Tools for User Interaction in Immersive Environments

N.E. O'Connor[1], D. Alexiadis[2], K. Apostolakis[2], P. Daras[2], E. Izquierdo[3], Y. Li[1], D.S. Monaghan[1], F. Rivera[3], C. Stevens[4], S. Van Broeck[4], J. Wall[3], H. Wei[1]

[1] INSIGHT Centre for Data Analytics, Dublin City University, Ireland
[2] Centre for Research and Technology Hellas, Informatics and Telematics Institute, Greece
[3] Queen Mary University of London, United Kingdom
[4] Alcatel-Lucent Bell Labs, Antwerpen, Belgium

Abstract. REVERIE – REal and Virtual Engagement in Realistic Immersive Environments – is a large scale collaborative project co-funded by the European Commission targeting novel research in the general domain of Networked Media and Search Systems. The project aims to bring about a revolution in 3D media and virtual reality by developing technologies for safe, collaborative, online environments that can enable realistic interpersonal communication and interaction in immersive environments. To date, project partners have been developing component technologies for a variety of functionalities related to the aims of REVERIE prior to integration into an end-to-end system. In this demo submission, we first introduce the project in general terms, outlining the high-level concept and vision before briefly describing the suite of demonstrations that we intend to present at MMM 2014.

1 The REVERIE Project

Within the REVERIE (REal and Virtual Engagement in Realistic Immersive Environments) project we believe that it is time to move online interaction towards the next logical step in its evolution: to immersive collaborative environments that support realistic inter-personal communication. Recent scientific advances in a variety of different research fields mean that it is now possible to integrate research outputs towards technologies that support real-time realistic interaction between humans in online virtual and immersive environments. REVERIE envisages an ambient, content-centric Internet-based environment, highly flexible and secure, where people can work, meet, participate in live events, socialise and share experiences, as they do in real life, but without time, space and affordability limitations. To achieve this we focus on the integration of cutting-edge technologies related to 3D data acquisition and processing, sound processing, autonomous avatars, networking, real-time rendering, and physical interaction and emotional engagement in virtual worlds. The project features two compelling use case scenarios that will be used as the basis for technical integration and

that collectively will allow the project to demonstrate the validity and potential socio-economic benefits of REVERIE's vision of the future of online interaction in immersive environments.

2 Use cases

The first REVERIE use case is an educational scenario involving teachers and students that experience a virtual school trip. The participants of this use case take part in an immersive 3D educational interactive experience while they have the opportunity to construct their own virtual scenes. The second use case aims at highly realistic visualizations, targeting the look and feel of real physical presence and interaction. It refers to an innovative and highly interactive social experience in a virtual scene based on motion capture techniques and video and audio reconstruction where participants can experience a virtual dance class or take part in a movie inviting their social friends. This is a scenario that involves many participants and therefore a challenge for efficient networking and rendering techniques.

3 Proposed demonstrations

Currently the project is in a technology development phase whereby individual components are being developed prior to integration into a complete system. In this section, we briefly describe these component technologies. All demos will be live interactive software demonstrations, except for "Navigable 3D video chat" & "Real-time full body 3D reconstruction", due to the impracticality of transporting complex capture set-ups. Illustrations of some of the demos are shown in Figure 1.

3.1 Navigable 3D videochat

This demonstrates how two users can sit in two different remote locations, each equipped with the REVERIE video chat system, comprising one Kinect, one ordinary computer display, and internet connection. A video will show the characteristics of the virtual view on the remote user and the interactivity features possible[†].

3.2 Gaze Translucency

We refer to being able to capture the information about what other people are looking at as gaze translucency. Current telecommunication tools like Skype do not provide gaze translucency which makes video sessions with several people very difficult and very different from our face to face conversations. Our solution

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[†] http://www.reveriefp7.eu/resources/demos/multi-party-3d-visual-and-audio-communication

automatically highlights the people that are looking at us and reveals who you are looking at, providing important contextual information in online interactions that we take for granted in our real-world interactions.

### 3.3 Real-time full body 3D reconstruction

This will demonstrate real-time 3D human reconstruction from multiple Kinect RGB+depth cameras. It will present various textured 3D reconstruction results from various view points, both for still and moving humans[‡].

(a) 3D reconstructions of moving humans in various poses
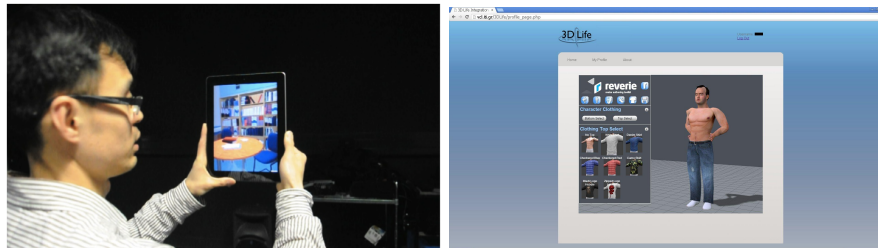
(b) An iPad-based window onto virtual worlds

(c) The REVERIE avatar authoring tool
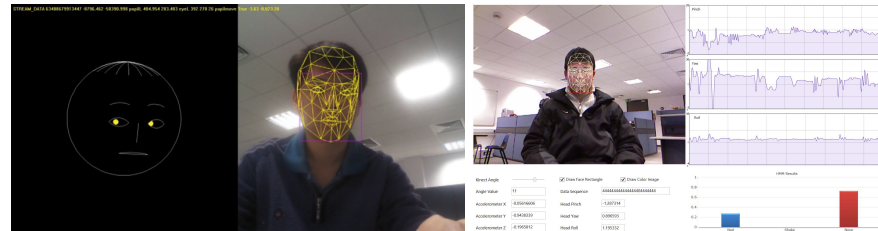
(d) Puppeting the gaze of an avatar

(e) Real-time head nod and shake detector

Fig. 1. Illustrations of some of the demos to be shown

3.4 RAAT: The REVERIE Avatar Authoring Tool

Here we will demonstrate a powerful online JavaScript library for avatar creation. The demonstration will present how RAAT is employed to power impressive online applications that can generate realistic looking 3D characters intended to populate virtual environments[§].

3.5 Puppeting the gaze of a virtual avatar

Increasingly avatars are becoming realistic virtual human characters that exhibit human behavioral traits, body language and eye and head movements. As the interpretation of eye and head movements represents an important part of human communication it is extremely important to accurately reproduce these movements in virtual avatars to avoid falling into the well-known "uncanny valley". In this demo we present a cheap hybrid real-time head and eye tracking system that can allow a human user to robustly puppet a virtual avatar.

3.6 Real-time head nod and shake detection

Almost all cultures use subtle head movements to convey meaning. Two of the most common and distinct head gestures are the head nod and head shake. In this demo we present a real-time head nod and shake detection system using Microsoft Kinect.

3.7 Window to Virtual Worlds

Not all REVERIE end users will be active participants, some will wish to attend and observe the events taking place in a virtual environment. This demonstration will show how a tablet can be used as a window on a virtual world. It utilizes the iOS inbuilt sensors to automatically update 3D perspective views for the user in response to their natural motion[¶].

4 Conclusion

Although a number of separate demonstrations are proposed, they all address aspects of the REVERIE integrated system which will be ready for demonstration mid-2014. To ease understanding of how the various components fit together, the individual demos will be accompanied by a poster that outlines the architecture of the overall system illustrating how these components fit together.

Acknowledgements

[§] http://www.reveriefp7.eu/resources/demos/reverie-avatar-authoring-tool
[¶] http://www.reveriefp7.eu/resources/demos/window-to-virtual-worlds