Immersive Educational Spaces - the Creation of Location-based Augmented Reality on the Hosting Platform i.appear

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Abstract

*"If only we had had such opportunities to grasp history like this when I was young" – words by an almost 80-year-old woman holding an iPad on which both, the buildings in the background and a tower in the form of a virtual 3D object, appear within reach. To "grasp" history - what an apt use of this action-oriented word for an augmented reality application built on considerations of thinking and acting in history. This telling image emerged during the first test run of the app i.appear which will be the focus of this article's considerations on the use of immersive learning environments. The application i.appear has been used in the city of Dornbirn (Austria) for a year now to teach historical content through location-based augmented reality and other interactive and multimedia technologies. After a brief description of the potential of such applications, the epistemological structure of the hosting app i.appear and its functionality will be outlined. This article will focus on the "*Baroque Master Builders*" tour of the hosting app that was created and tested as part of the current research.*

Keywords: *augmented reality, location based, immersion, mobile app, cultural heritage, history education*

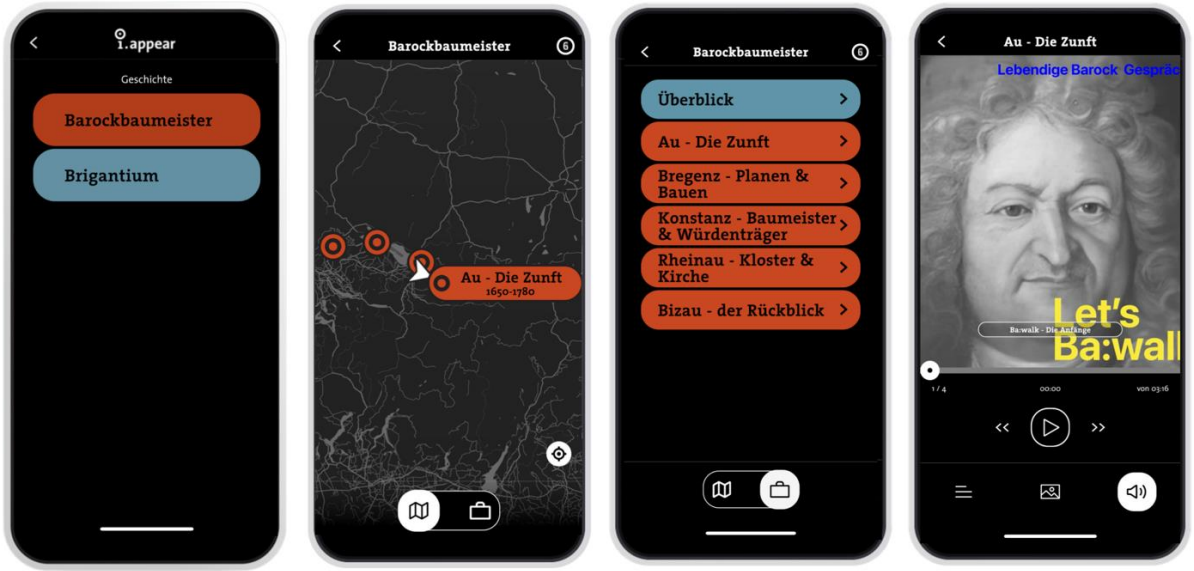
1. Introduction

Immersive learning environments can make a significant contribution in the classroom, but also in other areas of education. The use of immersive media in an educational context can increase the engagement of students, their motivation and active participation, as well as knowledge acquisition, concentration, curiosity, interest and fun [7]. Positive effects, such as the increase of positive emotions, were also observed in several studies around history education [5]. The increase in motivation has been identified as the factor that is most frequently mentioned in the literature as being conducive to learning [8] [5] [4] [2] [1]. Similarly, aspects of historical thinking are associated with immersive learning. Thus, AR technologies have been investigated on the basis of history didactic concepts such as historical reasoning or historical empathy, with quite positive results [8] [6] [9] [2]. With reference to these results, it can be said that immersive learning worlds also have great potential when it comes to opening historical content. In order to optimally promote the described positive influences of immersive media on the learning experience, the tour presented in the following was built on the findings of interdisciplinary research. After a quick description of the hosting app in which the tour was implemented, the “Baroque Master Builders” tour will be described, and its potentials will be outlined within the discussion of the results of its evaluation.

2. The hosting app i.appear

The i.appear is a company that hosts different tours from interdisciplinary projects. It was designed as a platform for location-based AR apps, means that a wide variety of tours can be implemented in the app and used in both school and other educational contexts.
Since the app itself builds on considerations of history didactic concepts, learning psychology theories and general learning theories, the decision was made to implement the "Baroque Master Builders" tour into this already existing hosting app that can be downloaded for free for iOS and Android.
The learning experience begins on a map (Fig. 1), on which the user's location is localised using GPS. The possibility to have a bird's eye view helps learners to orient in the real world but also in the app [4].

Particularly with regards to AR, the location-relatedness is important - for example, 3D objects from long-destroyed buildings are placed in life-size on the ruins that still vaguely remind us of their existence.
This on-site experience is described by Chang et al. (2015) as “Sense of Place". This is described as the combination of feelings of connectedness, dependence, concern, identity and belonging that people have in relation to a place. The "Sense of Place", which is enhanced by means of immersive learning environments, also stimulates learners' interest and thus increases their motivation to learn [3].
In addition to the map view, the stations can also be accessed in the "suitcase" (Fig. 1). This function is beneficial to learning in that the content can be revisited [2] [4]. The approach of unlocking stations only when they are visited ensures that learners focus on the current content and thus serves as a guidance system [2] [4].



