A visualization framework can be seen as a solution to a specialized data flow problem. Spiegel (Spiegel is the German word for mirror) is a visualization framework which uses the Unix pipeline model to execute programs to visualize scientific data. A visualization framework is constructed out of small, simple components which are connected together. We are interested in understanding how to construct a dataflow allowing to distribute the components in an environment where the communication endpoints are in space.

Visualization is, in mathematical terms, a conversion of $n$-dimensional data to $k$ variables, where $k < n$. The most developed sense is sight, therefore this process can provide a result which gives us faster and easier insight in a complex world. Visualization is, in mathematical terms, a conversion of $n$-dimensional data to $k$ variables, where $k < n$. Preceded only by sight, hearing can be considered the second most developed sense. Sight is one of our best-developed senses, therefore this process can provide a result which gives us faster and easier insight in a complex world. Visualization is, in mathematical terms, a conversion of $n$-dimensional data to $k$ variables, where $k < n$.

Visualization frameworks represent scientific data well for a human. While a visual can be used to publish visualization results, sound describing a data set can be created, but it certainly is not easy to publish. The question is what kind of audio description can be used to complement visualizations?

A sound describing data can only have broad strokes. A visual can be printed and can be used to publish visualization results. The sense of sight differs significantly from the sense of hearing in resolution and meaning. A visual can have many details while a sound describing data can only have broad strokes. A visual can be used to publish visualization results.

The qwert keyboard and a mouse are still the main input devices used today. The last upgraded mouse was introduced by Microsoft. The qwerty keyboard and a mouse are still the main input devices used today. The last upgraded mouse was introduced by Microsoft.

The question is how can gesture recognition be used to control a visualization environment. For this reason, Hans-Peter Bischof developed a language and visualization environment which allows modifications to the visualization parameters—i.e., the camera can be moved to focus the attention of the viewer, or the transparency of objects can be changed to expose otherwise hidden features. Visualizations are typically not composed of a single image because they usually contain a time dimension(s); and $k$ is significantly less than $n$.

What kind of gestures are natural in order to control a viewpoint position keeping in mind that the viewpoint may have to move very large distances or very small distances? The qwerty keyboard and a mouse are still the main input devices used today. The last upgraded mouse was introduced by Microsoft.

THE SPIEGEL PROJECT

The SPIEGEL project developed a visualization framework which uses the Unix pipeline model to implement visualization systems. Spiegel is extremely flexible and allows one to visualize data in 3-D space, which allows the exploration of data in time and space. Many visualizations have been created and used to promote research at RIT and at other institutions. A small selection of movies generated with this framework can be found here.

The ET consortium includes over 200 researchers across the world. We work together with computer scientists at the National Center for Supercomputing Applications (NCSA) to run and visualize our simulations on the Blue Waters system.

This facility is supported by the National Science Foundation under Grant No. OCI-0725070. More information see http://ccrg.rit.edu/research/visualization.

Contact: Hans-Peter Bischof. Working in this area are several graduate and undergraduate students.

Projects and Collaborations:

- The Ligo Scientific Collaboration (LSC) is a well-organized collaboration of approximately 760 scientists worldwide who have joined together in the search for gravitational waves from the most violent events in the universe, such as the merger of black holes and neutron stars, the explosion of supernovae and the Big Bang.

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[5] links: