

# Global Virtual Cultural Heritage Environment with attention to disability inclusion<sup>□</sup>

## A proposal for gamified immersive experiences of early watercraft and audience engagement

Kaja ANTLEJ, Deakin University, Australia

Nataša REBERNIK, University of Deusto, Spain

Lailan JAKLIČ, LaniXi.deviantart.com, Slovenia

Franc SOLINA, University of Ljubljana, Slovenia

Miran ERIČ, Institute for the Protection of Cultural Heritage of Slovenia, Slovenia

**Keywords:** virtual reality: applied games: early watercraft: disability inclusion: accessibility:

### A global network of Early Watercraft heritage

Early watercraft can be considered as one of the first and most significant human inventions from technical, cultural and environmental perspectives. The discovery that water – at the beginning rivers, lakes and bays – can be utilised to improve human mobility represents an important historic milestone with a direct impact on human migration, trade and infrastructure development. Most of the early watercraft such as logboats, reed/stalk boats, skin boats, bark boats, and rafts were made from organic material non-resistant to air and UV rays. Hence, these artefacts have mainly been preserved in watery environments which caused their research has always been a logistically complicated process. The lack of archaeological data in the last two centuries resulted in having only logboats being recognised as a significant cultural heritage (Kröger, 2018). However, the recent development of modern underwater archaeology and sophisticated 3D digitisation tools have accelerated the interest of a wider heritage community in studying early watercraft.

In 2015, Global initiative: Early Watercraft – a global perspective of invention and development (Erič, 2014) was inaugurated in Vrhnika, Slovenia (Fig. 1). The initiative aims to connect researchers interested in early watercraft into a global network and provide an open forum to geo-locate and exchange the data as well as to discuss the strategies to recognise this type of heritage as a significant human achievement. At this stage, 95 individuals from 18 organisations in 43 countries are involved in the network. The initiative coincides with Early Watercraft<sup>1</sup> a web-based geospatial information system published by the University of Ljubljana and the Institute for the Protection of Cultural Heritage of Slovenia. The platform runs on Arches (v3.0), an open source data management system for heritage developed by the Getty Conservation Institute and World Monuments Fund.<sup>2</sup> At this stage, the Early Watercraft (v1.0) platform includes detailed information on almost all known (92) logboats from Slovenia. The platform is aiming to expand into a Global Virtual Cultural Heritage Environment (GVCHE). When Arches will be upgraded to a newer version, it will provide a better user experience. It will also include a European database with almost 3500 logboats recorded from early 19th Century until today (Kröger 2018).

The information currently published on the platform besides the description of an artefact, its location, dating, condition and related publications, also contains visual material such as data images and 3D models of the main findings reconstructed based on archaeological drawings and/or 3D digitised artefacts. The Early Watercraft platform is generally targeting researchers. Therefore, it is due to its nature, too scientific to be used by a wider audience as a learning material and for enjoyment. Hence, our main question is as of how can we interpret data images and 3D assets to wider audiences? How can we give 3D assets a meaningful context to help wider audiences engage with early watercraft? Can gamified immersive experiences using Virtual Reality (VR), Augmented Reality (AR), Mixed Reality (MR) or Extended Reality (XR) improve the

---

<sup>□</sup> Author's address: Kaja Antlej, School of Engineering, Deakin University, 75 Pigdons Rd, Waurn Ponds, VIC 3216, Australia; email: kaja.antlej@deakin.edu.au. Nataša Rebernik, Engineering for Information Society and Sustainable Development, University of Deusto, Bilbao, Spain; email: natasa.rebernik@deusto.es. Lailan Jaklič, www.jakliclailan.wixsite.com/lanixi, Repče 15 1293, Šmarje-Sap, Slovenia; email: lailan.jaklic@gmail.com. Franc Solina, Visual Language Lab, Faculty of Computer and Information Science, University of Ljubljana, Večna pot 113 Slovenia; email: franc.solina@fri.uni-lj.si. Miran Erič, Institute for the Protection of Cultural Heritage, Poljanska 40, Ljubljana, Slovenia; email: miran.eric@guest.arnes.si (corresponding author).

