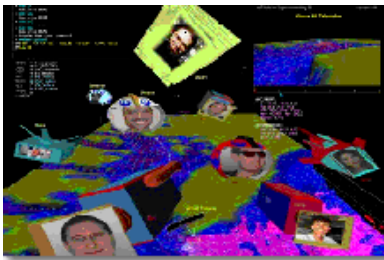


The Applications of SciVis and VR

How do Scientific Visualization and Virtual Reality Systems Enable Research?

Scientific visualization and virtual reality systems enable researchers to explore classes of problems that would otherwise be extremely problematic or tedious to analyze. Some research problems, such as traversing the interior of a severe storm and examining the flow of particles through it, would simply be impossible without the aid of visualization facilities. Others, like examining architecture across all of Europe, would be prohibitively expensive to many. Scientific visualization and virtual reality technologies provide solutions for many areas of science that require the ability to present data in an intuitive form and permit safe, feasible interaction with it. Humans have an extraordinary ability to recognize patterns once the data is placed into a visual form. These technologies provide the medium to enable the transfer of numbers on a page to graphical images that a human can analyze and comprehend.



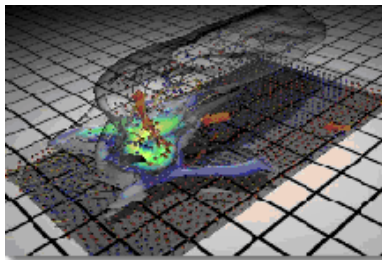
TRANSCENDING THE GLOBE

Collaboration is one of the cornerstones of modern scientific endeavor. By leveraging the collective experience and expertise of a group of researchers, their combined strengths can be brought to bear on an individual problem. However, in many cases it is not possible for all of the members of a team to meet in person. Geographic and political boundaries can often create insurmountable barriers to physical interaction. In these situations, the group members must remotely collaborate, using various means of communication.

One such means of electronic communication designed specifically for the task of remote collaboration is called "teleimmersion". This communications channel provides a virtual venue for geographically dispersed individuals to meet and interact. Using virtual reality technology, visual representations called "avatars" are chosen for each participant, so that cues such as gestures can be incorporated into the interactions of the meeting. The entire meeting takes place in a virtual environment created by the participants to suit the needs of their collaboration. Many times this environment is built directly on top

of an existing virtual reality application, to permit multiple remote participants to interact with each other while cooperatively controlling the application and sharing objects.

By enabling researchers to form partnerships unrestrained by traditional boundaries, this technology empowers those researchers to seek out otherwise impossible partnerships with individuals and organizations, promoting scientific collaboration.



MISSION IMPOSSIBLE

Many applications of scientific visualization and virtual reality technology are focused on research areas that are extremely difficult, if not impossible, to analyze through traditional techniques. Numerical simulations are a perfect example. The result of numerical simulations is a large list of numbers, representing the values calculated by the computer. Hidden in all of these numbers could be the solution to the problem being analyzed, but first a key is needed to unlock that potential. Scientific visualization and virtual reality technologies can often become that key, lending a familiar visual face to a ledger of numbers.

In other situations, the data being analyzed is already in graphical form, but has specialized display or interaction needs. An aerial photograph, for example, could be displayed on a tiled display wall in its entirety at full resolution. A Magnetic Resonance Imaging scan could be loaded into a virtual reality CAVE™ and interactively manipulated in 3D. Scientific visualization and virtual reality technologies uniquely provide the intuitive display and interaction capabilities required by many problems.



BETTER, FASTER, CHEAPER

Scientific visualization and virtual reality technologies have also found their way into the industrial design process as streamlining devices to enable "better, faster, cheaper" development cycles. Caterpillar was one of the pioneers of "virtual prototyping", using virtual reality to develop and test potential product designs before building physical models, significantly reducing costs and speeding time-to-market.



The textual content of this pamphlet was developed by Kalev Leetaru. Images courtesy NCSA.