Augmented Reality in Informal Learning Environments:  
A Music History Exhibition

José Duarte Cardoso Gomes, University of Algarve, Research Centre for Arts and Communication (CIAC), Faro, Portugal  
Mauro Jorge Guerreiro Figueiredo, University of Algarve, Centre for Marine and Environmental Research (CIMA),  
Research Centre for Arts and Communication (CIAC), Faro, Portugal  
Lúcia da Graça Cruz Domingues Amante, Universidade Aberta, Educational Communication and Digital Media, Lisbon,  
Portugal  
Cristina Maria Cardoso Gomes, University of Algarve, Research Centre for Arts and Communication (CIAC), Faro,  
Portugal

ABSTRACT

Augmented Reality (AR) allows computer-generated imagery information to be overlaid onto a live real world environment in real-time. Technological advances in mobile computing devices (MCD) such as smartphones and tablets (internet access, built-in cameras and GPS) made a greater number of AR applications available. This paper presents the Augmented Reality Musical Gallery (ARMG) exhibition, enhanced by AR. ARMG focuses the twentieth century music history and it is aimed to students from the 2nd Cycle of basic education in Portuguese public schools. In this paper, we will introduce the AR technology and address topics as constructivism, art education, student motivation, and informal learning environments. We conclude by presenting the first part of the ongoing research conducted among a sample group of students contemplating the experiment in educational context.

KEYWORDS

Art Education, Augmented Reality Musical Gallery, Basic Education, Students, Constructivism, Mobile Computing, Motivation, Twentieth Century Music History

INTRODUCTION

New and innovative technologies continue to modify every aspect of home, life and work: the way we communicate, learn and socialize. Computer technologies are changing the ways we think and make sense of our world (Collins & Halverson, 2009).

While educators may legitimately debate strategies and methods of education, all agree that participation in the world of the 21st century will demand technology competence. Technology is essential in teaching, communications, mathematics and science, and it is no less important in the arts. Technology is an important tool that can improve the educational system, but the challenge of integrating technology into the delivery of content remains. Digital technologies, in all areas, can enhance student achievement by addressing introductory and advanced skills, assessment of student progress and student motivation (Assey, 1999).

Presently, Information Technology (IT) has become a ubiquitous component of undergraduate education. The use of computers, and mobile computing devices in educational context are commonplace in terms of usefulness and acceptance over the past few years and technology has found

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its place inside and outside the classroom for academic purposes (Sandler, 2010). These devices have increased processing power and usability, and are accessible on a large scale, which has significantly contributed to their ease of use and at implementing innovative educational processes in numerous educational institutions and universities (Figueiredo, Gomes, Gomes et al., 2014).

AR is a technology that combines real-world objects and digital information in real-time. AR, according to Azuma (1997), is a system that features three main characteristics: First, it combines the real and the virtual world; second, allows interaction and third, it incorporates the possibility of visualizing three dimensional (3-D) digital objects. Early AR experiments date back to the late 1960’s and to Ivan Sutherland’s work. At present, AR is widely available through mobile computing devices such as smartphones and tablets. According to the 2012 Horizon Report, AR was identified as an emerging technology with high relevance for teaching and learning and predicted to have a large adoption by 2015 (“NMC Horizon Report: 2012 higher education edition,” 2012).

Constructivist pedagogical approaches are inherent in most performance-based music courses. Students can apply new knowledge and receive synchronous feedback from teachers. However, knowledge-based courses such as music appreciation, theory and music history have historically relied on direct instruction and the lecture-model. Technology offers new opportunities to bring constructivist pedagogy to knowledge-based music courses, adding the possibility of autonomous exploration of interactive multimedia content (Keast, 2009) into the teaching-learning process in music history.

This paper introduces the concept and development of ARMG, focusing an audience of 2nd Cycle of basic education students at Portuguese public schools. ARMG is an interactive exhibition that aims to provide a constructivist pedagogical approach to the music history teaching-learning process and to promote AR technology as a means to deliver educational multimedia content to young students in an informal learning environment. The ultimate exhibition goals are to enhance student motivation towards music history learning and to improve their educational outcomes in music classes.

The paper is organized as follows: Section II introduces AR technology, how it has been used for educational purposes and its major affordances. Section III introduces the concept of the constructivist pedagogic model and the topics of art, motivation and informal learning environments. Section IV describes the concept and development of the ARMG. Section V present the first part of the ongoing research conducted among students and focusing their experience with the exhibition. The study hereby presented surveys the current usage of mobile computing devices by the target-audience. Section VI presents conclusions and further work possibilities.

AUGMENTED REALITY

The first AR prototypes appeared in the late 1960’s as a result from Ivan Sutherland’s and his students work in Harvard and Utah Universities. AR is a variation of the Virtual Environments, also known as Virtual Worlds or Virtual Reality (VR).

Augmented Reality (AR) is a technology that allows computer-generated virtual imagery information to be overlaid onto a live direct or indirect real-world environment in real-time. AR differs from virtual reality (VR) in that VR user experience a computer-generated virtual environment, whereas in AR, the environment is real, but extended with information and imagery from the system (Lee, 2012). AR is also defined as a technique that allows interacting and visualizing virtual graphics on top of the real-world view (Jaramillo, Quiroz, Cartagena, Vivares, & Branch, 2010). Milgram’s continuum (Milgram & Kishino, 1994) proposes that AR is a mixed reality environment, with one part belonging to the real-world, and other purely virtual. However, the real environment predominates (Figure 1).

This mixed-reality environment presents large possibilities for human-computer interaction (HCI) and it has been used in different areas, namely medicine, architecture, education, training, military, astronomy, chemistry, biology, mathematics, geometry, amongst many others.
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