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Mixed Reality Game Using Bluetooth Beacons for Exhibitions

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1. INTRODUCTION

This is a description of a mixed reality game for smartphones, *Skansen*, currently in development. The application uses Bluetooth beacon nodes as a backbone for interacting with the physical environment and specific points of interest (POI), which in turn unlocks content that the users can view and interact with on their smartphone screen. The last two decades have seen a growing trend towards increasing the accessibility to content stored at memory sites, such as museums and historical sites, part of the cultural heritage, and nature and science centres, part of the natural heritage. The potential for a positive impact on society and the enlightenment of the individual is evident in recent studies that show how memory sites can enrich citizens through identity, cultural insight, social inclusion and democratic participation. This is achieved by acting as both formal and informal knowledge and learning spaces (Dodd & Jones 2014). Forums built around and for memory sites can promote participation, foster communities and create inclusivity. However, recent research into young people's perception of museum reveals that, contrary to the fact that they think memory sites are interesting, there's a lack of motivation to visit them (Drotner et al. 2017).

Today, exhibitions around the world include an increasing number of technology-driven, digital design interventions, to open up the museum space to a broader public and to make exhibitions more accessible. These digital layers, whether represented in embedded technologies or user operated devices, have the potential to make the visiting experience engaging and interactive, in ways signage or merely presenting the artefact in a display, cannot. They can overcome challenges such as presenting information in many different languages, or enable access to impaired people, or target demographics that are difficult to attract with

conventional means. Ageing solutions, such as audio guides that are not considered high tech, have been revived due to technical and technological advances. For instance, low-cost RFID sensors, Wi-Fi and Bluetooth beacons can be used to re-invent audio guides to become context aware, and adapt to the users and their behaviour, rather than forcing the users to adapt to the pre-recorded guides, such as the SFMOMA Audio Guide. However, previous studies have shown that the challenges of introducing new technologies and interaction modes, are the difficulties shown by a high number of users to adopt and interact with digital technologies (Vistisen et al. 2017).

2. BACKGROUND

This study draws from lessons learned from three previous cases. The first case stems from a research project to design a customizable mobile tour guide application that adapts to the visitor based on their behavioural pattern. The latter two are set years apart but aligned, as they are alternate reality games that used two different types of technologies.

2.1 Case 1: Egyptian Museum, northern Italy

Mapping of visitors' movement pattern using Bluetooth beacons in a large-scale archaeological museum. The mapping has been performed in order to investigate cognitive, social and physical factors that can influence the visitor experience, such as museum fatigue and hyper congestion. The intent with this case is to design an app that works as a personalised tour guide. This field study is an on-going project and at the current stage has provided a method to gather data to inform the right locations for placing beacon nodes (Germak & Khan 2017).

2.2 Case 2: Alternate Reality Game, Noorhjem, Northern Denmark

Noorhjem was a mobile treasure hunt game that ran from 2010–2011 and was technologically based on SMS-messages and IVR-calls (Interactive Voice Response) and virtually connected to hidden physical cues at the 31 locations. Each of the 31 quests was location-based, interactive and was designed as an independent mobile mini-game. Noorhjem was designed to add a digital layer of information to the guests' visiting experience thus Noorhjem could be played independently of the other experiences within 31 locations or as a combined experience. The main issue extracted from this study is that the majority of users experienced difficulties figuring out how to interact with the game, as they were unfamiliar with the technology. Thus, the on-boarding process must be carefully implemented when introducing new and unknown technologies.

2.3 Case 3: Marker-less Augmented Reality, North Sea Movie Maker, Northern Denmark

The North Sea Oceanarium is a Danish aqua zoo with an aim to inform visitors through edutainment activities. A mobile marker-less augmented reality application was developed as part of North Sea Oceanariums 2020 strategy; creating digital extensions of the physical experiences. The user records live footage during their visit to the zoo. The footage becomes distorted in real-time by the app, while special effects are layered on top of the recorded video, generating a scene where fish and objects interact with the filmed guests (Figure 1). The key take-away for this paper is that this application, although it was building on conventional use of a smartphone (taking pictures and recording videos), also proved difficult for to on-board new users.



Figure 1: Children using the Movie Maker to record at “movie spots” that are designed to create a backdrop.
Credits: Peter Vistisen.

3. THE SKANSEN APPLICATION

Skansen is being designed to investigate the possibility of on-boarding new users to a new type of technology and new mode of interaction – interacting with physical markers through proximity with smartphones. This is sought through the design of a game, where the visitor is guided to POI's that are designed to direct visitors to their personally preferred content, and through visual cues within the game setting instruct them to interact with the beacons.

4. DISCUSSION AND FUTURE WORKS

The adoption of Bluetooth technology has been taken into account due to its low-cost features, but also its “new signal of opportunity with which to perform more fine-grained indoor positioning” (Faragher & Harle 2014). The design issues we decided to tackle in these studies are linked to the need of enhancing the visitor experience. The aim was to design a better experience that can create inclusivity, awareness toward cultural heritage by diminishing hyper congestion and museum fatigue, as well as creating literacy toward the use of mobile technology, in order to ease the user's access to cultural content.

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