Being There and Then.
Cultural Presence for Archaeological Virtual Environments

LAIA PUJOL-TOST [1]

[1]Pompeu Fabra University (UPF), Barcelona, Spain, Pujol.Laia@gmail.com

Abstract

This poster presents a general summary of the development and outcomes of the two-year EU-funded project LEAP (Learning of Archaeology through Presence). {LEAP} aimed to provide a theoretical and methodological framework for the design and evaluation of archaeological virtual environments, based on a reformulation of the HCI concept of Cultural Presence

Categories and Subject Descriptors (according to ACM CCS): J.5 [Computer Applications]: Arts and Humanities—Architecture.

1. In one {LEAP}

One of the main goals of Virtual Heritage is currently to build 3D architectural photorealistic reconstructions of Cultural Heritage settings as a universal way to learn about the past. However, such 3D models seem to generate superficial knowledge about specific recognizable elements (see also PE09).

Thanks to the immersive and interactive character of VR, it may also allow a more direct understanding of the culture that lived there. This overlaps in part with the concept of Cultural Presence (CP), presented some years ago in the field of Human-Computer Interaction [RCGM02], but never fully investigated. The two-year EU-funded project LEAP (LEarning of Archaeology through Presence) aimed to develop this crossroad area by researching, implementing and evaluating a new interdisciplinary theoretical and methodological framework for Virtual Heritage. {LEAP} considered CP (the feeling of "being then and there") was the key to design and evaluate experiences that would enhance understanding, social relevance and enjoyment of Cultural Heritage according to specific goals.

2. {LEAP}ing at opportunities

Such interdisciplinary endeavour required the collaboration of strong research teams. At Pompeu Fabra University of Barcelona, MIDARQ Research Group (Archaeology), SPECS (Cognitive Sciences), and Cognitive Media Technologies Lab (HCI) joined forces.

3. A {LEAP} into the dark

We developed {LEAP} in three phases. Firstly, we built and successively refined with the help of relevant scientific literature a theoretical and methodological framework, based on a new understanding of the concept of CP [PC12].
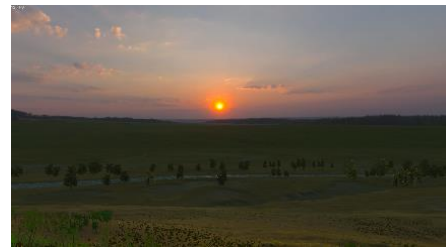

Figure 1: Sunset at ÇH3D.

The second step was the design and implementation of a VR-mediated experience of the UNESCO World Heritage Neolithic site of Çatalhöyük. We built "ÇH3D" with 3D Studio Max and Unity Game Engine. To define the content, we devised a novel methodology (3DCoD) adapted from co-design strategies and multimodal analysis. The experience requires light equipment (gaming laptop, HMD, earphones and gamepad), and therefore it can travel anywhere. It has two display modes, immersive and screen-based, which increases flexibility regarding audiences and environments. On the other hand, ÇH3D pretended to go beyond purely 3D architectural models. In this sense, the user

experience consists of a one-day trip to Çatalhöyük 9000 years ago. The model has six different versions: architecture only, objects, hotspots, still characters, scenes, and storytelling. In each one, users can explore five pre-defined points of interest (2 inside a house and 3 at different points on the settlement) displaying the most representative cultural aspects of Çatalhöyük. For test purposes, we introduced different levels of visual realism.

Figure 2: User evaluation (condition 1).

In the third stage, we assessed the cognitive, emotional and learning impact of ÇH3D. The evaluation consisted on a between-subjects experiment. 85 participants (47% male and 53% female; 12-80 years old; diverse backgrounds; different levels of experience with technology and Cultural Heritage) explored ÇH3D while being recorded, and filled in two questionnaires. The pre-experience questionnaire contained mainly demographic questions; the post-experience questionnaire corresponded to a novel Cultural Presence Questionnaire (CPQ), which was built and pilot-tested after an exhaustive review of Presence assessment tools. The subsequent analyses, both qualitative (e.g. multimodal, interpretation) and quantitative (e.g. ANOVA, Chi Square, Principal Components, Exploratory Factor Analysis, Correlations), provided the first comprehensive results about the factors underlying CP, learning, as well as guidelines for design.

The consistency of results across several Factor Analyses indicated the concept of CP is sound and composed by four main factors: 1) Realistic behaviour and scientific/cultural reliability of the virtual environment; 2) Distinctive cultural elements (place, material culture, everyday life, people's aspect); 3) Presence of realistic, autonomous human characters; and 4) Communicational aspects of technology (visual realism, affordances for interaction in environment; intuitiveness of interaction in devices).

The analyses detected a positive but not linear correlation between learning and CP. In other words, learning was a compromise between richness in content, affordances for exploration, and abstract explanations (textual and especially via narration).

Finally, contrary to their current use, virtual reconstructions are not a universal tool. ANOVAS revealed that several user factors should be taken into account: suspension of disbelief, expertise in related fields, experience with computer games, and with immersive VR. These variables influence users' expectations towards virtual environments (simulation, communicational tool or game), as well as the understanding of how culture is plausibly represented by visual means (material culture vs. autonomous characters).

4. The {LEAP} forward

{LEAP}'s main contributions are the following:

- Building a new research area. The proposal of CP as an empirically grounded theoretical and methodological framework should help develop the currently under-theorized area of Virtual Heritage.

- Providing new, verified, trans-disciplinary tools and methods for design and assessment. The Co-design Method for VR-mediated experiences (3DCoD) and the Cultural Presence Questionnaire (CPQ) must be tested in other contexts, but they could become standard tools for Virtual Heritage in the near future.

- Setting new models. ÇH3D intended to set a revolutionary model for the representation of the past: instead of 3D architectural models, a phenomenological VR-mediated experience; instead of static photorealism, a general feeling of dynamic verisimilitude (as in videogames); and instead of simulation of reality, enhancement of virtuality (to facilitate understanding).

- Providing guidelines. The comparative evaluation of ÇH3D in its different versions complements the above with a set of empirically supported guidelines for the design of different kinds of virtual reconstructions according to specific, explicit goals.

- Contributing to other research areas. True to its interdisciplinary character, {LEAP} has also delivered new statistical data about the factors underlying (Cultural) Presence and its (positive but not linear) correlations with learning to the HCI field.

5. Acknowledgments

References

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