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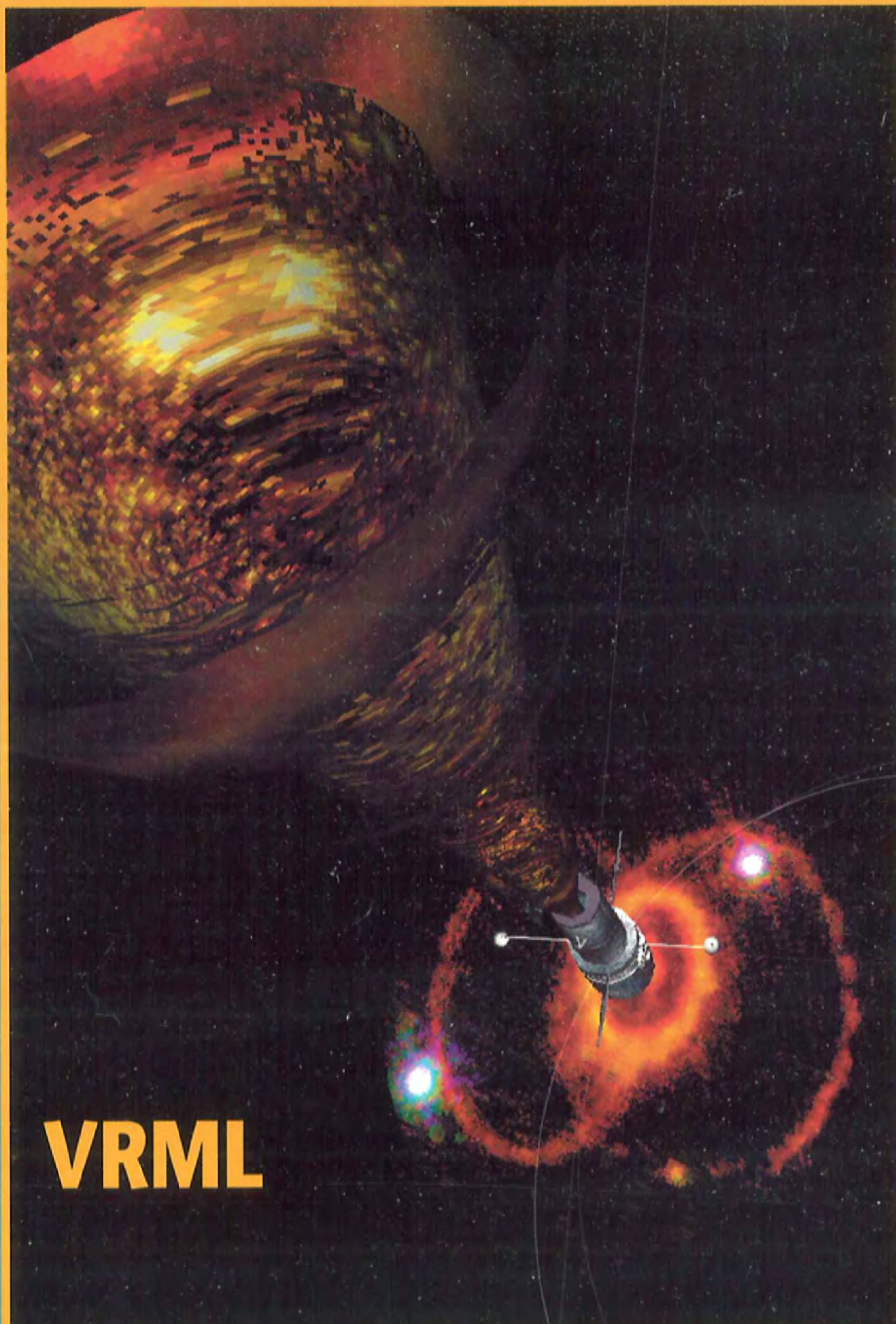

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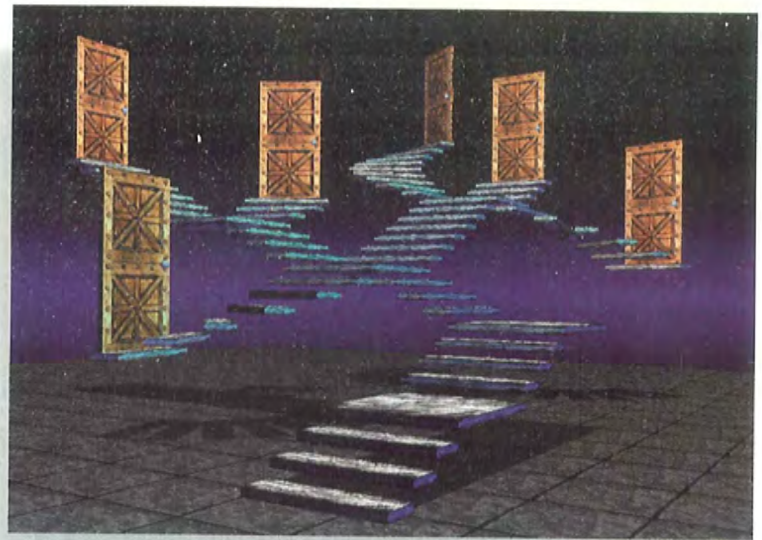

