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Expanded research program puts more students in the lab and in the field

> > Bats

Gordon Towne designed software that simplifies multicamera tracking of bats.

PHOTOGRAPH BY VERNON DOUCETTE

By Rich Barlow

Although he plants himself for hours in a computer lab, Gordon Towne is not your stereotypical geek. He's a triathlete who also races with the BU cycling team. In other tests of endurance, he travels to faraway places in record heat to study one of evolution's outdoor marvels. Towne (CAS'12, GRS'12) trekked to the Texas Hill Country west of Austin during the summer of 2011 with Thomas Kunz, the College of Arts & Sciences biologist whose career studying bats earned him the nickname Bat Man. In an unusually blistering season even by Lone Star State standards, they drove with other researchers to three bat caves and planted three cameras at strategic points near each entrance.

WEB EXTRA Watch a video of Gordon Towne as he helps track bats in Texas Hill Country at bu.edu/bostonia.

Before dark, hundreds of thousands of bats swarmed out of the caves in seemingly choreographed formation. (Normally nocturnal, they emerged before sundown, needing extra time to hunt the heat wave–depleted bug population.) The cameras captured their elegantly undulating ballet as their column split to swerve around obstacles and then merged again, with no visible leader or communication guiding them.

Later, Towne used a software program he'd helped to create to translate the three video feeds, showing the bats from three different angles, into a three-dimensional grid on his computer screen. The bats appeared as colored dots, their trajectories tracing color-coded lines across the grid.

Who wants to watch 3-D flight simulations of pointy-eared mammals? U.S. Department of Defense engineers, for one, who wonder if the bats' motion would work as a design guide for unmanned aerial vehicles, like drones. Biologists, meanwhile, use the data to count the bats and to study how such multitudes of creatures can move in graceful unison. And to computer scientists, Towne's software is the latest generation of tools that simplify the workflow for researchers doing such multicamera 3-D tracking.

"The software that I wrote could be applied to any application involving multicamera tracking," says Towne, whose research was paid for, in part, by the Undergraduate Research Opportunities Program (UROP). "It doesn't necessarily have to be bats."

Towne is among the more than 1,500 students whose research has been supported by UROP since 1997. More than 200 projects, from modeling the structure of space-time to deconstructing Woodrow Wilson's vision for world order, were funded in the 2011–2012 academic year alone. That number will soon swell. The University announced in April that it has doubled its funding for UROP to more than $1 million.

Towne's software, which took him about two months to develop, can "learn" the spatial geometry of the real-life scene outside the cave, reconstructing the scene virtually.

For Towne, each five-hour cave visit began by arranging the cameras and making sure that they were positioned optimally, something he did by parading to and fro in front of the cameras brandishing a 15-foot cross-shaped "wand." The cameras recorded the coordinates of each end of the crosspiece, matching each endpoint with its corresponding point on the other cameras. Towne would later feed this information to the computer software in the lab so that it could "learn" what the space looked like for the 3-D grid it would construct.

Then it was just a question of waiting for the bats. All one million of them.

"They're able to navigate as a group and make group decisions about their direction of travel," Towne says, "but it's not necessarily obvious whether there are leaders among the group or how the bats actually coordinate in order to make these group decisions."

That's what has the military interested. Margrit Betke, a CAS computer science professor and Towne's UROP advisor, says that a separate project, funded by the Office of Naval Research, is using the computerized bat research "to inform engineers who are designing bio-inspired aircraft, if they can get ideas from how bats are flying and then match that." While the idea is to guide the design of unmanned planes, Kenneth Sebesta, a College of Engineering postdoctoral researcher on that project, says that "just like GPS and the internet," which began as military research, "I hope that the civilian applications of this kind of technology are the focus."

For all of the whiz-bang algorithms with which Towne's computer performs, its wizardry depended on the human expertise of Kunz, who is recovering from brain injuries following a devastating car accident last fall.

Kunz, who had been to these caves many times, "would give us the rundown, where the column was likely to emerge," says Towne. "You know you're there with an expert who is able to answer all of your questions, and probably came up with the answers to most of those questions in his own research."