The Virtual House of Medusa: Guiding Museum Visitors Through a Co-located Mixed Reality Installation

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Abstract. In our submission we introduce a novel approach to guide Virtual Reality (VR) players and spectators via a Mixed Reality (MR) guidance tool trough a museum installation called the Virtual House of Medusa. The installation features an overview display, a VR headset for the player and a MR guidance tool (tablet with a VR-tracker) for the museum guide. This setup enables museum guides to support the VR player and to present the VR installation to a large audience. Our work deals with the issue that existing VR installations for museums are mainly designed as a single user VR experience and without any forms of spectators and player guidance. We argue that the interaction between the VR museum guide, the VR player, and the spectators has the potential to create a unique experience and to facilitate the feeling of being together in the VR world.

Keywords: Mixed reality museum installation
Head-mounted display · Co-located interaction

1 Introduction

Virtual Reality (VR) technologies have gained importance in recent years and are employed in various fields of application: Apart from health, entertainment, education and many other areas, these technologies have also found their way in the museum's context. In contrast to traditional approaches (such as info screens, installations with limited interaction functionalities, etc.), VR-based experiences in museums yield several benefits, such as providing the audience scientific data on cultural heritage. Although there are numerous positive aspects of VR-based solutions for museums, several design challenges have to be tackled. One of these issues can be seen in the fact that a majority of VR-based experiences

in museums, in particular installations using head-mounted displays (HMDs), are mainly tailored for single user experiences.

VR installations for museums have the potential to provide a more engaging experience for visitors including an educational value. Furthermore, they can be used for a wide variety of applications form cultural heritage to natural science. The first VR museum installations can be found in the early 90s. In most cases HMDs were employed, but also Cave systems [1] were used. The Cave is a multi-person, room-sized, VR environment and can be considered as a co-located VR installation that allows museum educators to guide visitors through virtual environments.

Museum guides can be visually represented through avatars in VR [2]. If they share the same physical space with other players, this co-located hybrid between real and virtual is defined as Mixed Reality (MR) [3]. A much cheaper and space-saving solution for museums are HMDs. Whereas Cave systems can be used by a large number of museum visitors, HMDs offer single user experiences. As robust and affordable VR technologies, like the Oculus Rift [4] and the HTC Vive [5], are now available, they are being increasingly utilized in museums. Recent examples for instance are Tate Modern [6] or the VRLab at Ars Electronica Center (AEC) Linz [7].

Current museum installations with HMDs are usually offering an overview display for the audience, showing the perspective of the VR player or providing an overview of the VR installation (see Fig. 1). But so far, VR players cannot share the experiences with others, as seen at recent examples of VR museum installations on cultural heritage [8,9]. This problem is known as "Perspective Gap" [10]. Research on shared, co-located MR settings with HMDs [10,11] and on remote MR collaboration [12] is still at its very beginning.

Based on these limitations, we propose a novel MR approach for guiding museum visitors through a VR experience: first, it includes the spectators of a VR installation by giving the guide a MR guidance tool (tablet that is connected to the VR space) to explain relevant events and mechanisms in VR, and, secondly, the VR player is supported by the museum guide through our solution. In the following sections the MR guidance tool will be explained in detailed, and several use cases will be presented to highlight the usefulness and flexibility of our solution.

2 Our Approach

In general, research on co-located VR installations is still in its infancy in general, especially in the museum application context. VR museum installations using current HMDs are single user VR experiences and offer no interaction possibilities neither for museum guides nor for visitors. This is quite surprising, as on the one hand museum installations are usually tailored for multiple participants, and on the other hand interactive VR installations have to be introduced by the museum staff. Especially for museum guides, additional interaction and guidance possibilities that support their explanations appear to be useful.

Following this notion, we propose a novel MR approach for guiding museum visitors through an VR experience: first it includes the spectators of a VR installation by giving the guide a MR guidance tool (tablet that is connected to the VR space) to explain relevant events and mechanisms in VR, and, secondly, the VR player is supported by the museum guide through our solution.

Based on this concept, a playful co-located VR museum installation called Virtual House of Medusa (VHM) was developed [13]. The installation enables interactions between the VR player, the museum guide, and the spectators and supports different player roles: VR player (VR device), museum guide (MR guidance tool), spectators (overview display).

2.1   The Installation: The Virtual House of Medusa

The VHM is a playful co-located VR museum installation about a Roman villa and its wall paintings [14]. These fresco fragments were found at the Danubian Limes in Upper Austria. The game prototype was developed in collaboration with the Federal Monuments Authority Austria [15] and designed as a seated VR installation for multiple exhibition scenarios (see Fig. 2). The VHM offers four playful virtual workstation: VR players can assemble collected wall fragments like puzzle pieces into nearly complete paintings and can explore a reconstruction of the villa and its wall paintings in multiple ways.

With the MR guidance tool the museum guide can look into the VR environment, can provide support for the VR player, and is able to introduce the experience to the spectators in detail. This is achieved with a Vive tracker, mounted on a tablet device. Furthermore, the installation consists of a VR headset (HTC Vive) with one VR controller. For reasons of simplicity only the trigger button of the VR controller is used.

Figure 1 shows the physical devices of the two actors (guide and VR player) and the rendered screen view of each device. The MR guidance tool user (guide) is visualized as an avatar and can touch objects by touching the tablet screen. With a wiping gesture from the top edge of the tablet, a menu appears. The menu contains multiple functions: reset of the installation, switch between different visualizations of the museum guide, switch between the four workstations, switch between different cameras (Camera Player, Camera Audience, etc.), controls of the avatar (wave, nod or shake head, wink), showing hints or additional functions (tutorial, language, etc.).

