

## EXPLORING VIRTUAL REALITY IN CYBERSPACE FINAL VERSION

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The Autodesk Research Lab is exploring a new interface and modeling technology for CAD called Cyberspace. The idea is to create a CAD working environment that simulates reality, and then to immerse the user in that virtual reality. Cyberspace hardware is intended to provide the illusion of direct experience with computer-generated models. Cyberspace software provides the tools for constructing and interacting with these models as if they were real.

The Cyberspace Toolkit is still in its initial research phase. Eventually, it will provide tools that will redefine the way we use computers. Imagine an AutoCAD 3-D image of a building, for example. Cyberspace lets you step into the image and walk around inside it to explore it. Imagine looking out of a virtual window, and seeing the scene that would be there in reality. In Cyberspace, you could change the view by grasping the window frame and pulling it to a new location. The underlying database would be updated automatically.

### Hardware

To make a CAD drawing come alive, Cyberspace requires special interface equipment. Most important is a head-mounted display. The head-mount contains two high-definition LCDs which project a stereoscopic image to each eye. Special optics provide a wide field-of-view and a comfortable viewing distance. The image occupies an area of vision greater than that of regular glasses, surrounding the user's view with computer generated graphics.

The head-mount also includes a head-tracking device which correlates head movement with the displayed scene. When you move your head to look around, the scene moves also. The combination of wide field-of-view and head-tracking creates the compelling illusion of being inside the virtual environment.

Now add a Dataglove, which tracks hand movement and the position of your fingers. The computer generated image of your hand mimics your movements, and permits natural grasping and gesturing within the virtual environment.

Add a 3-D joystick, which lets you fly around virtual space. Stereo earphones create the illusion of sound in a 3-D environment. And powerful graphics accelerator boards provide full-color rendering of solids in real-time.

## Software

The hardware lets us experience virtual reality. The software lets us construct, modify and interact with this computed environment.

Cyberspace construction tools will include a solid modeler, techniques for incorporating and changing physical models of gravity, friction, movement and collision, tools for hierarchical composition of objects and scenes, and techniques to support multiple interacting users. Cyberspace is designed to be a social environment, you can work with your colleagues in the same space at the same time.

Today, Cyberspace is a research project, a primitive prototype of future capabilities. If you like the idea, let us know; tomorrow, Cyberspace could be yours.