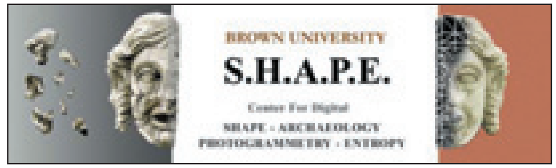
possibilities HPWREN opens for ecologists. For the past year, the biology researcher at the University of Zurich in Switzerland has been remotely studying hummingbirds at the Santa Margarita Ecological Reserve (SMER) in order to determine their role in the pollination of the bush monkey flower, *Mimulus aurantiacus*.

"Every hour of the day, a camera photographs pots of bush monkey flower representing each color of subspecies [red, orange, and yellow] as they grow and bloom - as well as a hummingbird feeder, as it encourages the hummingbirds to feed at the camera's location. From Switzerland, Baumberger can observe the flowers' rates of growth and see how often the hummingbirds feed at the site. Once the flowers bloom, the feeder will be removed, and Baumberger's team will begin observing the hummingbirds' decisions about which color of flower to feed from. This data will help him track the rate of hybridization among these California subspecies." (***http://hpwren.ucsd.edu/news/020415.html***)

HPWREN provides Baumberger with real-time access to SMER's high-resolution still camera. "Delivering more than three megapixels per image," describes HPWREN, "the connection of the camera to the Internet allows us to capture the wing of a hummingbird in flight."

Other examples of scientists utilizing SMER will be soon available at HPWREN's Web site, ***http://hpwren.ucsd.edu***. Bruch is currently interviewing nearly 40 field scientists, and will post her interview results in the upcoming weeks.

HPWREN is connected to SMER, the Mount Laguna Observatory, the Palomar Observatory, and the earthquake sensors at the Borrego Valley Downhole Seismic Array.



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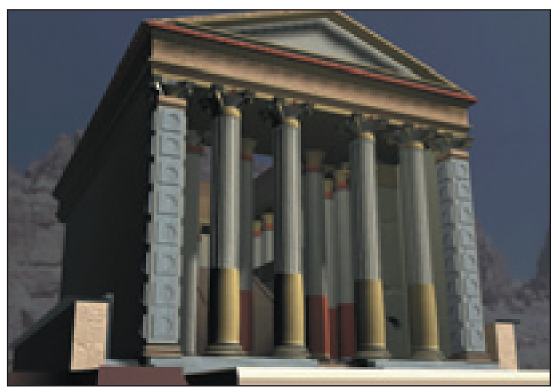
SHAPE

Researchers in engineering, computer science, applied mathematics, archaeology, art, and anthropology are working together at Brown University's SHAPE (SHape, Archaeology, Photogrammetry, Entropy) Lab to develop new forms of computer modeling and reconstruction software. Several projects are currently underway: SHARP, STITCH, STYLE, ARCHAVE, and MIRAGE.

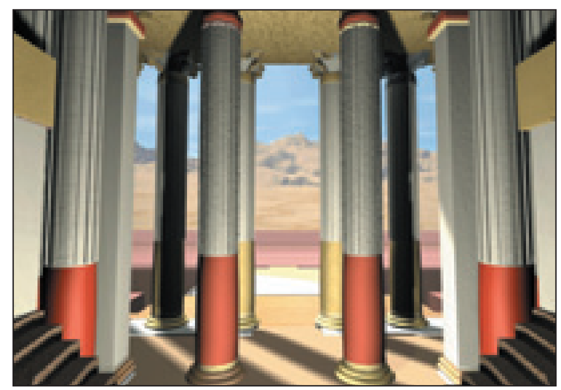
One of SHAPE's latest achievements was the creation of a life-size 3D model of the Great Temple in Petra, Jordan – a site under excavation for the past ten years. With glasses and a hand-held mouse, archaeologists can now explore the reconstructed site in Brown's 8 x 8 foot immersible virtual reality room, known as the CAVE. A desktop version is under currently development. "It is hoped that we will be able to have an archaeologist use virtual reality to look at an area under excavation as if that person was actually there and to make precise geometric measurements of small artifacts and large structures," says Martha Joukowsky, one of eight principal research collaborators and a professor at Brown's Center for Old World Archaeology and Art and Department of Anthropology.

New software that will allow archaeologists to model, recover, assemble, and reconstruct archaeological sites, structures, and artifacts – perhaps even humans and animals – is also in the works. "Other major applications of the work are to use computers to reconstruct models and images of objects in their original conditions from images of found artifacts, categorize reconstructed objects into like groups, relate them stylistically, and compare them to similar objects found at other sites," says David Cooper, Director of the SHAPE Lab and Professor of Engineering. "This technology could also help archaeologists determine where objects originated, and trace both ancient trade routes and the stylistic influences between sites."



By E. Vote, N. Raford & A. Walsky – June 2000.

A view at the preliminary 3D reconstruction (temple proper) of the Great Temple in Petra, Jordan.



By E. Vote, N. Raford & A. Walsky – June 2000.

Snapshot from inside the Petra Great Temple.

The software will eventually be able to recover 3D free-form objects and selected scene structures from digital photos and video. "In essence, the project is looking at new approaches for handling huge amounts of complex image data from single images or from video of complex freeform shapes in order to build three-dimensional models," says Dr. Frederic Fol Leymarie, Manager of the SHAPE Lab.

SHAPE is funded in part by the National Science Foundation of the USA (NSF), under grant ITR-0205477, directed towards difficult computational problems requiring multidisciplinary approaches. For further information, visit ***http://www.lems.brown.edu/shape.***

TRAILS

Training and Resources for Assembling Interactive Learning Systems, or TRAILS, was launched by SRI International's Center for Technology in Learning last fall. The project aims to address needs in K-12 education by helping undergraduate students develop high-quality K-12 software.

TRAILS performs educational research on how children engage in deeper problem solving, reflection, strategizing, generalization, and communication. Using this knowledge, TRAILS provides training and resources to undergraduate computer science and education students in order to help them develop interactive learning systems. Students in the program study a series of TRAILS modules, which focus on mutual understanding of educational requirements, shared elaboration of designs with modeling tools, building prototypes from components, and field-testing prototypes. SRI International provides three resources for co-designing the classrooms: tools for designing and prototyping educational software, shared spaces for design artifacts, and access to a network of pedagogical and technical experts.

Education and computer science students participating in the TRAILS program at Stanford University. Students collaborate on educational software projects in actual K-12 classroom settings.

In addition to gaining an appreciation for interdisciplinary collaboration, computer science students learn how to develop software that meets the needs of K-12 classrooms. Education students learn how to be critical and demanding of educational software, and gain a better understanding of how to use technology effectively in the classroom. TRAILS addresses real classroom needs by involving experienced teachers, complementing the role of textbooks, and aligning content to accepted academic standards.

With the assistance of university partners, TRAILS also designs course modules, publishes online resources, and recruits experienced mentors. Stanford University, The University of Colorado at Boulder, and Drexel University were the first three universities to become TRAILS partners. Students at Stanford and Colorado are currently working to develop prototype educational software and pilot its use in local K-12 classrooms, while The Math Forum at Drexel is publishing the software created by the TRAILS students.

In the future, the TRAILS team will seek university partners to field test the modules developed by Stanford and Colorado, dissemination partners interested in deploying selected TRAILS products through the Web, and middle school math classes to pilot initial TRAILS software. For information on how to get involved, send an email to ***trails-info@sri.com.***

The TRAILS annual report will soon be available at the TRAILS Web site, ***www.trails-project.org***. ■