

TimeWarp: An Explorative Outdoor Mixed Reality Game

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1 Introduction

As mobile technology has advanced a number of electronic city guide products have become available. However, most of these products still maintain a conventional form of tour that is information centered and forces the user to take a certain route through a city. In contrast, TimeWarp is an outdoor edutainment game that provides an immersive experience of the history of a city using Mixed Reality (MR) and mobile devices. The mixed reality experience is extended to a web application that provides travel journals for the mixed reality time travelers.

The game story is built upon the legend of the Heinzelmännchen of Köln, which are little elves. A player is equipped with a "brand-new top-secret" technology that allows him to travel in time using portals and to see the Heinzelmännchen. Each Heinzelmännchen is part of a small challenge, that imparts knowledge about the city and its history.

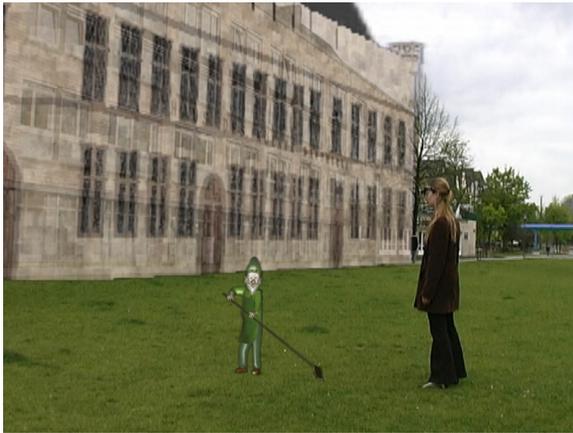


Figure 1: User wearing AR system in front of historic building.

2 A Sample Challenge

When Cindy arrives at the base station, she is equipped with the TimeWarp system and receives instructions. She decides to go to the Rhine promenade to look for a Heinzelmännchen. There she sees a ghostly Heinzelmännchen. She knows she has to jump to another time period. Looking around, she detects a time portal nearby and uses it. She returns to the Heinzelmännchen, which she now sees in color. The Heinzelmännchen rakes the ground. As she approaches, the Heinzelmännchen turns towards her. On her mobile

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information terminal, a PDA based system, she sees the options available to solve this challenge and decides to answer a question - she does so by tapping on the corresponding symbol. A multiple choice question appears on the PDA. Cindy does not know the answer. Looking for help she sees an information board. After reading it she enters the correct answer. The Heinzelmännchen is happy and hops onto her PDA...

3 Technology

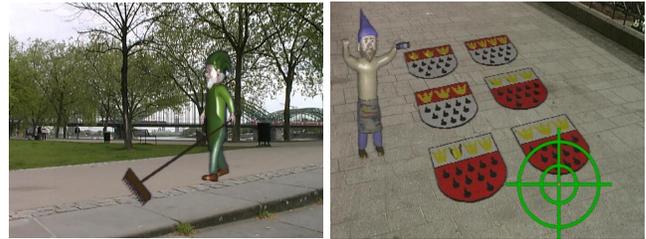


Figure 2: Augmented views with Heinzelmännchen.

In TimeWarp the player receives two mobile systems: the mobile AR system that augments the real environment with virtual characters, reconstructions of buildings and more, and the mobile information terminal. This is a PDA based system, that provides an overview on the game area and status. Our mobile AR system includes a head-worn display, an ultra mobile computer and sensors for tracking. The sensors include a GPS receiver, a 3-DOF orientation sensor and a web cam for natural feature tracking. The mobile information terminal runs on a PDA or smart phone. The application is based on our AR/VR framework Morgan and uses Marvin for rendering. GPS and orientation tracking are used to fuse the real world and the virtual content, but also to give a starting point for natural feature tracking at specific locations where precise tracking for overlays is required. The hypermedia game database contains 3D models, animations and sounds related to geospatial position as well as time levels. Challenges are described using our mixed reality interaction modeling language (MRIML), which is interpreted by the TimeWarp game engine during runtime.

4 Future Work

In our future work we will investigate different types of interaction for mobile AR games, considering speech dialogs or 3DOF orientation controllers like the Nintendo Wii. Furthermore, TimeWarp investigates into the subject of presence in mobile mixed reality by exploring the use of cues for creating a sense of temporal and spatial presence and examining engagement and augmentation issues that are designed to support a sense of presence.

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