

Sweet Rewards

Professor Craig Tovey measures himself by the calories he Serves

By Michael Terrazas

It's easy to tell when the grades have been handed out in Dr. Craig Tovey's class; just walk by, and if the aroma of homemade brownies is wafting through the hallway, the top students are enjoying their sweet rewards.

A professor with a joint appointment in the College of Computing and the College of Engineering's ISyE school, Tovey loves to cook, and he puts this passion to use in the classroom; "A" students are treated to his award-winning treats to applaud their efforts.

"I want them to see that I *am* happy when they do well," says Tovey, who in jeans and a flannel shirt looks more like a graduate student than a 41-year-old professor. "I am hoping they will perform at that level. I'm not going to change my standards as to what an A is, but I really want that."

Baking is just one example of Tovey's commitment. From childhood, he had been encouraged by his father to get a doctorate. So the

Ph.D. was never the question, but the desire to teach came later, inspired as much by examples of bad instructors as by good.

Tovey heeded the words of Dr. James McConnell, a psychology professor at University of Michigan. "Jim said if you're a really good teacher, all of your students will get A's -- grades are a measure of how good a teacher you are," Tovey recalls. "And even if that isn't *strictly* true, it's true enough that it gives you a different attitude toward teaching.

"A lot of professors think, 'Oh, I'm really smart, so it's the students' tough luck if they don't understand what I'm explaining.' But if you're that smart, you should be *better* at teaching. The smarter you are, the more it's your responsibility to communicate effectively."

Communicating is something Tovey does well, not only with his students, but also with his fellow professors. One reason he came to Tech is the cooperative, congenial atmosphere that exists among the Institute's faculty. He calls his ISyE

school "remarkable," saying it combines on friendly terms three or four departments of his alma mater.

"I'm familiar with just Computing and the ISyE school, but we don't hire people for tenure-track positions when there isn't a slot available. Some schools will hire three assistant professors, only having room to tenure one of them," he explains. "So imagine you're hired along with two or three other people, and you know that five or six years from now only one of you is going to be there; is that going to foster cooperative behavior among you and your colleagues?"

Tovey works with many of his colleagues, most recently with ISyE professors Leon McGinnis and Jane Ammons on printed circuit-card assembly. Tovey's research is in optimization methods called "local-search algorithms," which means using fairly limited, localized information to improve a system on a global level.

"It's like finding the top of a hill in the dark with a flashlight," he explains. "You have no idea where it is because you can't see more than two feet. But you can look around with your flashlight and see if there's a spot that's a little higher than where you are now. So you toddle over there and scan around with the flashlight again, and eventually you'll get to a peak."

Tovey cites a wide range of applications for the commonly used method of this type -- the Simplex Method, invented by Tovey's advisor at Stanford, Dr. George Dantzig -- such as blending gasoline, mixing livestock feed, making dog food. In 1988, he worked with AT&T in optimizing use of transmission

The Tovey File

Born: Oct. 1, 1955, in Washington, D.C.

Education: AB in applied mathematics from Harvard College, 1977;

MS in operations research from Stanford University, 1979; MS in computer science, Stanford, 1981; Ph.D. in operations research, Stanford, 1981.

Personal: Divorced, three children: Kendl, 11; David, 9; Leo, 7.

Achievements: Georgia Tech Institute Fellow, 1994; National Research Council Senior Research Associateship, 1990-91; Jacob Wolfowitz Prize, 1989; Sigma Xi; Omicron Delta Kappa; Presidential Young Investigator, 1985; honorary Phi Eta Sigma.

Leisure Interests: Cooking, Tai Chi, singing, dancing, listening to music. "Asking if I like teaching or research more is like asking if I like English or Scottish country dancing more; I would never give either one of them up."



Professor Craig Tovey's students enjoy the sweet taste of success: Good grades mean brownies for Tovey's top performers.

frequencies for the company's cellular phone system in Los Angeles. Tovey says by determining which frequency each individual cell site should use, the entire system's capacity was raised about 25 percent -- at basically no cost.

He started out in his current line of research by examining nature to learn how to better manage human-made systems. "Let's study a natural system," he says, "and see how it controls and regulates itself, and let's use the insights from that to help design and control, say, the Ford factory of the future, with lots of automated guided vehicles and robots running around."

Some natural systems he has examined are beehives, ant foraging, dominance relationships in fish, and the social hierarchy of the Mexican jay. He also looks at how glass catfish, a freshwater species that is actually translucent, form

and maintain the distinct shape of their schools.

"A fish doesn't see the whole shape of a school of anywhere from a few hundred to 100,000 fish," Tovey says. "So how do they get this nice, ellipsoidal shape? How do they do that?"

Turns out that, just like human bicyclists or race-car drivers, fish know how to "draft" each other. Fish at the front or outside of a school periodically drop back inside the formation to let other fish fight the current. And Tovey's hill-climbing algorithm analysis, "with just a few tweaks," explains how the fish are able to form their oval-shaped schools using only local information looking at the handful of fish around them.

"It's the same kind of question," he says. "It's the connection between the local and the global. What's amazing is the same set of

techniques from operations research gives you insight into all these different domains."

One domain Tovey might not have been prepared for was parenthood. But as the beaming father of three, he loves to talk about his kids. "Two of them are well on their way to being chocoholics like me," he chuckles. "I'm trying to get them all to become dancers and singers and musicians."

Having kids even helped him with teaching. "You know how people say men see women as sexual objects? Well, I used to see students as 'learning objects,'" Tovey says. "After I had kids, I became more attuned to all the rest of the stuff going on in their lives."

Whatever else is going on in the lives of Craig Tovey's students, they surely appreciate the occasional confection to get them through the day. **GT**