention to sustainability, resilience, technological innovation, heritage preservation, and socially responsive design. Contributions addressed sustainable architecture and green building, innovative construction technologies and materials, climate-responsive and energy-efficient design, disaster risk reduction, circular approaches to construction, and the integration of renewable energy. Equal emphasis was placed on digital transformation through Building Information Modeling, Geographic Information Systems, artificial intelligence, data analytics, automated solutions, digital fabrication, and advanced manufacturing.

ICBE 2026 also recognized that the future of the built environment cannot be approached through technological innovation alone. Urban transformation, cultural heritage, adaptive reuse, inclusive design, ecological thinking, art, and interdisciplinary research were therefore integral to the conference rationale. The scientific sessions examined topics ranging from seismic resilience, geotechnical engineering, and structural safety to urban fragmentation, public space, heritage conservation, adaptive environments, and new relationships between human and non-human systems.

Through keynote lectures, scientific presentations, case studies, and interdisciplinary debate, the conference encouraged connections between research and practice while promoting approaches capable of responding to environmental, social, cultural, and technological change. The breadth of contributions demonstrated the value of bringing engineering, architecture, urbanism, design, heritage, and emerging technologies into a shared academic framework for more resilient, sustainable, adaptive, and human-centered environments.

Held on 8-9 May 2026 at POLIS University in Tirana, with in-person and online participation, ICBE 2026 welcomed guest speakers and participants from Albanian and international universities, research institutions, professional organizations, and industry. Its sessions established a platform for presenting current research, exchanging expertise, strengthening meaningful collaboration, and identifying future directions for the built environment.

The event

The **1st International Conference on Built Environment (ICBE 2026)** is an interdisciplinary academic and professional forum dedicated to exploring contemporary challenges, emerging research, and innovative approaches shaping the future of the built environment. Bringing together researchers, academics, architects, engineers, urban planners, designers, practitioners, and industry professionals, the conference promotes the exchange of knowledge and encourages collaboration across traditionally interconnected disciplines. Its thematic scope encompasses sustainable and resilient construction, technological innovation, advanced building materials, urban transformation, cultural heritage, and interdisciplinary design approaches. Particular attention is given to the growing role of digital technologies, data-driven methodologies, intelligent design processes, and advanced analytical tools in supporting more informed and responsive approaches to architecture, engineering, and urban development. At the same time, ICBE 2026 recognizes the importance of environmental responsibility, cultural identity, social needs, and human-centered design in shaping contemporary cities and territories. Through keynote lectures, scientific sessions, case studies, and interdisciplinary exchange, the conference provides a platform for presenting current research, discussing professional experiences, and developing new perspectives capable of contributing to **safer, more sustainable, adaptive, inclusive, and resilient built environments**.

Objectives

- Promote interdisciplinary collaboration among researchers, academics, practitioners, and professionals in architecture, engineering, urban planning, construction, design, heritage, and related fields of the built environment.
- Advance the use of digital technologies and innovative methodologies, including BIM, GIS, artificial intelligence, data analytics, digital fabrication, and parametric approaches, in research and professional practice.
- Encourage sustainable, resilient, and climate-responsive approaches to architecture, construction, and urban development through innovative materials, energy-efficient strategies, and environmentally responsible design.
- Address contemporary challenges affecting cities, buildings, and infrastructure through scientific research, applied case studies, evidence-based approaches, and innovative design solutions.
- Promote the conservation, transformation, and adaptive reuse of cultural heritage, balancing cultural identity, contemporary needs, structural safety, and responsible urban development.
- Support human-centered and socially responsive urban transformation, considering public space, mobility, ecological systems, community needs, and the wider social and economic impacts of the built environment.
- Provide a platform for knowledge exchange and emerging research, enabling scholars, young researchers, professionals, and students to present innovative ideas, strengthen international collaboration, and contribute to future directions in the built environment.

Main Conference Themes

- Sustainable architecture and green building practices.
- Innovations in construction technologies and materials.
- Heritage preservation and adaptive reuse in the built environment.
- Digital tools and smart technologies in architecture and construction (e.g., BIM, GIS).
- Climate-responsive and energy-efficient design.
- Disaster risk reduction and resilience in the built environment.
- Circular economy approaches in construction and material usage.
- Integration of AI and data analytics in building design.
- Acoustic and thermal performance in building design.
- Renewable energy integration in building systems.
- Advanced manufacturing techniques in construction, such as 3D printing.
- Innovations in construction technologies and materials.
- Heritage preservation and adaptive reuse in the built environment.
- Disaster risk reduction and resilience in the built environment.
- Digital tools and smart technologies in architecture and construction.
- Advanced manufacturing techniques in construction.
- Geotechnical Engineering for Sustainable Development.
- Cartography and Geographic Information System.
- Computer Automated Solutions for Built Environment.
- Reliability in Civil Engineering.
- Urban planning strategies for resilient cities.
- Climate-responsive and energy-efficient design.
- Regulatory frameworks and policies impacting construction and urban development.
- Design in the Era of Anthropocene (Rethinking the Relation between Human and Non-Human Species)
- Speculative Design (with Attention to “Discursive” and “Critical” Design)
- Design and Cross-Disciplinarity (with Emphasis on Processes rather than Design Outputs)
- Inclusive Design
- Art and Urban Regeneration (Focus on Participatory, Collaborative, and Research-Based Practice)
- Relational Art and Architecture
- Monuments and ‘Anti-Monuments’ (Particular Attention to the Process of Designing and Building the City)

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The conference is structured around six thematic sessions, each addressing a specific area of research and practice within the built environment.
Each session is coordinated by experts in the relevant disciplinary field and is open to professors, researchers, PhD candidates, and other scholars and professionals contributing to the conference themes.