<sup>1</sup> www.earlywatercraft.org

<sup>2</sup> www.archesproject.org

engagement? Can digital technologies in combination with human-centred design approaches make an inclusive heritage paradigm a reality? This paper discusses a proposal of the development of an engaging GVCHE using a case study of early watercraft with attention to disability inclusion.

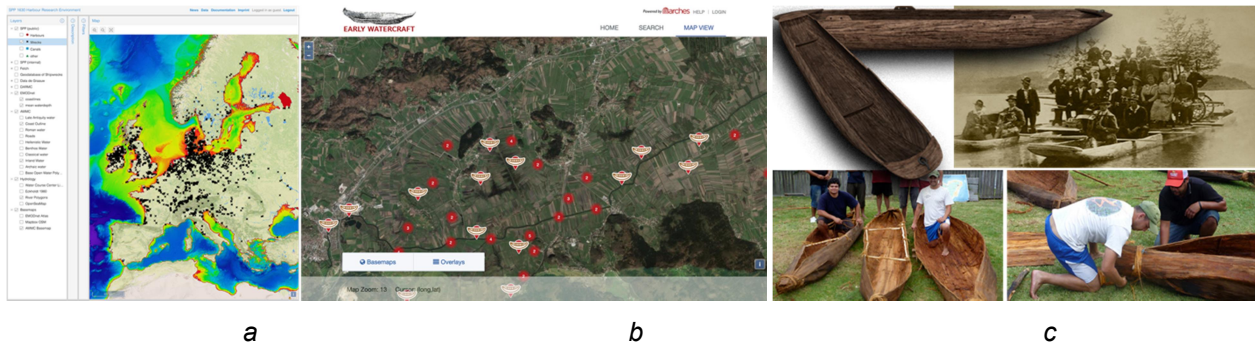


Fig. 1. a) Harbour Research Environment (HARE) of the SPP 1630 Harbours Program. b) Early Watercraft, a web repository showing logboats from Ljubljansko Barje. c) Top left: A 3D model of an extended logboat (© Lailan Jaklič). Top right: Weddings on extended logboat on Cerknjiško jezero, Slovenia (© Heritage House Cerknica). Bottom left and right: Building a typical Australian Aboriginal bark boat on the New South Wales south coast (© David Payne/Australian National Maritime Museum).

## Gamified VR/AR/MR/XR as a way to engage audiences with a GVCHE

Online heritage repositories have now matured to the stage they became rich and flexible virtual environments. An exceptional development of computer games in recent decades have enabled interactive history (Champion, 2015) in the forms of applied or serious games, to become widely used in museums and schools. Moreover, the democratisation of VR/AR/MR/XR is shaping a new wave of digital heritage interpretation and audience engagement.

Games enable learning through measured feedback by interacting with a game environment (Dubbels, 2019). The player memorises information subconsciously because it is meaningful to the storyline, is a subtle feature of the game, or through the method of winning the game, resulting in an engaging experience, where learning emerges as a side effect (Breuer and Bente, 2010). In addition, games applied in the context of cultural heritage contribute to its preservation, reproduction and appreciation (Schnabel, 2018).

## Disability inclusion in heritage

Heritage gives us a sense of belonging and identity, it touches the deepest parts of our human experience which reaches beyond just fulfilling one's everyday routine. Thus, it is of a paramount importance to make heritage accessible and inclusive for all people, including those with diverse impairments and disabilities, for them to be able to enjoy it on the equal basis with others (UN General Assembly, 2007). Immersive digital technologies and tools nowadays offer countless opportunities to achieve this goal. This paper explores the terrain of early watercraft heritage and the potential of technological advances towards enhancing inclusive heritage audience representation.

Putting the needs of the most vulnerable heritage users, such as those with disabilities first, might also help influence the way technology is used for heritage representation and interpretation to enhance inclusion for all (Deffner et al, 2015). As scholars and practitioners have suggested (Hanson, 2004; Rebernik et al, 2019), if the design is done with the disability inclusion in mind, also other users can benefit from it. Universal Design or Design for All refer to services, products and spaces (European Commission, 2015) and mean accessibility and inclusion for all. Virtual presence and distance accessibility, satellite connectivity, multimodality and many more of the technological advances enable people with impairments to experience the world heritage beyond the traditional logic of materiality. A person on a wheelchair will be able to access physically inaccessible heritage in immersive ways from the comfort of their home. A visually impaired or hearing-impaired person will get immersed through multisensory experience combining audio, visual and haptic forms of content interpretation. Intellectually impaired individuals will learn about heritage through easy-to-understand contents, gamification and visualisations. As we see, technology can help create a new

inclusive paradigm where no one is left behind. However, there is still a long way to go, as the design is done by people for the people and thus requires strong partnerships with user-centred and audience engagement methodologies.

