REENACT: A step forward in immersive learning about Human History by augmented reality, role playing and social networking ☆

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ARTICLE INFO

ABSTRACT

Classical pedagogy about Human History has dealt with many historic events as a mere collection of dates, locations and a number of confronted sides with a final result of victory or defeat. In the same line of thinking, many popular battles and wars are not well understood due to non-rigorous treatment in comics, movies and documentaries. In order to fight these drawbacks we propose a novel technology-enhanced pedagogical approach named REENACT which is aimed at engaging groups of people into immersive experiences to improve their learning about historical battles and wars from the points of view of reenactors and historians. To this aim, REENACT relies on handheld devices and an advanced technological facility that comprises social networking features, augmented reality capabilities and repositories of multimedia contents. Our pedagogical approach has been experimentally validated in collaboration with the Foundation of the Hellenic World in Greece and the School of Telecommunication Engineering from the University of Vigo in Spain. The obtained results in terms of Quality of Experience, Quality of Service and Quality of Community reveal the potential value of the approach to provide new edutainment collective experiences which remain unexplored thus far in educational environments.

1. Introduction

Human History includes a large number of battles and wars, whose results cannot be understood properly from the traditional teaching, where they are presented as occasional events that involve two sides (the good and the evil forces) and that apparently end fortuitously. Nothing is so simple in reality, and so the classical pedagogical approach neglects many facts about the reasons for the battles, alliances and supporters, why things went on the way they did, what were the winning or losing choices, what were the consequences in the short, medium and long terms, etc. As a result, our general awareness of History is rather partial and deficient, and students end up with little more that a collection of dates and a vague idea of who defeated who.

It is obvious that educational environments are scenarios where the promotion of debates and brainstormings should be a must.

The current technological context makes easier the development of novel approaches that boost the collaboration not only among students but also among them and the expert who leads the teaching about a particular topic/subject. Bearing these ideas in mind, we bet on taking the advantage of the emergence of novel technologies – such as smartphones and tablets, social networking, videogames for learning and even virtual reality – which pave the road to make things better and more interesting in teaching about historical events. Specifically, in this paper we present a new pedagogical proposal (called REENACT) that has been developed in the scope of a Seventh Framework Programme (FP7) research project named EXPERIMEDIA.[1] The REENACT approach exploits augmented reality (AR) technologies to improve the understanding of historical events with the aid of tactile mobile devices, repositories of multimedia contents, an advanced technological facility and remote experts (López-Nores et al., 2013). REENACT has been designed as a Future Media Internet application to engage groups of people into immersive learning experiences, to learn more about the reasons behind a particular battle or war, the course and the result of these historical events.

[1] www.experimedia.eu.

Our pedagogical methodology over REENACT is organized in three stages, where participants can live the event learning about it from inside as reenactors, and also from outside, as historians. Actually, REENACT is not a multiplayer online game but a collective in-person activity supported by handheld devices.

- Stage 1 (*reenactment*) is about involving groups of people in the reenactment of battles. They can physically move around in a room, playing the actions defined for a given role by a script of the particular historic event and interacting with the other participants inside the game. Tactile mobile devices provide the participants with an augmented reality vision resembling a multiplayer role-playing game. In this stage, the participants can spend some time in different designates zones (within the reenactment room), which correspond to real places relevant to the battle in question. While staying in a given zone, a participant can interact with other users as dictated by the reenactment script, e.g., to talk, to negotiate or vote on some decision, to fight, etc.
- In stage 2 (*replay*), the participants are taken to a projection room to analyze what has been happening. They have already lived the battle from inside, with a very partial vision, and now it is turn to learn more by watching things from outside, and to see how their recreation compares to the real historic events. The explanations are given by one expert, who may be physically present at the projection room or appearing on the screen from a remote location.
- Finally, in stage 3 (*debate*), the expert drives a collective brainstorming about the consequences of the conflict in the short, medium and long terms. The projection screen becomes a dynamic big board to display comments posted by the participants involved in the learning experience, which can be rearranged by the expert as the debate goes on. At any time, the expert can illustrate the different points that are raised by multimedia contents which will be automatically selected according to their relevance for the particular context.