The VHM was exhibited in different museum settings, at the art museum Kunsthistorisches Museum Wien (KHM) [16] and at the media art museum AEC, in the VRLab [7] and in the Deep Space [17], to identify design potentials and implications. These settings differ how the audience and the guides are integrated in the VR experience and will be discussed in the next sections.

2.2   Virtual House of Medusa at the AEC VRLab

The VRLab is a special exhibition at AEC, showcasing the latest VR, Augmented Reality (AR) and MR technologies. At 6 VR stations each supported
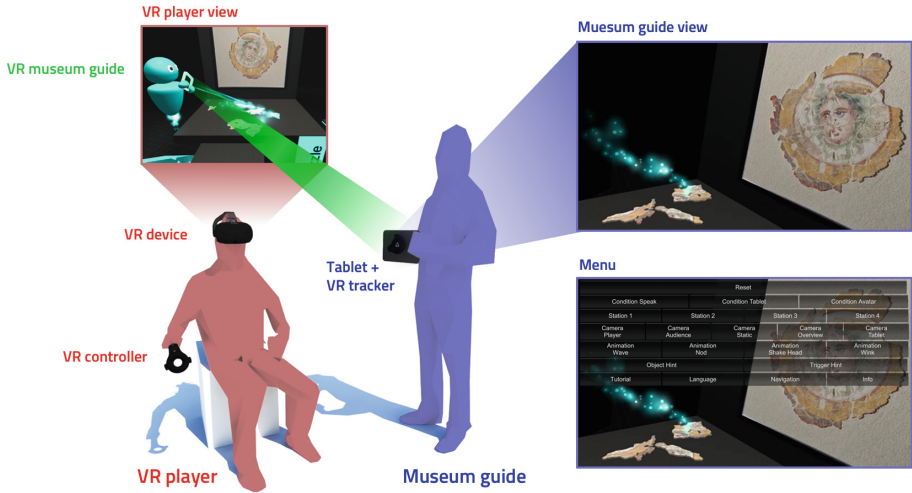
Fig. 1. Technical setup: VR player (red), seated VR experience with a HMD (Vive); museum guide (blue) can look into the virtual world and can touch virtual objects via a tablet, equipped with a VR tracker; trough a menu the museum guide can navigate the VR player and spectators trough the VHM. The museum guide is visualized in VR as an abstract avatar (green). (Color figure online)

with overview screens a broad range of different VR applications from art to industry use cases are presented. Hands-on experience and active involvement are a basic pillar at AEC. To achieve that, museum staff supports visitors in the entire exhibition. If a visitor wants to explore the VHM a museum guide introduces the installation. An additional overview screen shows the perspective of the VR player. The museum guide uses that screen to guide the VR players; further visitors can follow the journey. Neither the museum guide nor the spectators are actively involved. They can observe the VR player's perspective and can talk to him/her. In this setup the VR player is sitting in front of the others with his/her back turned, which does not ensure a perfect communication between the VR player and the museum guide (see Fig. 2).

2.3   Installation at the KHM

The VHM was fist presented at the KHM in Vienna as a co-located VR installation as part of the special exhibition of the original artifacts of the House of Medusa. Figure 2 shows the setup with one tablet device and an overview display at the back of the VR player. The installation was introduced by museum guides with the help of the MR guidance tool. Unlike the setup at the VRLab the museum guide is facing the VR player. The visual representation of the guide (VR museum guide) supports the communication between VR player, guide and spectators. Spectators can follow the virtual journey on the screen. After the

Fig. 2. The VHM was exhibited at three different museum settings: AEC VRLab: Museum guide introduces the installation to the VR player exclusively by talking to the him/her. Spectators observe the interaction process via an overview display. KHM: Museum guide introduces the installation using the MR guidance tool. Spectators can follow via an overview display. AEC Deep Space: A Museum guide navigates the VR player through VHM. A big audience can watch the journey through time via a large overview projection (16 × 9 m).

introduction phase the VR tablet was handed over to a museum visitor. Together with the VR player a co-located playful VR experience can be achieved.

2.4   Installation at the Deep Space, AEC

The setup at the Deep Space at AEC illustrates the potential for a large audience. The museum guide introduces the installation using the MR guidance tool and a head microphone (see Fig. 2). Up to 150 spectators can follow the time travel back to the Roman Age on a large screen (16 × 9 m). With additional tablet devices spectators can also actively participate in the virtual trip. Preliminary presentations have shown that the MR guidance tool is a big support for the museum guide and fosters the communication between VR player and spectators. In a further prototype a stereoscopic 3D projection for the audience and an enhancement of the user interface for the guide is in the planing.

3   Conclusion and Future Design Directions

In this paper we proposed a novel approach of guiding museum visitors through a VR experience: It features a unique MR guidance tool and is conceptualized

as a playful installation with multiple virtual workstations. The proposed solution grants museum staff to guide both the VR player and the spectators. As described in the previous sections, the installation was presented at several occasions. However, until now the potentials and design implications have not been investigated: Regarding the next steps, currently a study is carried out that focuses on the co-playing experience. Here, it is aimed to find out how participants with multiple roles supported by the MR guidance tool experience the installation. We are especially interested in the communicative acts among visitors. Via observations and questionnaires, it is anticipated that the presence of the MR guidance tool will have a positive impact on the social experience.

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