

# INTERNET 2 TELE-IMMERSION

## University Visualization and Animation Group (“VT-CAVE™”)

### GOALS

Goals that inspired the CAVE™ engineering effort include:

- The desire for higher-resolution color images and good surround vision without geometric distortion
- Less sensitivity to head-rotation induced errors
- The ability to mix virtual reality imagery with real devices (like one’s hand, for instance)
- The need to guide and teach others in a reasonable way in artificial worlds
- The desire to couple to networked supercomputers and data sources for successive refinement

“CAVE,” the name selected for the virtual reality theater, is both a recursive acronym (Cave Automatic Virtual Environment) and a reference to “The Simile of the Cave” found in Plato’s Republic, in which the philosopher explores the ideas of perception, reality, and illusion. Plato used the analogy of a person facing the back of a cave alive with shadows that are his/her only basis for ideas of what real objects are.

### HOW DOES IT WORK?

Virtual reality may best be defined as the wide-field presentation of computer-generated, multi-sensory information which tracks a user in real time. In addition to the more well-known modes of virtual reality – head-mounted displays and binocular omni-oriented monitor (BOOM) displays – a room constructed of large screens on which the graphics are projected onto two to three walls and/or the floor.



The CAVE™ is a multi-person, room-sized, high-resolution, 3D video and audio environment. In the current configuration, graphics are rear projected in stereo onto three walls and the floor, and viewed with stereo glasses. As a viewer wearing a position sensor moves within its display boundaries, the correct perspective and stereo projections of the environment are updated by a supercomputer, and the images move with and surround the viewer. Hence stereo projections create 3D images that appear to have a presence both inside and outside the projection-room continuously. To the viewer with stereo glasses, the projection screens become transparent and the 3D image space appears to extend to infinity. There are many rips and tears on projection screens where viewers have forgotten to be careful when walking within these invisible boundaries.

Specifically, the CAVE™ is a theater 10x10x9 feet, made up of three rear-projection screens for the front, right and left walls, and a down-projection screen for the floor. Electrohome Marquis 8000 projectors throw full-color workstation fields (1024x768 stereo) at 96 Hz onto the screens, giving approximately 2,000 linear pixel resolution to the surrounding composite image. Computer-controlled audio provides a sonification capability to multiple speakers. A user’s head and hand are tracked with ascension tethered electromagnetic sensors. Stereographics’ LCD stereo shutter glasses are used to separate the alternate fields going to the eyes. A Silicon Graphics Power Onyx with three Infinite Reality Engines is used to create the imagery that is projected onto the walls and floor.

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# MY TEACHER'S AN AVATAR!

The ThinkQuest event will bring participating teachers and/or students into the CAVE environment where they will have a chance to interact with teachers live across the Internet2 network in a virtual classroom environment. Extending the Use of Collaborative Virtual Environments for Instruction to K-12 Schools was a project between Silicon Graphics Inc. and Virginia Tech's Institute for Connecting Science Research to the Classroom. This project used the Electronic Visualization Laboratory's LIMBO together with the PACI Collaborative CAVE Console (CCC) project to create a collaborative learning environment between the VT-CAVE and two remote high schools in Virginia. The initial project was conducted prior to Internet2 and experienced problems with bandwidth and quality of service. The program for ThinkQuest will link Virginia Tech CAVE with an iDesk located at the University of Washington. Demonstrating the CAVE apps as developed by high school teachers will allow ThinkQuest participants an opportunity to interact with individuals in the virtual environment and experience this teaching capability. Experience instruction from a remote teacher interacting with you as an Avatar. Communicate with other students in a virtual environment. After experiencing the virtual lesson, ThinkQuest participants will provide insight into possible future uses of both the CAVE environment and Internet2 capabilities for a K-12 audience.



## Presenter

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## Additional Resources:

[www.icsrc.org/I2K20](http://www.icsrc.org/I2K20)

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