(Fig.1. Menu view in app, from left to right: tour selection, map view, suitcase view, audio guide view)

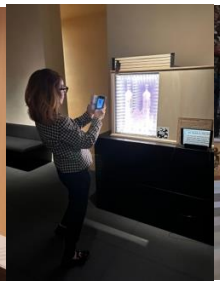
3. The "Baroque Master Builders” tour - extended museum

The tour about the Vorarlberg baroque master builders was created in cooperation with local museums – namely the “vorarlberg museum” and the “Barockbaumeister Museum”. The aim of the project was to extend the museal space by immersive experiences using innovative technologies. A feature of these innovative technologies that is often discussed in the literature is the possibility of enriching such learning worlds with a wide variety of multimedia content, building a framework that guides the learners [8] [5] [4] [2] [6] [9].
A wide variety of multimedia sources and representations in the form of text, images, audio, video, and animated illustrations where also embedded in the tour about the baroque master builders. These complement the content in the AR space, where users can explore a 3D object of a wall while interacting with a physical exhibit of the museum (Fig. 3+5). This fundamental requirement for an immersive learning world has always been recognised as having great potential [2] [4]. Thus, depending on the topic and the respective learning objective, a "source package" can be put together within such an application, which ensures guided research within the applications.
The project aimed to make the baroque buildings, which are spread over three countries, digitally accessible, which was achieved by integrating 360-degree videos (Fig., 2+4). This allows visitors to enter and explore the baroque buildings in the vitrual reality. Since the experience of this tour takes place in virtual reality rather than physical reality, narratives were developed to guide users through the app. Through this storytelling, learners can mentally follow the travels of Baroque master builder Franz Beer to the stations marked on the map (Fig. 1). Each station deals with a period of his life, so the journey begins in his home village, where he reports on the guild and his apprenticeship. The middle of his life is marked by the stations where he actively worked and lived as a master builder. at the end of the tour, the users

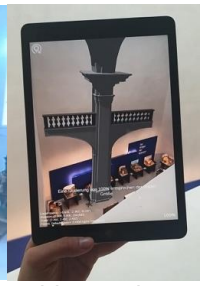
hear the stories of an old man who takes another look at his life back in his home country In the background of the narrator's voice, users hear the master builder's footsteps and the sounds of his surroundings. This emotional type of narration, accompanied by sound, is intended to further increase the immersion and involvement of the users [10]. The narratives in the app were developed by an interdisciplinary team of with experts in historical studies, design and museology which also achieved the claim of "historical rigour" [2].

3.1 Evaluation

In order to integrate as broad and diverse a group of test persons as possible, the Baroque Master Builder tour was evaluated inside and outside the museum space - with the youngest participant being 15 and the oldest over 80 years old (Fig. 2+3). The tour was tested with 30 participants. After using the app, the participants answered open-ended questions regarding their experience with the application. Several findings can be derived from the qualitative surveys. When asked about the personal highlight of the app, the immersive elements such as the 360-degree videos or the 3D objects were mentioned in particular. The narrative, which runs through the apps like a "red thread", was also rated positively. It was striking that the participants often reported "walks with Franz Beer" - from this wording it can be concluded that the audio guide could also achieve an immersive character through storytelling and sound effects. Also, the connection between the application and the museum content was often positively emphasised or demanded in the qualitative survey. Especially persons over 60 years reported that they liked the possibility of retrieving the content again at home and expanding existing knowledge. The connection of different museums and institutions, visualised by the geographical location of the stations on the interactive map in the hosting app i.appear, was also positively highlighted by the users.
In terms of possible improvements to the application, wishes were expressed for more or expanded immersive and interactive content.

(Fig. 2+3. App evaluation in local museums © Marianna Moosbrugger and author)

(Fig. 4+5. screenshot of 360-drgree Video and AR © Nino Brugger and author)

3.2 Conclusion

According to the qualitative survey, the most popular functions were the 3D objects in the AR space and the 360-degree videos. These were closely followed by the guiding narrative. It became clear that the connection with museum or local content also had a positive effect on the user experience - this was reported by the majority of users. It also became clear during the observation that there should be physical elements in and around the museum that point to the app experience. The connection of different museums and institutions, which is also visualised by the geographical location of the stations on the interactive map in the hosting app i.appear, was also positively highlighted by the users.

4. Discussion

This paper presented the location-based augmented reality tour "Baroque Master Builders", which was made accessible in the hosting app i.appear. The core functions of the app as well as the central mediation goals of the tour were described, whereby it was made clear how their mechanisms of action were worked out on the basis of empirical studies. Finally, the research results of the study were outlined. The participants in the qualitative survey described the expansion of the museum space through interaction with objects in the museum and the digital and immersive preparation of the topic as very positive. It could be shown that a diverse immersive learning world could be created. This diversity is

shown in interactive maps, immersive storytelling, 3D objects in augmented reality space and 360 degree videos. This content was described as very beneficial by both younger and older test persons during the survey. It could also be shown that users of all ages and with different educational backgrounds had a positive attitude towards the immersive experience space. The results from the qualitative survey also speak for the use of immersive learning and experiences in the educational context.

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