SESSION I
Urban Planning and Societal Impact

Chair: Dr. Gent Avdija

This session examines the relationship between urban transformation, spatial development, and their social implications within contemporary cities. Contributions address rapid urbanization, urban fragmentation, the transformation and loss of public space, informal and spontaneous development, and the challenges associated with balancing growth and modernization with human-scale urban environments. Particular attention is given to the evolving conditions of Albanian cities and to planning approaches capable of supporting more inclusive, sustainable, socially responsive, and livable urban environments.

SESSION II
Sustainable Materials, Resilient Construction & Smart Design

Chair: Dr. Endri Duro

This session explores innovative approaches to sustainable construction, resilient structural systems, and environmentally responsive design. Particular attention is given to sustainable materials, energy-efficient and climate-responsive strategies, prefabricated and lightweight construction technologies, and human-centered approaches to structural and architectural design. The session investigates how material innovation, technological development, and responsible design practices can contribute to safer, more efficient, adaptable, and environmentally sustainable built environments.

SESSION III
Technological Advancements and Seismic Design for Resilient Places

Chairs: Dr. Seyyed Behrad Emadi & Dr. Ornela Şen

This session examines the role of technological innovation and advanced engineering methodologies in developing safer, more resilient, and adaptable built environments. Contributions address seismic hazard and risk assessment, digital fabrication, parametric and computational approaches, transformations of building envelopes and prefabricated housing systems, and emerging concepts for future urban mobility. The session highlights how the integration of engineering knowledge, digital technologies, and resilience-oriented design can strengthen the capacity of buildings, infrastructure, and urban environments to respond to contemporary and future challenges.

SESSION IV

Cultural Heritage

Chairs: Dr. Nikolla Vesho & Dr. Marsela Demaj

This session addresses the preservation, interpretation, and transformation of cultural heritage within contemporary architectural and urban contexts. Contributions explore conservation strategies for historic buildings and sacred architecture, seismic assessment and strengthening of heritage structures, adaptive reuse, and the social implications of urban regeneration and heritage loss. Particular emphasis is placed on achieving a responsible balance between conservation ethics, cultural identity, structural safety, and the evolving functional requirements of historic buildings and urban environments.

SESSION V

Spaces of Connection: Art and Design for an Interspecies and Interdisciplinary Environment

Chair: Dr. Francesco Scasciamacchia

This session explores the intersections of art, architecture, design, technology, and the built environment through interdisciplinary and experimental perspectives. It investigates changing relationships between human and non-human systems, spatial perception, adaptive reuse, post-industrial landscapes, urban representation, digital heritage, and environmentally and socially engaged design practices. Through critical, speculative, participatory, and research-based approaches, the session examines how art and design can generate new forms of connection, reinterpret existing environments, and contribute to emerging cultural and spatial narratives within contemporary cities.

SESSION VI

Next-Generation Pioneers of the Built Environment

Chair: Dr. Flogerta Krosi

This session provides a dedicated platform for emerging researchers and students to present innovative, experimental, and forward-looking approaches to the built environment. Contributions span architecture, engineering, urban planning, environmental resilience, design, and related creative disciplines, reflecting the interdisciplinary character of a new generation of researchers and practitioners. Through projects addressing topics such as bioclimatic design, flood-risk management, structural technologies, architecture-inspired design, and critical interpretations of objects and social space, the session encourages critical inquiry, experimentation, and new perspectives on the future of the built environment.

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Spaces of Connection: Art and Design for an Interspecies and Interdisciplinary Environment

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Human and non-human environments: Interspecies design / Ecological relationships / Human–environment interaction / Alternative spatial narratives.

Critical and speculative approaches: Critical design / Speculative design / Spatial perception / Relational art and architecture.

H Adaptive and post-industrial environments: Adaptive reuse / post-industrial landscapes / Urban regeneration / Transformation of existing spaces.

Representation, heritage and material experimentation: Urban photography / Digital heritage interpretation / Textile upcycling / Material reuse / New cultural narratives.

IN Illyria, Episode I: Apollonia

A Pixel-Art Game Framework for Archaeological Interpretation and Cultural Heritage Learning

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Abstract

This paper presents the conceptualisation and prototype development of "Interactive Illyria, Episode I: Apollonia", a pixel-art-based mobile application designed for archaeological interpretation and informal heritage learning. The study positions itself within the intersection of digital heritage studies, game design, and media theory, addressing the lack of accessible interpretative tools for non-expert audiences in Albanian archaeological contexts.

Rather than proposing a full reconstruction, the project adopts a selective interpretative methodology, where architectural elements of the archaeological site are translated into an interactive system based on click-based exploration. Users engage with spatial fragments of

the site through three narrative agents, each offering differentiated interpretative perspectives. In this sense, archaeological knowledge is not presented as fixed "facts", but as layered interpretations derived from artefacts, spatial relationships, and historical reconstruction.

The use of pixel art is framed not merely as a stylistic choice, but as a representational strategy that enables abstraction, readability, and computational efficiency within mobile environments. The system is structured around micro-interactions that function as units of informal learning, supporting gradual knowledge acquisition.

