

Hyve-3D and rethinking the “3D cursor”: Unfolding a natural interaction model for remote and local co-design in VR

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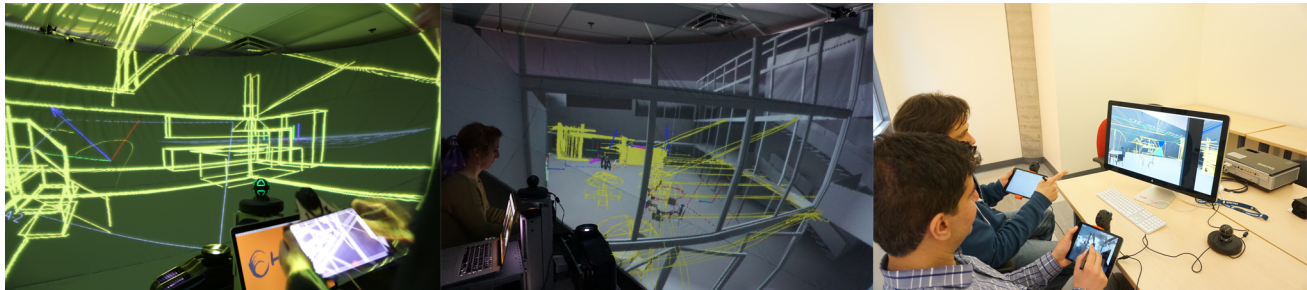


Figure 1: The 3D cursor and Hyve-3D in immersive and non-immersive configurations.

Abstract

Hybrid Virtual Environment 3D (Hyve-3D) is a system to actively design inside Virtual Reality by a new model of interaction through a *3D cursor* that is specially envisioned to facilitate local and remote collaboration. It introduces a novel approach to the concept of the cursor inside the 3D virtual space, rethinking it as a drawing and control plane. 3D cursors are intuitively manipulated by multi-touch handheld tablets that are tracked in 6DOF. The system also features a lightweight immersive 3D rendering technique that runs on a single laptop allowing texture and lighting effects on 3D geometry. Users can simultaneously access their individual complementary orthogonal views on the tablets, as personal windows into the shared display of the virtual environment; they can concurrently 3D sketch, select, edit, manipulate 3D objects using the tablets as tangible *props*, as well as collectively navigate the scene using the tablet as a *3D trackpad*. With the notion of multiple 3D cursors the personal computer becomes a collaborative working environment. The first version was implemented in 2014 [Dorta et al. 2014]. A product level system is presented with the immersive and non-immersive implementations. A variation of the interface which works without the need of an external tracker is also demonstrated that opens the possibility of using the system with any handheld device such as smart phones and watches.

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;

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1 System Description

Hyve-3D is created to aid co-design inside virtual environments. Users can interact with the 3D scene via the 3D cursor, reenvisioned as a plane manipulated by multi-touch handheld tablets. Freehand sketches made on the tablets are placed on the virtual plane. Each tablet displays an orthogonal personal view of the 3D scene, complementary to the perspective view of the shared environment. The immersive Hyve-3D is composed of a laptop, a high-resolution projector, a 5m diameter concave-spherical fabric screen with a mirror, a 6DOF tracking system with controllers, and multiple handheld tablets. The system can also run non-immersively on a regular display. The *Client* software turns the laptop into a multi-user collaborative VR workstation that takes care of networking sessions and rendering. The tablets run a *Satellite* application, which serves as the main interface. The system can also be controlled via “non tracked” tablets. In this implementation the aspects of interaction with the 3D cursor, such as selection methods, object manipulation using the tablets as props are explored.

2 The “3D cursor”

The 3D cursor is presented as a control plane manipulated via tablet movements and multitouch gestures using any of the following constraints: *free*, *normal*, *planar* and *hinge*. The 3D cursor can be scaled by *pinch zoom*. The tablets can also be used as *3D trackpads* to *navigate*, *orbit* and *tilt* around the scene with tablet movements and multitouch gestures based on the orientation. A *auto-parallax effect* also aids the depth perception. We present the *Butterfly-net* metaphor for 3D selection and natural affine transformation actions with the above constraints. Selection is done by sweeping the 3D cursor through existing objects and sketches. These can be then edited using the abovementioned interactions. The 3D cursor can be also used as a cutting plane within the virtual world.

References

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