

Virtual Reality and the Lesser Long Nosed Bat

Developing Scientific Visualization Tools in the Cave

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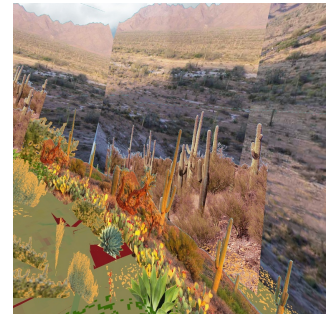
This capstone project is an investigation into the potential of using virtual reality as a visualization tool for scientific inquiry, specifically as an immersive education tool for concepts related to bat anatomy and flight mechanics.

[The Cave](#) is an 8x8x8 foot cube in the Granoff Center for the Creative Arts and serves as the site for various virtual reality environments created in classes at Brown University. In the Cave, stereo images are projected onto three of the walls and the floor, which can be understood three-dimensionally with the help of 3d glasses. Users can physically move around the projected objects as well as use a remote to zoom in and out of the environment and progress through the virtual space.



This capstone project uses the Cave and the CavePainting software in order to create two spaces in which participants can interact with virtual objects in order to gain scientific knowledge about the Lesser Long-Nosed Bat and the mechanics of hovering flight.

In the first space, the participant is introduced to a virtual room containing a bat and a toolbox. By selecting various options on the virtual toolbox via remote, participants can affect the visualization of the bat. The user can gather an anatomical understanding of the bat by switching between displaying the skeleton, muscles or skin of the bat. He or she can choose a specific point in the wingbeat cycle of the bat, turn on 'Muscle Activation Mode' to see which muscles are activated throughout the cycle, or turn on 'Leading Edge Vortex Mode', which displays the air vortices generated by the wing during flight. The user can also choose to display explanatory text and labels for these numerous concepts.



To reach the second space, the user exits the virtual room through a window. The user is now in a sweeping outdoor space modeled after the environment of the Lesser Long-Nosed bat, a semi-arid grassland habitat. The user follows the bat to its feeding spot, a cactus plant, to witness a situation in which hovering flight is put to use.

These visualizations are not generated based on specific data points, although they have their roots in scientific concepts. For example, the airflow of the Leading Edge Vortex Mode illustrates simplified general fluid dynamics behavior. This project is based, rather, in an exploration of user interface design issues in the groundbreaking new medium of virtual reality. The immersive quality of virtual reality, as well as the manner in which movement and manipulation of objects is intuitive in a 3D space, makes it an ideal tool for data visualization and science education. There is no doubt that as virtual reality technologies become more widely accessible in the future, we will be seeing tools like this used for a wide variety of applications.

This project was created as a final project for the Fall 2013 class "Virtual Reality Design for Science". This class is co-taught by Brown Computer Science professor David Laidlaw, Brown Engineering and Biology professor Sharon Swartz, and RISD Illustration professor Fritz Drury. It is open to both RISD and Brown students and aims to create an experimental space for students from various disciplines and backgrounds to collaborate on developing strategies for scientific visualization in virtual reality.