The paper discusses the design logic of the environment, the reconstruction strategy of the Temple of Apollo, and the integration of narrative-driven interaction. It argues that lightweight game systems can operate as mediating interfaces between academic knowledge and public understanding, particularly in contexts where digital heritage dissemination remains underdeveloped. Finally, the study outlines the limitations of the prototype nature of the project and identifies the need for future empirical validation through user-based testing.

Keywords: *build heritage, pixel art technique, interactive gaming, archaeology, educational issues*

1. INTRODUCTION

Digital built heritage is increasingly shifting from static visualizations toward interactive systems based on user engagement and experiential interpretation. These systems attract diverse audiences by enabling active interaction with archaeological environments and architectural data. Currently, mobile platforms and digital games are considered effective tools for supporting e-learning and experiential engagement with historical content. However, within the Albanian context, despite the existence of well-documented archaeological sites, there remains a significant gap in the translation of this knowledge into accessible, user-oriented formats, particularly for younger generations and non-expert audiences.

Through interactive systems, it becomes possible to engage with complex historical datasets through exploration and interaction, rather than passive reading or observation. In this sense, the study is positioned as an attempt to bridge physical exploration, historical learning, and visual engagement within a unified interactive framework. Although this approach has advanced internationally, Albania remains at an early stage in the implementation of digital tools applied to cultural heritage. Archaeological sites such as Apollonia, Bylis and Amantia present significant historical and architectural value, including multi-layered developments from Illyrian, Greek, and Roman periods [1]. However, their representation in interactive formats remains limited, particularly in educational environments where traditional methods continue to dominate. Apollonia, including its temple, agora, and urban morphology, represents a complex archaeological landscape situated within a Mediterranean environment

near the Vjosa River [2,3]. It combines architecture, urban planning, and mythology into a unified spatial system. Despite this complexity, its interpretation for non-specialist audiences remains largely descriptive rather than interactive.

From a theoretical perspective, this research is informed by media and cultural studies. Stuart Hall's encoding/decoding model suggests that meaning is actively constructed by users rather than passively received [12]. In parallel, the concept of interpassivity, as discussed by Žižek [13], highlights how digital systems may simulate engagement without necessarily producing active interpretation. The proposed framework responds to this tension by structuring interaction as a mechanism for incremental knowledge construction.

Within this framework, IN Illyria Ep.1 (Apollonia) proposes a mobile game designed for Android and iOS platforms, focusing on the interpretation of the archaeological landscape. The game is conceived as a hybrid system combining educational and interactive functions. Archaeological content is not presented as static information, but is progressively revealed through user-driven exploration. The system is based on a click-based interaction logic, where each interaction reveals layers of information combining historical references, mythological narratives, and architectural interpretation. This approach transforms interaction into a micro-learning process, where knowledge is acquired incrementally rather than delivered in fixed sequences.



Figure 1. Graphical representation of the game's basic scene and main character

Pixel art is used as the primary visual language. Its role is not only aesthetic but functional, enabling the abstraction of complex spatial and architectural data into readable visual systems adapted to mobile environments. This allows users to understand morphological characteristics of built heritage through simplified representations [6]. The primary target audience of this study is defined as secondary school and early university students, while maintaining accessibility for a broader non-expert public interested in cultural heritage.

The research is positioned at the intersection of architecture, archaeology and game design. It investigates: (i) the role of pixel art as a strategy for heritage communication; (ii) the effectiveness of click-based interaction models for learning; (iii) the impact of character-driven narratives on user engagement.

Through this framework, the study aims to contribute to the development of alternative pedagogical models based on informal learning, where knowledge is constructed through interaction rather than passive transmission.

2. PIXEL-ART AND DIGITAL HERITAGE (STATE-OF-THE-ART)

2.1 Art, Technology and Contemporary Digital Heritage Discourse

In modern cultural production, digital media has evolved into a hybrid field where technology and artistic expression operate within the same conceptual space. The development of computer systems, game engines and interactive platforms has transformed the communication of built heritage from static representation to dynamic, user-oriented systems. Within this framework, digital heritage should not be understood solely as documentation, but as a mediating system that structures how cultural meaning is accessed, interpreted and reconstructed by users.

In contemporary communication, digital media has become a cultural object developed through technological systems such as computers and networks. According to Aleksić and Simeunović (2024), pixel art today is no longer defined by technical limitation, but by its capacity to connect early digital aesthetics with contemporary representational strategies [6]. This position aligns with broader media theory, where visual systems are understood as active agents in the production of meaning rather than neutral carriers of information [12].

The aesthetic and conceptual roots of digital art can be traced to artistic movements such as Dadaism, pop art, conceptual art and video art, which introduced experimentation and abstraction into visual culture [6]. Within this context, pixel art can be interpreted as a continuation of reduction-based visual strategies, where simplification functions as a method of conceptual clarification rather than loss of information. Advances in software and hardware during the 1990s enabled wider access to digital tools, transforming them into platforms for both artistic and technical production. In built heritage applications, this evolution allows the translation of complex architectural systems into simplified, interactive visual models adapted to contemporary media environments [12].

