Odyssee – explorations in mixed reality theatre using DirectX 9
extended abstract

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Abstract

In this paper we will discuss our experiences in developing a mixed reality application for a theatre production of the Odyssee. The Odyssee is a wellknown account of the travels of Ulysse leaving Troje, in 24 episodes ending in his return to Ithaca and his reunion with Penelope. The actual theatre production, which is performed in temporarily empty office buildings, takes 12 parts which are played in 12 successive rooms through which the audience, subdivided in small groups, is guided one room after another for about five minutes per room. The initial idea was to have a large number of see-through goggles and augment the actual performance with additional information using text and images. In the course of the project, however, we had to scale down our ambitions, and we ended up using simple LCD-projection goggles with a low-resolution camera, for which we developed a mixed reality application, on the DirectX platform, using video capture projection in 3D with text and images. What we will describe here covers our final application, the criteria and guidelines we used in our production, as well as what may in retrospect be characterized as our explorations of DirectX.

Keywords and phrases: mixed reality, digital story telling, DirectX technology, multimedia presentation

1   Introduction

In june 2003, our group was asked to advise on the use of VR in a theatre production of the Odyssee. Lacking experience in this field, we accepted the invitation to participate with some reluctance, since at the time we didn't have any clue what the VR for the theatre production should look like. Nevertheless, we took the invitation as a challenge and started looking for appropriate hardware, bothering collegues for information on mixed reality art productions, and downloading code to explore software technologies. Many hurdles ware to be taken. We had to deal with organizational issues, such as finding the money for financing the actual production (which is at the time of writing still an issue), finding the right people (students, in our case) to select material and contribute to the code; aesthetic issues, in particular to determine which approach to take to reach at an effective solution; and not in the least technical issues, to realize the production on a sufficiently efficient low-cost platform.

structure In this short paper, we will first briefly describe the Odyssee theatre production. Then we will report on how we arrived at our present mixed reality solution. And, after a brief characterization of our platform of choice, we will look at our mixed reality solution in somewhat more (technical) detail. We finish with recapitulating the lessons we learned from our explorations in mixed reality theatre.

2 Background – the Odyssee theatre production

The Odyssee[1]. theatre production was initiated by Ground Control[2], as a successor of previously succesful theatrical spectacles, including an open air performance of Faust[3]. In effect, two performances of the Odyssee are planned, an out-door (external) version, involving real ships at the shore of a lake, and an in-door (internal) version, to be played in temporarily empty office buildings. The in-door version is meant to give a more psychological rendering of the Odyssee Entanaclaz (2003), where the travels of Ulysses are experienced by the audience as a confrontation with themselves. Our contribution was asked for the in-door version, to enhance the experience of the audience with additional VR.

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3 Initial ideas – VR and augmented reality

Our first problem was to find suitable hardware, that is see-through goggles. Searching the Internet gave us the name of a relatively nearby company, Cyber Mind NL[4], that specialized in entertainment VR solutions. Both price-wise and in terms of functionality semi-transparent see-through glasses appeared to be no option, so instead we chose for simple LCD-projection goggles with a (head-mounted) low-resolution camera. This solution also meant that we did not need expensive head orientation tracking equipment, since we could, in principle, determine focus using captured image analysis solutions such as provided by the AR Toolkit[5]. Moreover, captured video feed ensured the continuity and reactiveness needed for a true (first-person perspective) VR experience.

Augmented or mixed reality[6] is an interesting area of research with many potential applications. However, in the course of the project we dropped our ambition to develop personalized presentations using image analysis, since we felt that the technology for doing this in a mixed reality theatre setting is simply not ripe, and instead we concentrated on using the captured video feed as the driver for text and image presentation. In addition, we developed image manipulation techniques to transform the (projection of the) captured video, to obtain more implicit effects, as to avoid the explicit semantic overload resulting from the exclusive use of text and images.

