# Welcome to The CAVE™

Welcome to NCSA's CAVE™ at the Beckman Institute

The National Center for Supercomputing Applications welcomes you to its CAVE (Cave Automatic Virtual Environment). This cutting-edge virtual reality facility is used by NCSA's Visualization and Virtual Environments Group to conduct various types of research in the fields of virtual reality and scientific visualization. Located on the third floor of the Beckman Institute for Advanced Science and Technology in Urbana, Illinois, it is one of the centerpieces of NCSA's visualization facilities. An Open House of this CAVE is held free of charge for the general public by reservation every Monday and Thursday from 11:00AM to noon.
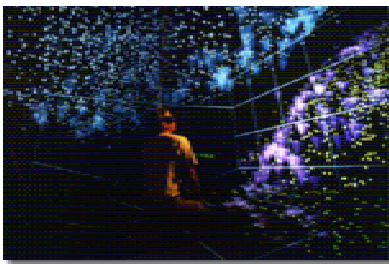
WHERE DID IT COME FROM?

Plato, in his famed Republic, introduced "The Simile of the Cave," through which he was able to explore the concepts of reality and human perception. In his exploration, he used the analogy of a man who defined the foundation of his reality by the dancing shadows of firelight which shone upon the walls of his cave.

It was upon this paradigm that Thomas DeFanti and Dan Sandin first conceived of the Cave Automatic Virtual Environment (CAVE) in the spring of 1991. Graduate candidate Carolina Cruz-Neira and several other collaborators endeavored to realize this dream in the later half of 1991. Working at the Electronic Visualization Laboratory at the University of Illinois in Chicago, they unveiled the first prototype CAVE at the ACM SIGGRAPH convention in 1992 as part of the Showcase feature.

The CAVE that they developed ultimately took on the form of a small room, approximately ten feet on each side, with three walls and a floor. Projectors situated behind the walls projected computer-generated imagery onto the walls and floor. Two perspective-corrected images were drawn for each frame, one for the right eye, and one for the left. Special glasses were worn that ensured that each eye saw only the image drawn for it. This created a stereoscopic effect, where the depth information encoded in the virtual scene was restored and conveyed to the eyes of those viewing it.


WHAT IS IT GOOD FOR?

The stereoscopic capabilities of the CAVE, coupled with its uniquely immersive design, enable scientists and researchers to interact with their data in ways never before possible. An atmospheric scientist, for example, can actually "climb inside" of a hurricane and visualize its complex and chaotic elements from any angle or visual perspective. A biological researcher, examining a tightly coiled strand of DNA, can virtually "unravel" this strand and manipulate it in an environment that preserves the critical depth information of the data.

WHY DOES IT WORK?

When you look at the world, you are seeing it from two different perspectives. The small distance between your eyes means that each eye sees the world from a slightly different angle. Your brain assembles these two images into a single composite image and uses the differences in perspective, along with other cues, to determine the depth of the scene.

The CAVE recreates this effect by providing the right and left eyes with slightly different perspectives of the scene that mirror what they would see in real life. This provides the critical depth information that makes everything seem to "come alive" in the CAVE.
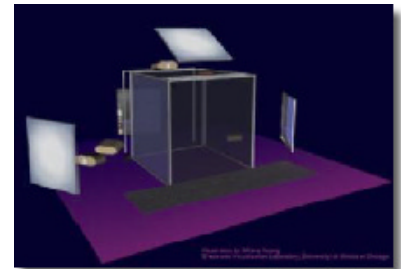
WHAT ARE SOME INTERESTING FACTS?

- There are approximately 200 CAVE's in the world.
- The graphics supercomputer that runs the NCSA CAVE costs between $500,000 and $1,000,000, while each of the special CRT projectors costs around $30,000.

WHERE CAN I LEARN MORE?

Check out the new NCSA CAVE website at http://cave.ncsa.uiuc.edu/ to learn more about the CAVE and how it works.