2.2 Educational games as actual tools

Educational games have evolved from basic entertainment systems into structured digital environments that facilitate knowledge acquisition through interaction. Their significance within heritage studies lies in their ability to transform static and complex information into dynamic and exploratory experiences. Rather than presenting heritage as a fixed narrative, these systems distribute knowledge spatially and temporally through user interaction. This

approach is particularly relevant in archaeology, where datasets are inherently fragmented, multi-layered and interpretative. Digital game systems enable the organisation of such complexity into accessible interaction-based structures, functioning as mediators between academic research and public understanding.

For example, Arias et al. (2020) highlight that virtual technologies enhance the preservation and accessibility of cultural heritage by enabling broader engagement with archaeological sites [10]. Similarly, Ferreira-Santos and Pombo (2025) emphasize the role of mobile AR-based systems in promoting architectural awareness and informal learning [7]. Their findings reinforce the idea that interactive environments are particularly effective when learning emerges through exploration rather than instruction. In this context, educational games operate within the framework of informal learning, where knowledge is constructed outside traditional institutional settings through user-driven engagement and interaction.

2.3 Game Aesthetics. Pixel-art model as graphic language

Game aesthetics should be understood as an experiential system rather than purely a visual attribute. It emerges from the interaction between the user, the system and the environment. In heritage-based applications, aesthetics plays a functional role in shaping how information is perceived and interpreted. Pixel art, in this context, operates as a visual language rather than a stylistic preference, enabling the translation of complex architectural and archaeological systems into simplified and readable forms [6]. This approach is particularly relevant for mobile platforms, where screen size, processing capacity and user attention are limited.

From a design perspective, pixel-based systems support cognitive accessibility. Early applications of pixel art were linked to interface design in operating systems such as Xerox and Apple [6]. In contemporary applications, its relevance extends to the representation of incomplete, fragmented or hypothetical archaeological structures, where abstraction avoids the illusion of total reconstruction.

The player experience in these systems is defined by layered interaction. Visual exploration is combined with micro-narratives generated through click-based mechanisms. Each interaction functions as a discrete cognitive unit, linking discovery with interpretation and reinforcing incremental knowledge acquisition.

2.4 Latest development and simple theoretical framework

In built heritage contexts, game development increasingly priorities conceptual clarity, modular design and resource efficiency over computational complexity. This approach reflects a methodological shift, where technical limitations are reframed as design parameters guiding the structure of the system.

Lightweight game systems are particularly effective in mobile environments. Pixel-based rendering, simplified animation and modular interaction logic enable the clear representation of spatial and narrative relationships [10, 11]. Within this framework, the system is not designed to simulate reality in full detail, but to construct an interpretative model that supports user understanding.

3. CASE STUDY: APOLLONIA AND THE GAME PHILOSOPHY

3.1 The Site of Apollonia

Apollonia represents one of the most significant archaeological parks in Albania, characterized by a complex system of historical, cultural and architectural layers. Founded in the 6th century BC by Corinthian colonists [2], the city developed as a strategic node between the Adriatic coast and inland Balkan regions. Its topography, located within the hills of the Myzeqe plain, established a spatial hierarchy between sacred areas, civic spaces and defensive structures. The site includes key architectural elements such as the temenos, agora, stoa, bouleuterion and theatre [3, 4, 5].

Within this study, Apollonia is approached not only as an archaeological site but as an interpretative and pedagogical context, particularly relevant for younger audiences with limited access to interactive heritage tools.

The Temple of Apollo represents the central symbolic element of the site. Although currently in a fragmented state, archaeological studies have proposed partial reconstructions based on available evidence. These reconstructions remain interpretative hypotheses rather than definitive representations, reinforcing the need for flexible and non-final visualization systems. In this research, Apollonia is therefore conceptualized as a dynamic interpretative environment, where absence, reconstruction and fragmentation coexist as core design principles.

3.2 Narrative Framework, Characters and Game Environment

The game structure is based on a character-driven interpretative system, where three narrative agents: Sihana, Artas and Robin mediate the interaction between the user and the environment. These characters function as interpretative interfaces rather than decorative elements, each representing a distinct mode of engagement with archaeological content.

Sihana provides structured historical and cultural explanations. Artas encourages exploratory interaction and discovery, while Robin simplifies complex information through accessible narrative forms. This multi-perspective system allows the same architectural element to be interpreted through different narrative logics, transforming the site into a layered knowledge environment.

The game environment is represented through a pixel-based 2D system derived from archaeological documentation and simplified spatial modelling [11]. The Temple of Apollo is reconstructed through a hybrid approach, combining documented elements with abstracted representations, while maintaining visible traces of its current fragmented condition.

This duality between reconstruction and ruin reinforces the interpretative nature of heritage knowledge. It avoids presenting the site as a fixed historical reality and instead frames it as an open system subject to continuous interpretation.

