Using CavePainting to Create Scientific Visualizations

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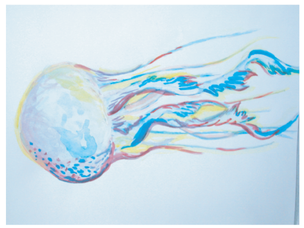
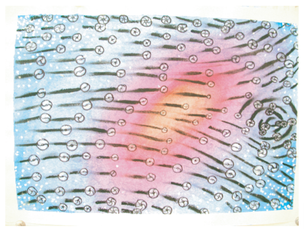
CavePainting

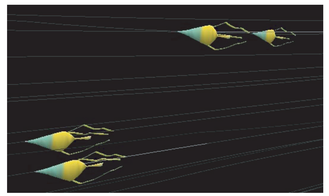
CavePainting provides an easy to use interface for painting 3-dimensional forms directly in a Cave VR environment.

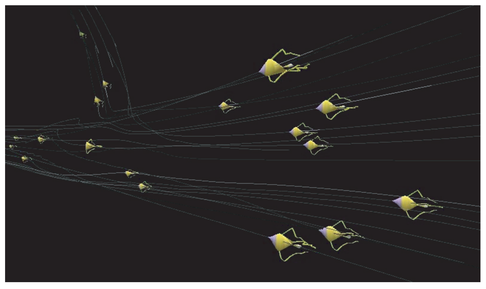


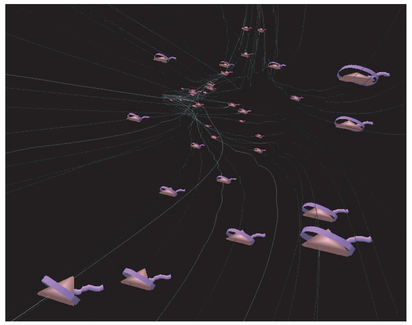


Problems with 2D designs

The main problem with designing VR images on paper is that paper design does not fully characterize what the resulting visualization will look like in a VR environment. For example, choosing colors for VR is difficult to do on paper since the projected colors are often dim and unsaturated. Furthermore, any design on paper is still a 2D design, and 3D designs on a 2D medium may have problems when viewed in immersive 3D.

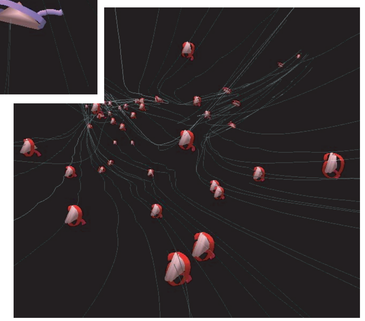


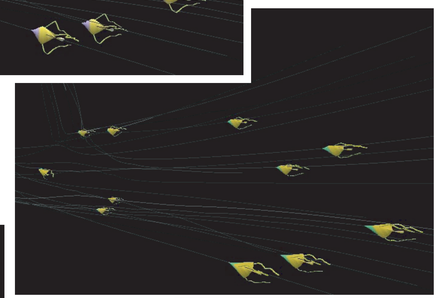


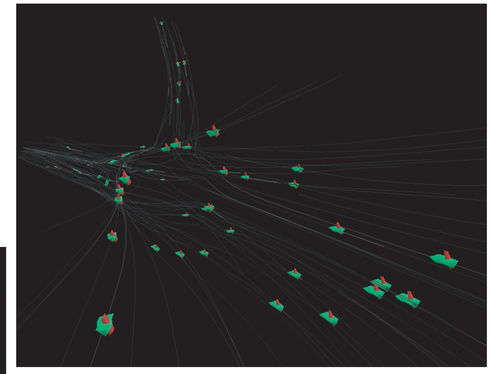


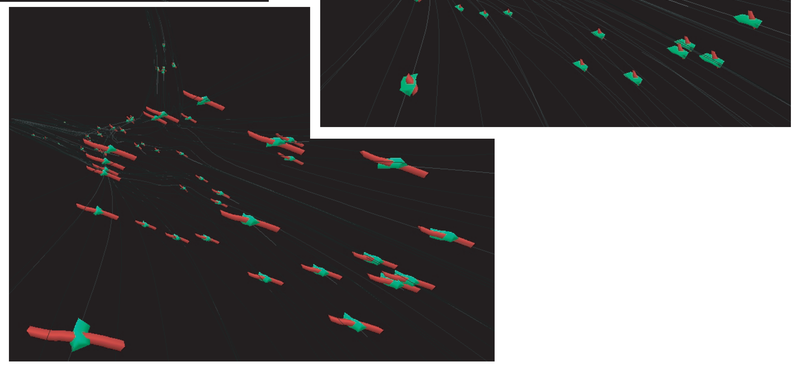
Visualization Prototypes

We extended CavePainting and applied it to design tasks in the scientific visualization domain. These figures are snapshots of 3D visualizations of blood flow patterns in a bifurcated artery. The flow is pulsatile, so it is difficult to capture change in a single frame. The prototypes contain icons composed of 3D CavePainting strokes.









Overview

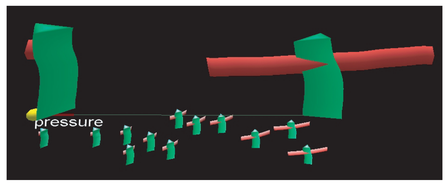
According to Senay and Ignatius, "The primary objective in data visualization is to gain insight into and information space by mapping data onto graphical primitives" [Senay and Ignatius 1994]. The first step in this process is often a quick sketch of the elements of the visualization. When designing visualizations for VR, sketching on paper does not capture the immersive nature of VR. Furthermore, implementing each design often takes hours or even days as visualization styles are coded, examined, and evaluated.

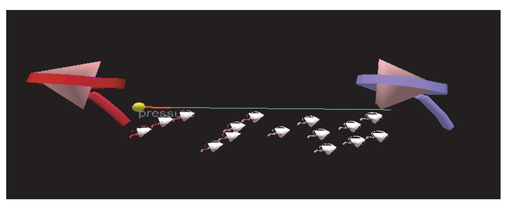
The goal of our system is to drastically reduce the iteration time for designing a visualization. We accomplish this by allowing an artist to sketch a visualization in VR, and then apply that to the actual visualization data. The end result is a hastened research cycle; each design can be implemented and evaluated in under half an hour.

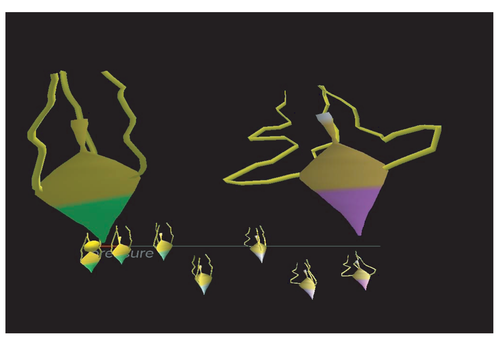
The CavePainting system allows users to draw 3D forms in virtual reality directly using a six degree-of-freedom tracker. The user manipulates a brush to generate a stroke of color and texture. These strokes can be edited and combined into compound strokes.

Linking Art to Data

Legends were used to combine Cavepainting strokes with the data being visualized. CavePainting strokes added to the legend indicate how the final visualization element changes in response to a particular data type. The lower portion of the legend shows miniature versions of the final visualization element. There is one legend per data attribute visualized. Shown below are the pressure legends for the visualizations to the right.







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