Hyve-3D: A New Embodied Interface for Immersive Collaborative 3D Sketching

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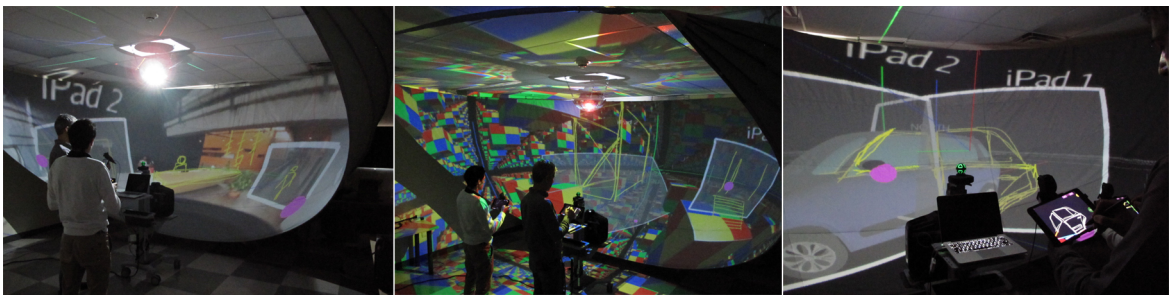

Figure 1: *Hyve-3D in use: Sketching over an interior architecture panorama, a complex 3D geometry and an industrial design object*

Abstract

We present the Hybrid Virtual Environment 3D (Hyve-3D), a new interface for 3D content creation via embodied and collaborative 3D sketching. Hyve-3D introduces a semi-spherical immersive 3D sketching environment based on spherical panoramas and uses 2D drawing planes that are intuitively manipulated in 3D space by the help of handheld tablets that are tracked in 6DOF. Orthogonal sketches created by the user on the tablet are used to build the 3D scene based on the position of the drawing planes.

CR Categories: D.2.2 [Software]: Design Tools and Techniques—User interfaces H.5.2 [Information Interfaces and Presentation]: User interfaces—Input devices and strategies I.3.6 [Computer Graphics]: Methodologies and Techniques—Interaction techniques;

1 Introduction

Hyve-3D is designed to aid the first steps of 3D creation inside virtual environments via embodied interaction and collaborative (co-localized and remote) 3D sketching without necessitating complex GUI. It is implemented as an innovative and non-intrusive immersive *trompe-l'oeil* projection system, based on spherical panoramas. Users can interact with the 3D scene via 2D construction planes manipulated by handheld tablets that are tracked in 6DOF. Free-hand sketches made on the tablets are placed on the 3D construction plane. The tablets also display an orthogonal view of the 3D scene, complementary to the perspective view surrounding the users. The Hyve-3D is an evolution of the Hybrid Ideation Space [Dorta 2007], as an immersive collaborative design system that allowed real-time sketching over spherical panoramas.

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2 System description

The system is composed of a MacBook Pro™laptop, a WUXGA projector, a 5m diameter half-hemispherical fabric screen, a 16-inch dome mirror, a wireless router, a 6DOF tracking system (Razer Hydra™) with two controllers, and two Apple iPad mini™tablets. Each iPad is attached to a Hydra controller. The *Client* software takes care of all the networking, scene management, 3D graphics and projection and also couples the sensor inputs from the Hydra and iPad devices. The iPads run a *Satellite* (iOS) application, which serves as the user interaction front-end of the system. We make use of OpenGL vertex and pixel shading techniques to render the 3D scene onto a spherical projection in real-time.

3 User Interaction

The location, orientation and size of the drawing area are manipulated via 3D tablet movements and multitouch gestures using any of the following modes that define axial freedoms and restraints: in *free tracking* drawing planes follow the tablets in 6DOF; in *normal panning* drawing planes ignore the rotation but follow the position of the tablets, allowing work on parallel planes; in *planar panning* movements of the tablet are restricted to the current plane; in *pinch zooming* the size of the drawing plane is changed via a pinch gesture. The tablets can also be used as *3D track-pads* to navigate and orbit around the scene with sliding and multitouch rotating motions based on the orientation of the tablet. Drawing planes are displayed in 3D as *semi-translucent* planes to allow easy placement in depth via penetration cues. Each time a drawing area is being moved, a slow-motion *auto-parallax animation* aids the perception of depth.

4 Conclusion

The embodied user interaction model proposed using the handheld tablets to create, view and manipulate 3D content can be also used not only in immersive environments but also on conventional 2D displays and projections. A commercial version is developed.

References

DORTA, T. 2007. Implementing and assessing the hybrid ideation space. *International Journal of Design Sciences and Technology 14*, 2, 119–133.