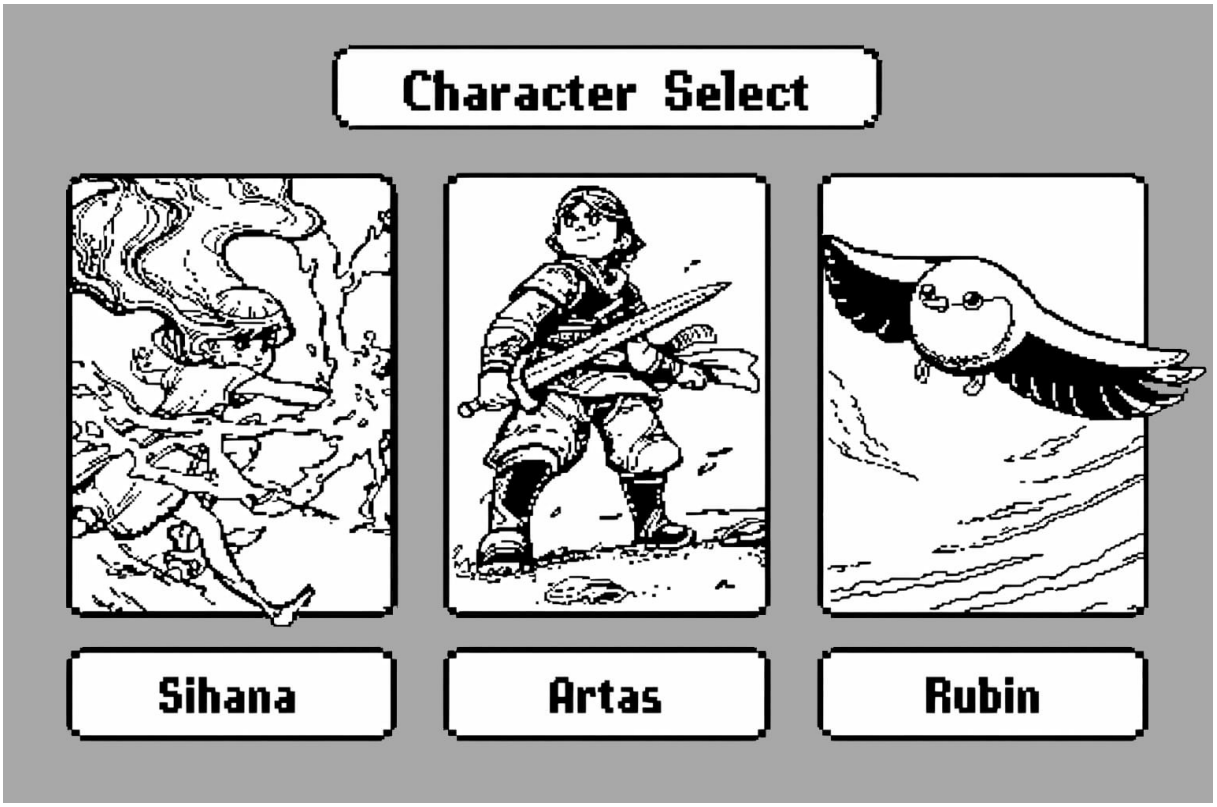


Figure 2. Sihana, Artas and Rubin, main characters at the main menu toolbar of the game

Gameplay is based on simple navigation and click-based interaction. Each interaction activates a micro-narrative combining text, visual representation and character input. This structure supports incremental learning through repeated engagement rather than linear information delivery.

From a methodological perspective, the game operates as an interpretative model rather than a simulation. It reorganizes selected elements of the archaeological site into a structured interactive system, balancing scientific accuracy with design clarity.

4. GAME PHILOSOPHY AND EXPERIMENTAL PROPOSED METHODOLOGY

4.1 Interaction Model (Click-Based System)

The interaction model of IN Illyria, Episode 1: Apollonia is structured around a minimal click-based logic designed specifically for mobile platforms (Android and iOS). The system prioritises clarity, immediacy and reduced cognitive load, allowing users to navigate and interact without prior gaming experience. This design approach follows user-centred interaction principles, where accessibility and usability are considered essential parameters for educational digital systems.

A simplified top-down map of the archaeological site is used as the primary navigation interface. Users move through the environment using touch-based input, ensuring intuitive spatial exploration without additional interface complexity [7]. The spatial configuration is

intentionally reduced to its essential elements, preserving readability while maintaining key morphological relationships of the site.

The system is organized through discrete interaction points distributed across the map. Each point corresponds to a specific architectural element, artefact or spatial fragment. This replaces continuous gameplay with episodic interaction, reinforcing the interpretative logic of the system. As shown in (Figure 3) the interaction sequence is structured around a clear visual and narrative cycle.

