BeA-ViR Game: From Virtual Exploration to Simple Gamification

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Abstract. Our Cultural Heritage is a treasure trove of human history, consisting of collective knowledge, traditions, and artifacts passed down from our predecessors. Communication of Cultural Heritage in the contemporary digital era can be facilitated through interactive media, such as games, which serve a purpose beyond mere entertainment. Serious Games have evolved as a potent instrument for engaging users in investigating Cultural Heritage. They offer an immersive and intriguing experience transcending mere passive observation, encouraging active participation.

The demo of the BeA-ViR Game presents a work-in-progress Serious Game to emphasize Cultural Heritage content in a virtual environment. To be more specific, simple gamification elements focused on chronological and spatial dimensions are introduced presenting ancient archaeological findings uncovered in Japan in order to engage users with the virtual contents.

Keywords: Serious Games · Cultural Heritage · Archaeology

1 Introduction

Cultural Heritage Communication (CHComm) is recognized as part of the strategic objectives of UNESCO regarding Cultural Heritage (CH) [12]. Typically, heritage conservation is combined with disseminating heritage to current and future generations. Indeed, heritage conservation is a "communicative act", and public communication is an integral aspect of the conservation process [3]. Nowadays, ubiquitous Internet access and the usage of digital media to communicate CH have drastically altered CHComm. In fact, senders worldwide can include CH meaningful information in a message transmitted via a digital medium.

Among the different media, Serious Games have shown to be a potential instrument in the field of Cultural Heritage and can attract more individuals who are unfamiliar with art [2], history [11], or archaeology [1]. In the archaeology context, they have been designed to boost user interest in remote and inaccessible archaeological sites, raise awareness of these sites, and possibly offer a way to visit them using digital technologies [7]. In these games players can move around reconstruction of archaeological sites and examine 3D artifacts (often

photoscanned). They may rotate, zoom in, and inspect artifacts from various angles to understand their details, significance, and historical context [4]. Most of games in this field are based on the spatial and temporal organization of content, fundamental elements in archaeology. In fact, some Serious Games feature interactive ways to explore content chronologically, allowing players to navigate through different historical eras (e.g. Father and Son Game[1]). This may concern significant events, cultural shifts, and archaeological discoveries, giving players a sense of how civilizations evolved over time. The spatial feature is considered through the use of maps or 3D reconstructions that provide information on the geographic distribution of unearthed artifacts or sites present in the game [10].

The BeA-ViR System [9] enables users to visit and analyze the spatially and temporally organized digitized Japanese sites and artifacts excavated by the BeArchaeo Project[2]. In this demo we present BeA-ViR Game, that relies on exploration and engaging gamification elements based on geographical and chronological dimensions. Gamification may aid users in their reception of cultural information pertaining to Japanese history by promoting an interactive, user-action-based approach that goes beyond the passive presentation of the content.

2   BeA-ViR Game

Beyond Archaeology (BeArchaeo, for short) is an archaeological project that employs digital techniques throughout the entire process of excavation, interpretation, and presentation of findings from the Tobiotsuka Kofun, a late 6th-century mounded tomb located in Soja City, Okayama Prefecture, Japan. The project focuses on the excavation activities at Tobiotsuka Kofun as well as the archaeological and archaeometric studies from other sites in the same region (Okayama Prefecture) and nearby prefectures (Shimane and Tottori). Its methodology involves the use of a semantic database that contains comprehensive information on all excavation and analytical activities conducted [5] [6]. BeA-ViR is a multilingual and multi-platform (desktop, browser and CAVE) system for showing and assessing photoscanned artifacts from the BeArchaeo project. BeA-ViR was presented at the exhibition "The Tale of Be-Archaeo: between Science and Tradition" which was held at the Shimane Museum of Ancient Izumo, Japan, and at the Rectorate Building of the University of Torino, Italy.

