Spotting Perceptual Learning

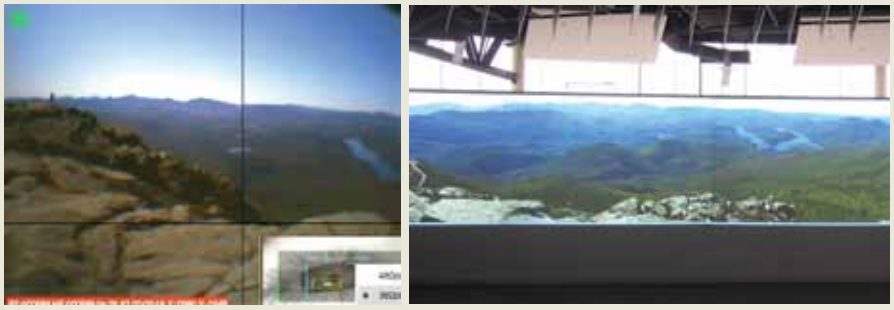

Jeff Pelz


Mitchell Rosen

From the sliding San Andreas Fault to the desert of Death Valley, the landscape provides geology lessons professors could only dream of bringing to the classroom. Dr. Jeff Pelz, professor at the Chester F. Carlson Center for Imaging Science and an expert in visual perception, is leading an RIT team in a multidisciplinary research project to explore how perceptual learning occurs in these complex environments. Co-PI Dr. Mitchell Rosen, research professor of RIT's Center for Student Innovation (CSI), and doctoral student Brandon May are capturing the experience in photographs, video, and audio to create a semi-immersive virtual field trip. The team will compare how people learn in actual versus virtual environments.

For over 10 years, Dr. John Tarduno, professor of geophysics at the University of Rochester, has led undergraduate students on a transformational 10-day journey from San Francisco, Calif., to Las Vegas, Nev., teaching fundamental geology lessons. The experience has led students to pursue advanced degrees and professions in geology.

A research team consisting of Dr. Robert Jacobs, professor of brain and cognitive sciences at the University of Rochester, Tarduno, Pelz, and Rosen won a five-year National Science Foundation grant to support the research. They seek to understand how students develop perceptual expertise in the field, what role perceptual learning plays in the understanding of geology, and to what extent those experiences transfer to the classroom through the use of imaging.



Capturing Perceptual Learning: A screen-capture from a student's eye-tracking device (left) depicts where the eye gazes while at a geological site in an effort to understand how perceptual learning occurs. Ultra-high-resolution imagery is used to replicate the experience in a virtual semi-immersive environment at the Center for Student Innovation (right).

Each student on the real and virtual trips will be equipped with a wearable eye-tracking device developed by Positive Science, a company formed by RIT graduate Jason Babcock. Each eyetracker has a camera that watches eye movements and another that captures the scene. Expert geologists will also be equipped with the device to help understand the differences in gaze behavior.

Rosen and May are producing ultra-high-resolution still imagery of the sites and a hemispherical video view with a 12-megapixel video camera. When projected on screens in the CSI, the final footage will allow viewers to walk up and examine some of the geological landmarks in life size.

"If we can understand how learning takes place in the natural environment, we may be able to replicate this experience for thousands of students across the country," adds Pelz.

Bringing Virtual Surfaces into the Real World


Ben Darling


James Ferwerda

Color scientists at the Munsell Color Science Laboratory are bringing a new dimension to computer graphics through a new immersive display system called the tangiBook. Developed by Dr. James Ferwerda, associate professor at the Chester F. Carlson Center for Imaging Science, and Benjamin Darling, color science doctoral student, the device allows users to interact with virtual surfaces as if they existed in the real world.

The first-generation tangiBook is based on an off-the-shelf laptop computer that incorporates a webcam and accelerometer, along with custom software that tracks the position of the viewer and the orientation of the laptop in real time. Using this information, realistic images of surfaces with complex textures and material properties illuminated by environment-mapped lighting are rendered to the screen at interactive rates. Tilting the laptop or moving in front of the screen produces realistic changes in surface lighting and material appearance.

The tangiBook can provide enhanced access to collections in digital libraries and museums, allowing viewers to interact in a whole new way. When you visit a museum, you are able to observe the original artwork at a distance; with the tangiBook you can have a more intimate interaction, viewing the piece from different angles and under different lighting conditions. The technology also allows curators or artists to simulate how restorations or treatments may affect the artwork. Similarly, the technology can be used for soft proofing applications to simulate the effects of different papers and finishes on photographic prints.

A second-generation tangiDesk system is currently being engineered for high-performance applications. The research team is also developing a hand-held tangiPod device for the mass market that will provide consumers with interactive 3-D digital swatch books or catalogs of materials like cloth, carpet, and tile whose true appearance is difficult to capture in conventional photographs.

tangiBook in Action: Using an accelerometer, webcam, and custom software, the tangiBook tracks the orientation of the laptop screen and the position of the observer in real time. Tilting the laptop (as shown) or moving in front of the screen produces realistic changes in surface lighting and material appearance.