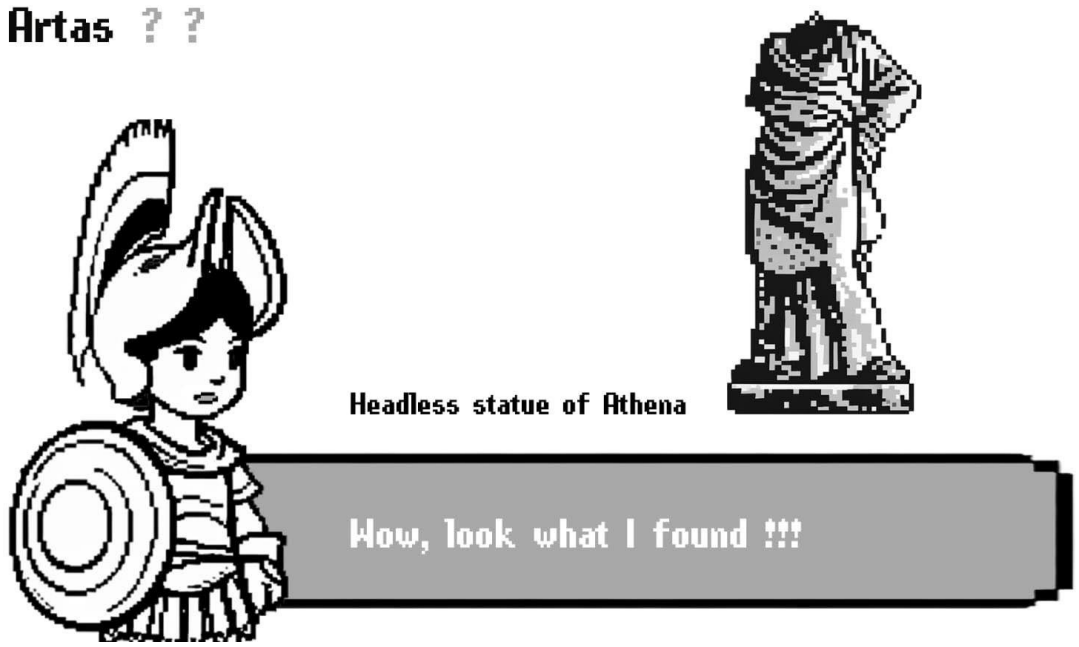


Figure 3. Interactive sequence of the game, main character discovering architectural artifact.

The core mechanism is based on click interaction. When the user selects an element, the system activates an information layer composed of three interconnected components: (i) a pixel-based visual representation, (ii) a short textual explanation and (iii) a character-based narrative. This triadic structure establishes a consistent interaction cycle linking perception, interpretation and feedback.

Within this framework, each interaction operates as a micro-learning unit, supporting incremental knowledge acquisition through repetition and exploration rather than linear instruction. The simplicity of the system does not reduce its depth. Instead, depth emerges through the accumulation of interactions, variation in narrative perspectives across characters, and progressive spatial discovery.

Micro-events are integrated as short narrative interruptions that maintain engagement without disrupting continuity. These elements strengthen the connection between gameplay and interpretative content.

From a design perspective, the absence of complex controls and layered menus ensures that user attention remains focused on spatial exploration and architectural interpretation. This reinforces the role of the system as an interpretative interface rather than a purely entertainment-oriented game.

4.2 Information Architecture and Pixel Art Workflow

The game system is structured through layered content organization, consisting of three main categories: historical, archaeological and mythological. These categories are not presented separately but are interconnected through curated narrative fragments activated during interaction. This approach avoids fragmented information delivery and instead constructs a coherent interpretative framework distributed across the game environment.

Each interaction generates a micro-narrative designed to communicate a specific concept through concise text and visual representation. The objective is not exhaustive explanation, but contextual clarity that stimulates curiosity and supports further exploration. The presence of multiple characters allows variation in tone, depth and perspective, enabling different interpretative approaches to the same content [6]. This reinforces the plural and interpretative nature of archaeological knowledge.

Isometric pixel art is used to simulate spatial depth within a 2D environment. The technique relies on color variation, tonal hierarchy and contrast to represent distance and form [6]. This allows spatial readability without requiring complex rendering systems. Each architectural component is first analyzed in terms of proportion, geometry and typology before being translated into simplified pixel-based representations. This process is illustrated in Figure 4.

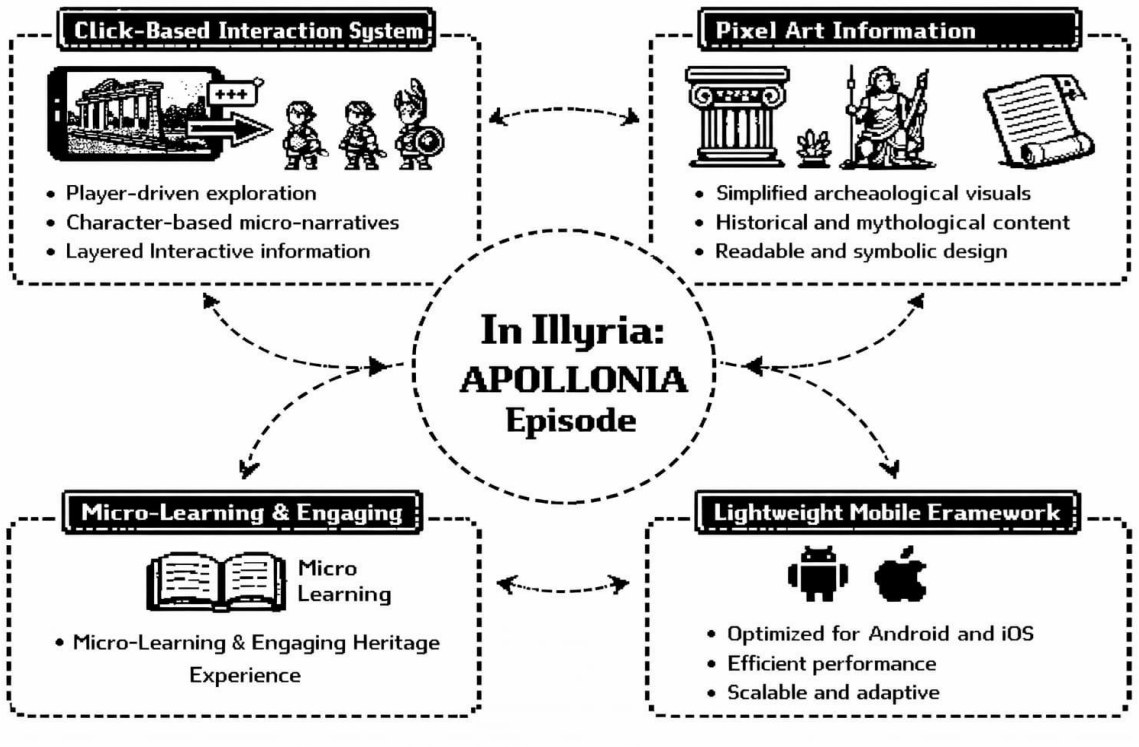


Figure 4. Diagram showing our proposed method for building the game IN Illyria

This process of controlled abstraction ensures that essential morphological characteristics are preserved while reducing visual complexity. The workflow is based on subtraction and simplification, transforming complex forms into recognizable pixel patterns. The objective is not visual realism, but structural clarity and coherence within the system.