Through BeA-ViR, users can view sites and artifacts by interacting with virtual surfaces in various exhibition environments. The application provides three exhibition layouts based on archaeological content: Single Finding Exhibition (which concerns only one finding), Multiple Findings Exhibition (which concerns several findings from multiple related sites), and Site Complex Exhibition (which concerns a virtual representation of an archaeological site and its findings). The entry to the individual environments is controlled by an introductory environment (Main Hall, Fig. 1a) via virtual gates. Users can navigate

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[1] Father and Son Game

[2] BeArchaeo Project Website

through the gates and explore the site-related photoscanned findings in each environment. The controls used by the user are the triggers and buttons on the gamepad or keyboard controller as well as the footboards in the surrounding virtual environment. The footboards allow the user to move from one area to another and activate specific functions related to the archaeological and geographical information of an environment. The controls, standardized to the various target platforms, allow the user to move in first person and also observe the environment from above through a particular action, such as flying or jumping to a greater height before falling with gravity. Finally, users who don't want to explore can use the "guided tour" function that leads them through predetermined paths of exploration, stopping at each specified point of interest. Users can approach each finding in each environment, assess its original size using metric cues, and view the linked information acquired from the BeArchaeo semantic database using graphics panels (Fig. 1b). The facts displayed vary depending on the user; there is more generic information aimed at the general public and more technical information aimed at professionals. In addition to the objects, 3D representations of archaeological sites where the artifacts were discovered are available. In BeA-ViR, spatial and temporal dimensions are crucial. In fact, the

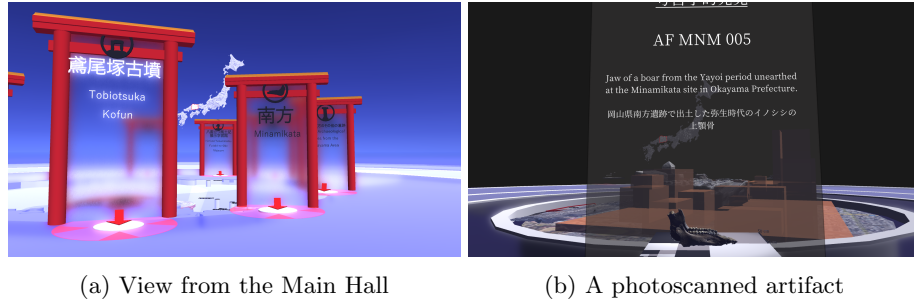(a) View from the Main Hall   (b) A photoscanned artifact

Fig. 1: Screenshots from BeA-ViR

contents shown, in addition to the division based on the number and type of artifacts, are grouped from their geographical origin and the period of Japanese history to which they belong. The spatial dimension is highlighted through a 3D map of Japan present in each explorable environment in which the name of archaeological sites from which the artifacts come are shown. The Main Hall is organized as a double-encircled surface, with the inner circle implementing the spatial dimension (with all the gates visible) and the exterior circle representing the time dimension. If the user touches the external circle, the chronological dimension is enabled and a transparent wall appears between them and the gates. This wall works as a timeline and allows exploration of the areas by exploiting the historical period to which the displayed contents belong.

3   Geospace and Chronology Through Interaction

BeA-ViR Game contains simple gamification components, which create a higher level of engagement and immersion when compared to a passive presentation of the CH content. In fact, information about geographical and temporal dimensions is only displayed as a result of the user's exploratory activity, with the goal of fostering discovery and observational abilities. Instead of immediately displaying all the information to the user, the goal is to present it in a playful manner, allowing it to be discovered through exploration. A tight relationship between user engagement and CH dissemination keeps the player engaged in long-term sessions [13] and indicates promising improvements in the learning process, improving user attention and boosting higher-level critical thinking [8].

In conveying the spatial aspects, the gamification approach implemented involves emphasizing the archaeological sites highlighted on the map of Japan. Specifically, as the user approaches a gate, the map of Japan shows a bright beam of light centered on the site related to the gate the user is about to explore. In addition, the name of the site in question is enlarged, placing more emphasis on the user's exploratory choice and geographic information referring to the site (Fig. 2a).

In terms of temporal aspects, the timeline has been the primary focus. To investigate the environments by utilizing the historical eras to which the artifacts and sites belong, the user must access the Main Hall's outer surface. In this manner, the timeline is displayed, and interaction with it requires circumnavigating it. Only the gates that lead to sites that were active in the current chronological era are depicted on the inner surface for each period of Japanese history. On the timeline, historical period names and reference dates are represented by 3D models that are highlighted (via a change in color and size) when the user is in close proximity, in order to elucidate the impact of the timeline on the game environment (Fig. 2b).
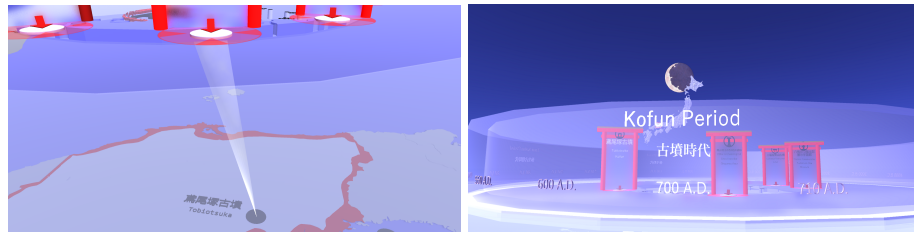
(a) Map reference   (b) Timeline