The validation of our pedagogical proposal over REENACT was done in collaboration with two institutions: first, the Foundation of the Hellenic World (henceforth, FHW), a not-for-profit cultural institution in Athens that enjoys a unique technological infrastructure (including a dome-shaped virtual reality theatre named Tholos), and second, the School of Telecommunication Engineering at the University of Vigo. In both experiments, we dealt with the Battle of Thermopylae, a historic event where Greek city-states (led by King Leonidas of Sparta) and the Persian Empire of Xerxes I fought during three days at the narrow coastal pass of Thermopylae. This scenario is propitious for our validation purposes because the event is quite popular but it is not really well understood due to non-rigorous treatment in movies and comics, where the Battle of Thermopylae is presented as a fight where some handsome good Spartans were defeated by a huge number of abnormally-ugly bad Persians. Fortunately, the details reported by Herodotus (1922) and other historians provide sufficient scenes to yield both a didactic and enlightening experience to explain such facts as the advantages of training, equipment, and good use of terrain as force multipliers. Furthermore, the FHW had produced its own multimedia contents about the battle, which was invaluable material for the three stages of the REENACT experiences. We also enjoyed support from the FHW historians to develop historically rigorous reenactment scripts and to foster interesting debates.

This paper is organized as follows. In Section 2 we review related approaches to technology-driven learning experiences. Next, Sections 3 and 4 describe the internals of the three stages that shape our pedagogical proposal and the implementation details behind the REENACT system, respectively. The experimental validation of our approach in collaboration with the FHW and the School of Telecommunication Engineering will be described in Section 5, where we also discuss the achieved results in terms of key performance indicators derived from *Quality of Experience* (QoE), *Quality of Service* (QoS) and *Quality of Community* (QoC) metrics. Finally, Section 6 highlights the main conclusions drawn by the authors from our first testing experiences, along with possible extensions to enhance the REENACT approach.

2. Related works

The use of certain technologies (like video games) in learning activities is not new at all (Abt, 1970), yet recently there has been a renewed interest in their adoption in order to motivate and stimulate higher order thinking when it comes to providing the students with improved instructional experiences (Anagnostou, 2011; Charsky & Ressler, 2011; Fassbender, Richards, Bilgin, Thompson, & Heiden, 2012). In the line of these samples of new educational approaches, we can highlight the work presented in Akkerman, Admiraal, and Huizenga (2009), where Akkerman et al. analyze a mobile game (called *Frequentie* 1550) which includes a one-day activity meant for secondary school students to actively experience the History of the city of Amsterdam in late medieval era. Before starting the game, the students were introduced into the main story line of the game, its parts, tasks and tools to be used. Next, the users were organized in groups of four or five people. Each group was divided into a *city team* and a *head quarter team*, so that the students of the first one moved around the city experiencing buildings, receiving messages and instructions from the head quarter team members, completing game assignments (e.g., taking pictures or shooting videos), while using mobile phones for communication and exchanging information. The results derived from Akkerman et al. (2009) reveal different levels in the students' engagement as per their role in the game: the city team members actively participated in the game (living the story and experiencing it more deeply) but their focus was also distracted by what was happening in real time in the street. However, the head quarter members were aware of what they had been doing during the game, without losing the sight of its overall structure and its narrative. Extrapolating these results to our REENACT approach, we might think that the reenactors could lose the flow of the historic event due to their active involvement in the first stage of the experience (reenactment). However, we guess that the brainstorming driven by the expert (a role not considered in the game by Akkerman et al.) during the replay and debate stages will be crucial to trigger the participants' awareness of the historic event considered.

The adoption of educational video games has gained momentum especially in teaching about History. For instance, in Watson, Mong, and Harris (2011) assess the videogame *Making History* as a valuable tool in capturing the experience of a teacher and his students when it comes to teaching about the World War II in a high school. While students played the game, the teacher moved around the classroom answering to questions and posing his own, having a final discussion about the strategies the countries tried, how they differed from History, and what conclusions could be drawn. The results published in Watson et al. (2011) are concluding and common to other technology-enhanced learning experiences published in literature (Chien, Wu, & Hsu, 2014; Kim, Olfman, Ryan, & Eryilmaz, 2014; Noteborn, Dailey-Hebert, Carbonell, & Gijselaers, 2014): the teacher noted the active participation within the classroom, and the students highlighted the edutainment potential of the game, which undoubtedly reinforces the adoption of technological capabilities in improved learning experiences about historic events like those handled in our REENACT approach.