The visual language is based on a limited color palette dominated by grey tones, enhancing coherence and reducing visual distraction. Contrast is selectively applied to highlight interactive elements and guide user attention. Animation is minimal and functional, consisting of subtle transitions such as fade-ins or slight movements. This restrained approach ensures visual stability and supports interpretative clarity.

Overall, the integration of information architecture and pixel art workflow results in a system where content, form and interaction are closely interconnected. Each component supports the others, producing a coherent and readable user experience.

4.3 Technical Framework

The technical framework of the project is defined by the need to ensure stable performance across a wide range of mobile devices. The application is designed for both Android and iOS platforms, requiring a flexible, efficient and scalable development approach. Game engines such as Unity, Unreal Engine and Godot are suitable for this type of application due to their cross-platform capabilities and support for 2D environments.

The creation of pixel art follows a structured process based on morphological analysis, abstraction and formal reduction. This process enables the translation of architectural elements into simplified visual systems while preserving their identity and recognizability. Once multiple design proposals are developed, they are evaluated based on expressive clarity, representational accuracy and technical feasibility [6]. This selection process ensures coherence between visual representation and system performance.

The user interface is intentionally minimal, with menus, icons and navigation tools limited to essential functions. This reduces interface complexity and reinforces direct engagement with the content. The system is designed to be accessible across different age groups and levels of digital literacy. Accessibility is achieved through simplified controls, clear visual language and concise textual information.

From a development perspective, the project follows an iterative workflow. Prototypes are continuously tested and refined, allowing adjustments in both interaction design and content structure. This approach is particularly relevant in heritage applications, where interpretative accuracy and user engagement must be balanced. Within this framework, technical constraints are not treated as limitations, but as parameters that actively shape the design logic of the system.

The resulting system integrates usability, performance and interpretative clarity, supporting the transformation of archaeological information into an accessible interactive experience.

5. DISCUSSION

The proposed methodology for IN Illyria, Episode 1: Apollonia positions the project as an experimental interpretative system within the broader field of digital heritage and interactive media. The study does not aim to present a complete technological solution, but rather to

explore how simplified interactive environments can mediate complex archaeological knowledge in an accessible and structured manner. At a conceptual level, the project contributes to the transition from representational models of heritage, based on static visualization and reconstruction, toward interpretative models where meaning is progressively constructed through user interaction and spatial engagement. This shift reflects broader developments in digital heritage studies, where emphasis is placed not only on visual accuracy but also on the conditions under which knowledge is accessed, experienced and understood [10].

The interaction model plays a central role in this framework. Each click-based action generates a discrete unit of knowledge composed of visual, textual and narrative elements. This structure aligns with micro-learning principles, where knowledge is acquired incrementally through short, repeated interactions rather than extended linear content. Such an approach is particularly relevant for mobile platforms, where user engagement is often fragmented and time-limited [7]. The visual and narrative synthesis of the system is illustrated in Figure 5, which presents the main graphical context of the game, integrating dramatic atmosphere, historical references and artistic abstraction.



Figure 5. Game context main graphics, showing drama, history and art together

As shown in Figure 5, the combination of spatial representation, pixel-art abstraction and narrative elements creates a unified interpretative environment, where visual and informational layers operate simultaneously. The use of multiple characters further enhances the interpretative dimension of the system. Each character introduces a distinct narrative

perspective, enabling the same architectural or historical element to be understood through different interpretative lenses. This multi-perspective approach reflects the epistemological nature of archaeology, where knowledge is constructed through interpretation rather than presented as a fixed and singular narrative. From a spatial perspective, the system adopts a simplified top-down structure that allows users to navigate the environment freely. This open-ended spatial configuration supports exploratory learning processes, where users construct their own paths and interpretations rather than following predefined sequences. This aligns with constructivist approaches to learning, where knowledge emerges through active engagement with the environment.

The adoption of pixel art as the primary visual language represents both a technical and conceptual strategy. Technically, it enables efficient performance across mobile devices, reducing computational requirements while maintaining visual clarity. Conceptually, it introduces a level of abstraction that avoids the illusion of complete reconstruction. As illustrated in Figure 5, the visual system does not attempt to reproduce reality in detail, but instead presents it as a structured abstraction, allowing users to interpret rather than passively consume visual information.

