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VOL 19 PART 2

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**VRML**

- Public Speaking in VR
- Glassner on string Crossings

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# IEEE Computer Graphics AND APPLICATIONS

## Articles

### VRML

- 17** **Guest Editor's Introduction:  
Virtual Reality Modeling Language**  
*Maureen Stone*

- 18** **Tutorial: Building Virtual Worlds  
with VRML**  
*David R. Nadeau*

VRML makes it easy to create virtual worlds. This tutorial reviews VRML's syntax and features as well as its world construction and animation abilities.

- 30** **TerraVision II: Visualizing Massive  
Terrain Databases in VRML**  
*Martin Reddy, Yvan Leclerc, Lee Iverson,  
and Nat Bletter*

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

- 39** **Large-Scale Mine Visualization  
Using VRML**  
*Keith Russ and Andrew Wetherelt*

Traditionally, mine plans and sections in 2D stored 3D information. This article shows that using VRML to model this information leads to new, interactive methods of data visualization.

- 45** **"Bottom, Thou Art Translated":  
The Making of VRML Dream**  
*Stephen N. Matsuba and Bernie Roehl*

Bringing virtual theater to the Web requires 3D graphics, efficient networking, and strong content. The authors discuss the VRML Dream Project, a real-time Internet performance.

- 52** **Developing the VRML 97  
International Standard**  
*George S. Carson, Richard F. Puk, and  
Rikk Carey*

VRML 97 arose from a cooperative effort between the standards and VRML communities. The methodology employed applies equally well to development of future standards.

- 59** **VRML Testing: Making VRML Worlds  
Look the Same Everywhere**  
*Mary Brady, Alden Dima, Len Gebase,  
Michael Kass, Carmelo Montanez-Rivera,  
and Lynne Rosenthal*

NIST tools address problems posed by testing 3D graphics. This article explains the test development strategy and design issues in developing and delivering these testing tools.

- 68** **A Framework for Streaming Geometry  
in VRML**  
*André Guézic, Gabriel Taubin, Bill Horn,  
and Francis Lazarus*

The authors introduce a framework for streaming geometry in VRML that eliminates the need to perform complete downloads of geometric models before starting to display them.

- 79** **Dynamics Modeling and Culling**  
*Stephen Chenney, Jeffrey Ichnowski, and  
David Forsyth*

The tools described permit including large numbers of complex dynamic models in a VRML world easily and efficiently while maintaining high frame rates.

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domains,<sup>1</sup> and VRML offers cartographers the potential to disseminate 3D map data over the World Wide Web. However, not seen useful large-scale VRML geogra-

**R**esearchers 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, geo-

domains,<sup>1</sup> and VRML offers cartographers the potential to disseminate 3D map data over the World Wide Web. However, not seen useful large-scale VRML geogra-

We aim to enable visualization of near real-time 3D models of terrain that can be on the order of hundreds of gigabytes. This might include data from terrain imagery for particular regions, as well as 3D models and auxiliary information for global terrain.

The following scenario indicates what is required. Say a user wants to find a particular city in a particular city. Her journey begins with a view of the earth viewed from space. This view is mapped with satellite imagery of 1000 pixels per inch resolution—that is, each pixel in the texture represents a region on the planet's surface covering 1 square mile. To find the city, the user first rotates the earth to see the city.

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,<sup>1</sup> 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.

Michael Abernathy and Sam Shanley used their work using VRML to visualize the 197-mile relay race through the San Francisco Area.<sup>2</sup> They did this using standard USGS Survey (USGS) 7.5 arc min digital elevation models (DEMs) for the terrain georeferenced satellite imagery draped over the terrain. Their system also used Global Positioning System (GPS) input to create a line showing the race's course over the terrain.

1. K. Moore, "Interactive Virtual Environment," *British Cartographic Society*, available at <http://www.geog.le.ac.uk/~kmoore/>
2. M. Abernathy and S. Shaw, "Interactive Information in VRML Models," *VRML*, ACM New York, 1998, pp. 1-10.

Karen Anderson  
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8<sup>th</sup> January 2016

Dear Ms Anderson,

TerraVision II: visualizing massive terrain databases in VRML (Volume:19, Issue: 2)  
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Yours sincerely

**Miss S Jennings**