Chapter 39
Augmented Reality in Informal Learning Settings:
Leveraging Technology for the Love of History

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ABSTRACT

Cultural heritage sites and museums are faced with an important challenge – how best to balance the needs of engaging visitors in meaningful and entertaining experiences, while at the same time exploiting the affordances of exhibits for instructional purposes. In this chapter, we examine the use of augmented reality in the context of informal learning environments, and how this type of technology can be used as a means to enhance learning about history. The research case studies are reviewed in terms of the use of historical locations, experience mechanics, narrative/plot, and role-playing (the later two representing game-based elements) in the design guidelines of instructional activities and applications (Dunleavy & Dede, 2014). In doing so, we critique the theoretical, methodological, and instructional underpinnings of studies that evaluate augmented reality applications and draw several recommendations for future research in this field.

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INTRODUCTION

Augmented Reality (AR) provides a user with additional digital information, often by superimposing images, texts, and/or sounds over a display of a real environment through a portable or head-mounted device. This type of immersive technology is commonly distinguished from virtual reality, where a user is immersed in an artificial, virtual environment, and from telepresence (e.g., videoconference software or devices) that enables a user to feel as if they were present in a real environment (Azuma, 1997; Azuma, Baillot, Behringer, Feiner, Julier, MacIntyre, 2001; Milgram, Takemura, Utsumi, and Kishino, 1994). Klopfer (2008) further characterizes AR in terms of the amount of digital media that is provided to the learner, ranging from light AR where information is provided primarily through the real world setting, to heavier AR where most of the informative is conveyed through a digital medium. AR technologies can also be differentiated in terms of sensors and devices. AR software applications utilize different types of sensors to capture either locations or objects in the real world. Location-aware or place-based AR utilizes a global positioning system or indoor positioning system to track the learners as they physically move throughout the real world location, in contrast to context-sensitive AR where 2D or 3D objects are recognized by the application. The essential characteristics of AR include (1) the blending of real and virtual media; (2) interactivity with the environment through location and orientation (e.g., GPS) or image sensors (e.g., 2-dimensional QR codes, 3-dimensional objects); and (3) a representation of the actual environment in order to superimpose digital information. The composition of the real environment with digital content is a means to augment the user experience in relation to specific locations or artifacts featured in the environment. In augmenting an aspect of the environment, the user is provided with informative and engaging content, such as a display of range distance when playing golf, markers to the nearest location for restaurants, or groups of star constellations in the night sky.

How are museums and cultural heritage sites implementing AR into their exhibits? In 2013, Tallon conducted a survey to explore the use of mobile devices by 551 professionals working in museums and related sectors across the US, Canada, the UK, and 26 other countries. The results show that 43% of respondents reported that their cultural institution currently offered a mobile experience to visitors, and that 23% planned to do so in the next twelve months. However, AR applications were reported as being less prevalent in cultural institutions in comparison to audio tours or interactive experiences that are associated with social media. The reasons for its limited use likely vary, including but not limited to inadequate financial resources and specialized technical expertise, lack of awareness of AR, and resistance to change. In any case, the primary implication of this finding is a need to establish and disseminate best practices in designing and developing AR learning experiences. This requires evidence of the instructional benefits and return on investments in terms of user satisfaction and enjoyment in comparison to alternative methods that are traditionally used in informal learning environments.

Of particular relevance to addressing this issue are the recent efforts of researchers to explore the educational benefits of gamifying instruction and its implications for designing AR to learn and teach about history (Kee, 2014). Museums and developers at large are faced with an important challenge: how best to balance the needs of engaging visitors in meaningful and entertaining experiences, while at the same time exploiting the affordances of exhibits for instructional purposes (Bressler, 2013). The use of AR is perhaps most promising in its ability to bring the past back to life by augmenting such exhibits with virtual graphics, animations, and video, while game-based AR applications leverage learner reactions, feelings, and identities as a means to further enhance instruction. Although there is substantial debate as to the definition of gamification, we rely on the conventional definition of the term as referring to