Fig. 2: Geospace (2a) and Cronology Discovery (2b)

4   Conclusions

This paper presented the demo of the BeA-ViR Game, which is a work-in-progress evolution of the BeA-ViR System. Users of BeA-ViR can interact with multiple exhibition environments, see artifacts and sites digitized by BeArchaeo Project, and access data from the semantic database for a distinctive virtual exploration experience. In BeA-ViR Game, gamification increases user involvement by emphasizing spatial and temporal aspects through interactive exploration. Exploration by users can reveal spatial and temporal information, making learning more pleasurable and productive. This method encourages a greater comprehension of historical and archaeological contexts and strengthens critical thinking.

Acknowledgements

References

1. Antoniou, A., Lepouras, G., Bampatzia, S., Almpanoudi, H.: An approach for serious game development for cultural heritage: Case study for an archaeological site and museum. Journal on Computing and Cultural Heritage (JOCCH) **6**(4), 1–19 (2013)
2. Froschauer, J., Arends, M., Goldfarb, D., Merkl, D.: Towards an online multiplayer serious game providing a joyful experience in learning art history. In: 2011 Third International Conference on Games and Virtual Worlds for Serious Applications. pp. 160–163. IEEE (2011)
3. on Interpretation, I.I.S.C., Presentation: ICOMOS Charter for the Interpretation and Presentation of Cultural Heritage Sites. Technical Report. ICOMOS (2008)
4. Liu, Y., Lin, Y., Shi, R., Luo, Y., Liang, H.N.: Relicvr: A virtual reality game for active exploration of archaeological relics. In: Extended Abstracts of the 2021 Annual Symposium on Computer-Human Interaction in Play. pp. 326–332 (2021)
5. Lombardo, V., Damiano, R., Karatas, T., Mattutino, C.: Linking Ontological Classes and Archaeological Forms, pp. 700–715 (11 2020)
6. Lombardo, V., Karatas, T., Gulmini, M., Guidorzi, L., Angelici, D.: Transdisciplinary approach to archaeological investigations in a semantic web perspective. Semantic Web **14**, 361–383 (2023). https://doi.org/10.3233/SW-223016, https://doi.org/10.3233/SW-223016, 2
7. Mariotti, S.: The use of serious games as an educational and dissemination tool for archaeological heritage potential and challenges for the future (2021)

8. Martin, F., Bolliger, D.U.: Engagement matters: Student perceptions on the importance of engagement strategies in the online learning environment. Online learning **22**(1), 205–222 (2018)
9. Murtas, V., Lauro, V., Lombardo, V.: Virtual archaeology in a multi-platform and multi-lingual setting. In: Adjunct Proceedings of the 31st ACM Conference on User Modeling, Adaptation and Personalization. p. 422–426. UMAP '23 Adjunct, Association for Computing Machinery, New York, NY, USA (2023). https://doi.org/10.1145/3563359.3596664, https://doi.org/10.1145/3563359.3596664
10. Pescarin, S., Fanini, B., Ferdani, D., Mifsud, K., Hamilton, A.: Optimising environmental educational narrative videogames: The case of 'a night in the forum'. J. Comput. Cult. Herit. **13**(4) (dec 2020). https://doi.org/10.1145/3424952, https://doi.org/10.1145/3424952
11. Šisler, V., Brom, C., Cuhra, J., Činátl, K., Gemrot, J.: Stories from the history of czechoslovakia, a serious game for teaching history of the czech lands in the 20th century–notes on design concepts and design process. In: Entertainment Computing-ICEC 2012: 11th International Conference, ICEC 2012, Bremen, Germany, September 26-29, 2012. Proceedings 11. pp. 67–74. Springer (2012)
12. UNESCO: UNESCO World Heritage Centre - The World Heritage Convention. UNESCO (2020)
13. Vocaturo, E., Zumpano, E., Caroprese, L., Pagliuso, S.M., Lappano, D.: Educational games for cultural heritage. In: VIPERC@IRCDL (2019), https://api.semanticscholar.org/CorpusID:67865981