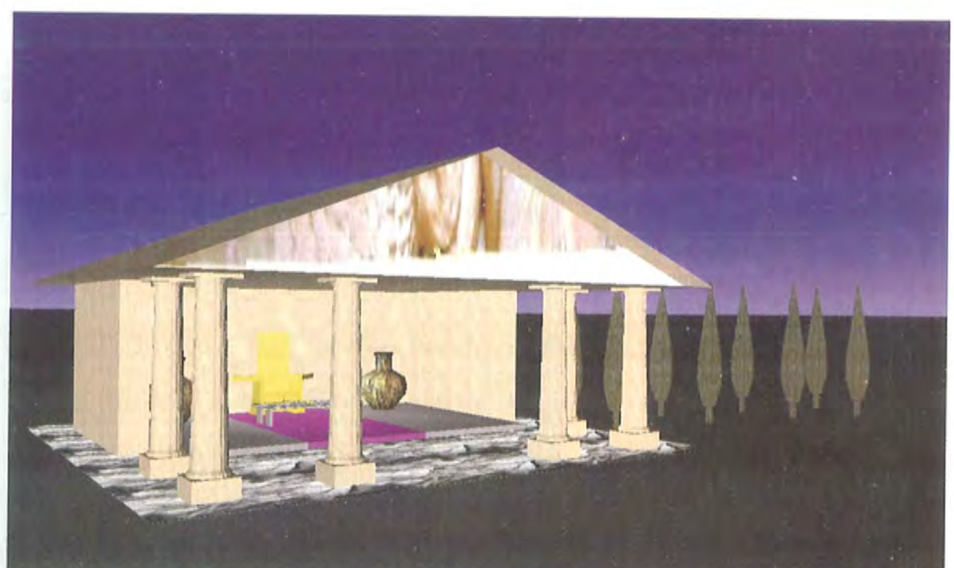

TerraVision II: Visualizing Massive Terrain Databases in VRML

Martin Reddy, Yvan Leclerc, Lee Iverson, and Nat Bletter
SRI International

To disseminate 3D maps and spatial data over the Web, we designed massive terrain data sets accessible through either a VRML browser or the customized TerraVision II browser.

Researchers have increasingly turned to Virtual Reality Modeling Language (VRML) to represent geographic information. In VRML's early days, the result was a few toy examples that did not scale well, such as coarse, single-resolution elevation grids. Today, VRML is drawing more serious interest from researchers across the spectrum, including geographers, cartographers, geologists, and computer scientists, as the sidebar "Related Work" describes. As Theresa-Marie Rhyne noted, geographic information system (GIS) and scientific visualization tools have begun to expand into each other's domains,[1] and VRML offers cartographers and geographers the potential to disseminate 3D maps and spatial data over the World Wide Web. However, to date we have not seen useful large-scale VRML geographic databases.

We aim to enable visualization of near photorealistic 3D models of terrain that can be on the order of hundreds of gigabytes. This might include different types of terrain imagery for particular regions, as well as site models and auxiliary information for ground features.

The following scenario indicates the capabilities required. Say a user wants to find a particular building in a particular city. Her journey begins with a 3D model of the earth viewed from space. This model is texture-mapped with satellite imagery of 100 kilometers resolution—that is, each pixel in the texture map represents a region on the planet's surface covering 100 km^2. To find the city, the user first rotates the earth to view the

Related Work

Currently, interesting and significant work addresses the problem of representing geographic data in VRML. In the earth sciences, Kate Moore described the work of the Virtual Field Course (VFC) project,[1] which is developing software tools to familiarize students with fieldwork locations and aid data collection and analysis. The VFC project uses VRML and Java to provide interactive 2D and 3D views of geo-referenced data to enhance students' cognition of the real environment.

The US Naval Postgraduate School is currently working on a project to develop a 3D model of the Monterey Bay National Marine Sanctuary. They aim to create a VRML representation of the sanctuary based on raw bathymetry (below sea level) data for a 2.5 × 2.5 degree region of the bay. Their representation uses multiresolution techniques to deliver these large data amounts over a 28K modem connection.

Michael Abernathy and Sam Shaw described their work using VRML to visualize the course for a 197-mile relay race through the San Francisco Bay Area.[2] They did this using standard US Geological Survey (USGS) 7.5 arc min digital elevation models (DEMs) for the terrain geometry with geo-referenced satellite imagery draped over the terrain. Their system also used Global Positioning System (GPS) input to create a line segment showing the race's course over the VRML terrain.

References

1. K. Moore, "Interactive Virtual Environments for Fieldwork," *British Cartographic Society Annual Symp.*, 1997; available at http://www.geog.le.ac.uk/mek/VirtEnv.htm.
2. M. Abernathy and S. Shaw, "Integrating Geographic Information in VRML Models," Proc. Third Symp. VRML, ACM New York, 1998, pp. 107-114.

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