

# VR Scientific Visualization in the GROTTTO

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## Abstract

*This paper describes the efforts being carried out at the Naval Research Laboratory (NRL) towards VR Scientific Visualization. We are exploring scientific visualization in an immersive virtual environment: the NRL's CAVE<sup>TM</sup>-like device known as GROTTTO (Graphical Room for Observation, Training and Tactical Orientation). We describe the AVS GROTTTO viewer, a VR interface to the AVS visualization system. The AVS GROTTTO viewer has been used by a number of scientists in current, ongoing research projects within NRL.*

## 1. The AVS GROTTTO Viewer

We would like to build a VR system integrated with an existing scientific visualization package such as AVS (Application Visualization System). We have chosen AVS because aside from fulfilling our visualization needs, it is widely used by the scientific community. The advantages of such a system are clear. The scientist is not required to have programming expertise or a great investment of time to be able to visualize scientific information in the GROTTTO, as he would just need to program/develop at the AVS visualization system level. Also, there is no need for the user to do program development inside the GROTTTO, as they would be able to develop visualization networks at their desktop that would be readily available for GROTTTO visualization.

We have been working in the development of an AVS wrapper of our VR software named the AVS GROTTTO viewer module. This module replaces the geometry output module of the visualization networks and displays information on one or more walls of the GROTTTO. As the rendered image is part of an AVS network, we can perform interactively all the visualization functions permitted by the AVS modules libraries and the user's hand written modules. To increase the effectiveness of the system, we are developing software that would also allow the user to display the AVS network on one wall of the GROTTTO, while simultaneously allowing interaction with the network and the image through the use of the same 3D joystick.

Over the last five months we have supported more than 25 scientists in over 15 scientific visualization projects. These projects cover a wide range of scientific disciplines

from materials sciences and chemistry, to biochemistry, computational fluid dynamics and space sciences. Each project has its own unique aspects for visualization given the data types and the types of analysis which were performed.

## 2. Advantages and Limitations

We have found a variety of problems when trying to implement VR visualization: (i) Network Connection Bottleneck: Current network bandwidths ranging from Ethernet at 10 MB/s to OC3 ATM at 155 MB/s cannot quite accommodate 100 MB datasets at an efficient time rate. (ii) Large Data Sets: Some scientific data sets that are being generated are of order 100's MB. Current rendering hardware cannot efficiently and interactively cope with such large data sets.

But even with these problems and limitations, we feel that the GROTTTO shows great potential as a device for the analysis, communication and dissemination of 3D visual information. Some of the advantages of GROTTTO VR visualization are: (i) GROTTTO's wide field of view. (ii) The physical dimensions of the GROTTTO allow several users to share the virtual environment at the same time. It is also not as cumbersome to operate as the HMD. (iii) The software that we have developed allows for a fast transition of VR technologies to scientific research.

## 3. Conclusions

The AVS GROTTTO viewer allows any member of the scientific community who works with AVS to use Virtual Reality Technology to visualize their data instantaneously, without further VR software development. The rapid access and real time interaction with the AVS libraries gives plenty of freedom for the visualization.

## References

- [1] R. Rosenberg, M. Lanzagorta and E. Kuo. "Desktop Development of VR Applications", Proceedings of the *Department of Defense High Performance Computing Users Group Meeting 98*.

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