### Case studies proposal: inclusive audience engagement with Early Watercraft

In this paper, a systematic approach to develop inclusive gamified immersive experiences from a publicly available archaeological repository is proposed. The proposal will be tested on the Early Watercraft GVCHE platform. Since early watercraft is shared and inclusive heritage it can serve as a bridge between different continents, countries and time zones, which gives an opportunity to create a unique multi-user experience through immersive collaborative game design focused on availability, accessibility and connectivity.

The proposed model contains the use of data images and/or 3D scanned assets as a scientific input for CAD (computer-aided design) reconstructions. The 3D models are then texturised using available libraries to better understand the material used. Once CAD 3D models combined with GIS (geographic information system) environment are created, polygonised 3D models are generated for the use in VR/AR/MR/XR. In order to develop an inclusive and meaningful gamified experience, a user interaction with 3D assets have to be well designed. These low-cost and transferable solutions of short gamified VR/AR/MR/XR heritage experiences are inspired by indie games, a genre of simple computer games developed by independent authors. Alongside the Early Watercraft platform, the games will be accessed from various locations including museums, interpretation centres, and schools as portable pop-up experiences. The model will be developed and tested using the case studies in Slovenia, Australia and other countries. The proposed model will be suitable to be applied to different heritage environments.

### References

- Breuer, J. and Bente, G. (2010). 'Why so serious? On the relation of serious games and learning.' *Eludamos. Journal for Computer Game Culture*. Available at: <https://www.researchgate.net/publication/200737995> (Accessed: 22 June 2019).
- Champion, E. (2015). *Critical gaming: interactive history and virtual heritage*. London: Routledge. DOI: 10.4324/9781315574981.
- Deffner, A., Psatha, E., Bogiantzidis, N., Mantas, N., Vlachaki, E., Ntaflouka, P. (2015). Accessibility to culture and heritage: designing for all Conference, *AESOP 2015, Definite space – fuzzy responsibility*, Czech Technical University, Faculty of Architecture, Prague. 13th –16th July 2015.
- Dubbels, B. (2019). 'Requirements-based design of serious games and learning software: an introduction to the Vegas Effect.' *Exploring the Cognitive, Social, Cultural, and Psychological Aspects of Gaming and Simulations*. Available at: <https://www.academia.edu/38047994/> (Accessed: 4 April 2019).
- Erič, M. (2014), 'New reflections on the protection of World Heritage in the future: Global symbolic meaning of autochthonous and indigenous origins of water navigation.' *International Journal of Heritage in the Digital Era* 3 (4). 597-612.
- European Commission (2015). *Study on the socio-economic impact of new measures to improve accessibility of goods and services for people with disabilities - Final report*. Brussels, European Commission.
- Hanson, J. (2004). The inclusive city: Delivering a more accessible urban environment through inclusive design, *RICS Cobra 2004 International Construction Conference: Responding to Change*, York, UK.
- Kröger, L. (2018). *Within The Network Of Fluvial Ports. European Harbour Data Repository Vol.1* DOI: 10.22032/dbt.35240.
- Rebernik, N., Goličnik Marušić, B., Bahillo, A., Osaba, E. (2019). 'A 4-dimensional model and combined methodological approach to inclusive urban planning and design for ALL.' *Sustainable Cities and Society* 44, p. 195-214.
- Schnabel, M. A. (2018). 'Tangible and intangible digital heritage: creating virtual environments to engage public interpretation. Computing for a better tomorrow.' *36th Annual Conference on Education and Research in Computer Aided Architectural Design in Europe (eCAADe2018)*, 2, 225–232.
- UN General Assembly (2007). *UNCRPD, Convention on the Rights of Persons with Disabilities: resolution / adopted by the General Assembly, 24 January 2007, A/RES/61/106*.