However, despite these contributions, the study acknowledges several limitations that require critical consideration. First, the system remains at a prototype stage, and its effectiveness as an educational tool has not yet been validated through empirical user testing. While the conceptual framework suggests potential for informal learning, there is currently no experimental data to support claims regarding user engagement, learning outcomes or knowledge retention. This limitation highlights the need for future studies based on user evaluation and quantitative analysis. Second, the process of abstraction inherent in the pixel-art approach introduces the risk of oversimplification. While simplification is necessary for clarity and usability, it may result in the reduction of architectural detail and historical complexity. This tension between readability and accuracy represents a fundamental challenge in digital heritage representation. Third, the reconstruction of architectural elements, particularly the Temple of Apollo, remains interpretative. Archaeological data is inherently incomplete, and any reconstruction involves assumptions based on available evidence. The system addresses this condition not by concealing uncertainty, but by integrating it into the visual and narrative logic, as seen in Figure 5 where reconstructed elements coexist with fragmented forms.

Another important aspect concerns the relationship between the digital and physical experience of heritage. The application is not intended to replace a visit to the archaeological site, but to complement it. It can function as a preparatory tool that introduces spatial and historical context before the visit, or as a reflective tool that reinforces understanding after the experience. This complementary relationship ensures that the authenticity of the physical site remains central.

From a technical perspective, the lightweight structure of the system represents a significant advantage. Optimized performance allows the application to operate across a wide range of

devices, increasing accessibility, particularly in contexts with limited technological resources. This is especially relevant within the Albanian context, where access to high-end digital infrastructure may be uneven. At a broader level, the study suggests implications for cultural dissemination and public engagement. By translating complex archaeological data into accessible interactive formats, the system contributes to bridging the gap between academic knowledge and public understanding. This has potential implications for heritage awareness and education, particularly among younger audiences.

The study also demonstrates scalability potential. The methodological framework developed for Apollonia can be adapted to other archaeological sites, each with its own spatial and historical characteristics. Future applications could extend to sites such as Butrint, Gjirokastra or Berat, forming a distributed digital network of heritage interpretation.

Finally, from a theoretical perspective, the study contributes to the understanding of interactive systems as mediating interfaces in cultural heritage. Interaction is not treated merely as a technical feature, but as a cognitive mechanism through which users engage with, interpret and reconstruct knowledge. In this sense, the project demonstrates that even simplified and resource-efficient systems can produce meaningful engagement when structured around clarity, narrative coherence and spatial logic.

6. CONCLUSIONS

This research presents Interactive Illyria – Episode I: Apollonia as a focused experimental framework positioned at the intersection of digital heritage, architectural interpretation and interactive media design. Rather than proposing a fully resolved technological product, the study explores how a lightweight, narrative-driven game system can operate as an interpretative interface through which complex archaeological knowledge becomes accessible to a broader audience. The central argument of the study is that the effectiveness of such systems depends less on visual realism or technical complexity, and more on how interaction, narrative and spatial structure are organized to mediate knowledge. Within this perspective, the project shifts attention from reconstruction as a final output toward interpretation as a continuous and open-ended process.

The application of pixel art is approached not as a stylistic preference, but as a methodological strategy. Through controlled abstraction, pixel-based representation translates architectural and archaeological elements into simplified yet legible forms, preserving essential spatial relationships while reducing visual overload. This balance becomes particularly relevant in mobile environments, where constraints of scale, performance and attention shape the user experience. At the same time, simplification does not imply a reduction of meaning. When supported by a coherent interaction logic, reduced visual systems can enhance interpretative clarity by directing attention toward key spatial and historical relationships. In this sense, the study contributes to current discussions on abstraction as a valid representational approach within digital heritage.

The click-based interaction model further supports this framework by structuring engagement into discrete and repeatable units. Each interaction operates as a compact interpretative event, combining visual cues, concise text and narrative input. This aligns with micro-learning dynamics, where knowledge is progressively constructed through short, focused engagements rather than extended linear sequences. The inclusion of multiple narrative characters introduces an additional interpretative layer. By distributing perspectives across different voices, the system reflects the non-linear and interpretative nature of archaeological knowledge, avoiding a single authoritative narrative. This approach supports varied modes of engagement and accommodates different levels of user familiarity. Despite these contributions, the study remains aware of its limitations. The project is currently positioned as a prototype framework, and its educational impact has not yet been validated through empirical testing. As such, claims regarding user engagement and learning effectiveness remain provisional and require further investigation through structured evaluation methods. A second limitation concerns the nature of representation. All archaeological reconstruction is inherently interpretative, and the process of abstraction introduced by pixel art may further reduce detail. Rather than attempting to conceal this condition, the project integrates it into its logic by maintaining the coexistence of reconstructed elements and visible fragments, reinforcing the provisional nature of heritage knowledge. From a broader perspective, the study suggests that lightweight interactive systems can play a significant role in expanding access to cultural heritage. In contexts such as Albania, where digital heritage practices are still developing, accessible and resource-efficient approaches offer a realistic pathway for connecting academic research with wider audiences. The methodology also demonstrates potential for scalability. While developed for Apollonia, its structure can be adapted to other archaeological sites with comparable adjustments in content and spatial logic. This opens the possibility of extending the project into a series of interconnected applications, contributing to a broader digital framework for heritage interpretation.

Finally, the study advances an understanding of interaction not merely as a technical feature, but as a cognitive process. Interaction is positioned here as the mechanism through which users engage with, interpret and reconstruct knowledge, rather than passively receive it. In conclusion, Interactive Illyria – Apollonia shows that carefully structured, small-scale interactive systems can generate meaningful engagement with cultural heritage when grounded in clarity, narrative coherence and spatial logic. While further development and validation are required, the framework offers a viable direction for future research and application.

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