What is Geographic Visualization?

Human beings have a remarkable capability to process and understand visual information. Visualization takes advantage of this capability by graphically representing data, and allowing scientists to visually pick out patterns in that data. Geographic visualization (GVis) facilitates exploration, analysis, synthesis, and presentation of georeferenced information. GVis is part of a broader rapidly developing field of research known as Geographic Information Science (GISci). GISci integrates research traditions including cartography, remote sensing, and geographic information systems.

Penn State is at the forefront of GVis developments nationally and internationally both in developing fundamental GVis concepts and in application of those concepts in the areas of health, environment, and learning about the world. GVis is providing methods and tools that allow users to develop hypotheses, synthesize information, and (when linked to temporal GIS, spatial data mining, and other methods) to construct knowledge.

Collaborative Visualization in Virtual Environments – a Demonstration

Exploratory analysis of complex, multi-dimensional space-time data sets demands new and innovative tools. As an extension from the Apoala Project (see note below), we have begun collaborating with environmental and computer scientists at Old Dominion University to explore the potential of Immersive Virtual Reality (VR) technology and high speed networking to facilitate collaboration among scientists at remote locations as they explore complex spatiotemporal data. The specific virtual environments being used in our collaboration are a pair of ImmersaDesks. An ImmersaDesk uses a large format screen, 3D projection, and head tracking of the “driver” to provide users with a sense of being “in” the environment and allows small groups to use the system at the same time.

The data used in the Penn State component of the demonstration are extracted from a much larger climate data set for the Susquehanna River Basin of Pennsylvania, New York, and Maryland -- specifically daily maximum temperature and precipitation extending from May through July, 1972. The primary visualization method implemented is dynamic manipulation of slices through a remapping of real world time onto one of the spatial axes of our display space (to produce what we call a space-time cube). In the demonstration, the lower portion of this display space has a double mapping, with terrain elevation also represented in the z-dimension. Among the features that the resulting dynamic environment highlights are the relationship of temperature with both topography and precipitation. With the latter, one of the more dramatic relationships is substantially reduced temperature across the basin following Hurricane Agnes, as the huge quantities of water dumped on the region slowly evaporated.

The technology used here is very new. As a result, we must trade off an ability to dynamically control many attributes of the display (e.g., temporal aggregation, color schemes, etc.) for the ability to see the display in stereo, fly around the space-time cube, and interact with collaborators at remote locations. Over time, we expect to focus attention on integrating methods of visualization possible in collaborative virtual environments with our related research on methods for dynamic manipulation of geoinformation database query and display parameters.

Work presented today is part of the Apoala Project, a three-year effort to develop and test an integrated spatio-temporal geographic information, visualization, and analysis system with the goal of supporting complex exploratory analysis of environmental data as well as policy decision-making based upon those data. Apoala is Co-lead by Donna Peuquet and Alan MacEachren in the Department of Geography, and supported by the U.S. Environmental Protection Agency under grant # R826195-01-0. http://www.geog.psu.edu/apoala/

Building on a strong GISci base that involves several faculty with related research and teaching interests, the Department of Geography recently established the GeoVISTA (Geographic Visualization Science, Technology, and Applications) Center – devoted to fundamental and applied scientific research on the visualization of georeferenced information, development of geographic visualization (GVis) technologies, and the application of both in science, industry, decision-making, and education. http://www.geog.psu.edu/geovista/

Credits

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