4 Technological constraints – the DirectX platform

After a few experiments with the AR Toolkit, it soon appeared that the frame rate would not be sufficient, on the type of machines our budget would allow for. Moreover, reading the AR Toolkit mailing list, marker tracking in a theatrical context seemed to be more or less unfeasible. So, we shifted focus to the DirectX SDK 9[7], both for video capture and projection in 3D. The DirectX toolkit is a surprisingly functional, and very rich technology for multimedia applications, supporting streamed video, including live capture, 3D object rendering and precise synchronisation between multimedia content-related events. At that time, and still at the time of writing, our own *intelligent multimedia technology*[8] was no option, since it does not allow for using live video capture and is also lacking in down-to-the-millisecond synchronisation.

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[1] www.odyssee2004.nl
[2] www.ground-control.org
[3] www.faust2002.nl
[4] www.cybermind.nl

[5] www.hitl.washington.edu/research/shared_space/download
[6] www.se.rit.edu/~jrv/research/ar
[7] www.microsoft.com/windows/directx
[8] www.intelligent-multimedia.net

After exploring texture mapping images copied from the incoming captured video stream, we decided to use the VMR-9 *video mixing renderer*[9] introduced in DirectX 9, that allows for allocating 3D objects as its rendering surface, thus avoiding the overhead of explicit copies taken from a video processing stream running in a separate thread. Although flexible and efficient, DirectX is a low-level toolkit, which means that we had to create our own facilities for processing a scenegraph, world and viewpoint transformations, and, even more importantly, structuring our mixed reality presentations in time.

5 Structuring time – maintaining 'see-through' aesthetics

One of the problems we encountered in discussing what we conveniently may call the VR with the producer of the Odyssee theatre performance was the high expectancy people have of VR, no doubt inspired by movies as the Matrix and the like. In mixed reality applications, manipulating persons, warps in space, and basically any intensive image analysis or image manipulation is simply not possible in real time. Moreover, there is a disturbing tendency with the layman to strive for semantic overload by overlaying the scene with multiple images and lines of text, thus obscuring the reality captured by the camera and literally blocking the participants view and awareness of the scene. Basically, as a guideline, we tend to strive for 70% visibility of the scene, 20% image or projection transformations and only 10% of information in the form of text and images.

The total duration of our presentation is only 2 minutes, or 118 seconds to be precise. We made a subdivision in 4 scenes, with transitions inbetween, hierarchically ordered in a tree-like structure. Initially, we abstracted from the actual duration, by taking only the fraction of the time passed (in relation to the total duration) as an indication for which scene to display. However, when the development reached its final stages, we introduced actual durations that allowed us to time the sequence of scenes to the tenth of

a second. In addition, we used multiple layers of presentation, roughly subdivided in background captured image, the transformed captured image projected on 3D objects, and, finally, pictures and text. These layers are rendered on top of eachother, triggered in a time-based fashion, semi-independent of one another. The frame rate varies between 20 and 30, dependent on the number of images simultaneously used for texturing. Our final mixed reality theatre application may be considered a prototype, awaiting to be put to the test by the audience.

6 Lessons learned – our explorations revisited

Altogether, the development of the mixed reality theatre application has been quite an experience, in multiple ways.

Not in the least it has been (and still is) a challenge to explain the possibilities of mixed reality applications to the layman, that do not take the abstractions we use in our daily academic life for granted.

To be frank, it also has opened our eyes to what some consider 'politically incorrect' technology, in other words Microsoft DirectX, originally developed as game technology, and no doubt a rich toolbox for real life multimedia applications.

Reinventing the wheel is not as simple as it seems. Nevertheless, developing scenegraph processing facilities and the appropriate timing mechanisms for controlling the mixed reality presentation was, apart from being a rekindling of basic skills, a learnful experience.

Finally, even before putting the application to the test, considering the aesthetics of mixed reality theatre productions, it may be called an eye-opener to realize how important reality is, and how meaningless explicit semantics (in the form of text and images) may become. Rather, we see our explorations as an incentive to further explore more implicit (graphical) modifications of the captured scene to convey meaning.

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[9]www.cs.vu.nl/~eliens/media/resources-directx.html

7   Conclusions

We have described, in a somewhat anecdotical fashion, our experiences in developing a mixed reality application for the Odyssee theatre production, to enhance the participants experience of the performance. Our explorations involved, among others, to deal with expectancies of VR, aesthetic issues, not to mention production schedules, cooperation, financial issues, but above all it meant setting the first steps in developing technology for mixed reality theatre.