2005 CARLETON UNIVERSITY CONVOCATION

Researcher keeps eye on the big picture

Gabriel Wainer hopes to develop computer systems that can react in real-time to real-life situations, writes **PAULINE TAM.**

Technicians bearing new computers come and go from Gabriel Wainer's office, adjusting the equipment that links him to a lab down the hall. If Mr. Wainer has his way, the 64 extremely fast computer chips in the lab will eventually work together, performing complex tasks at dizzying speeds.

One of Mr. Wainer's ideas is to use this automated system to control a mock factory built entirely of Lego pieces. An even better idea would be to run the factory remotely from his office, where he could control the whole operation on a computer.

This is one of the ways Mr. Wainer plans to spend a $25,000 prize from Carleton University, which recently named him one of its top researchers of the year.

The experiment may sound like child's play, but there's a deeper purpose behind the set-up. Mr. Wainer, a computer scientist, is trying to solve a problem that has long eluded specialists in the field: How to simplify the design of large, intricate computer systems, while improving the efficiency and accuracy of the software that controls them.

To engineers, this is the challenge of real-time computing — the ability of machines to simulate real-life situations, and react instantaneously to their surroundings.

In the future, Mr. Wainer's work may even lead to what's known as predictive computing — the ability of machines to perceive, reason and make decisions ahead of when they're needed, ushering in a new age of "intelligent" technologies.

It's not the type of cutting-edge work Mr. Wainer was able to do in his native Argentina, which is what led him to Carleton five years ago.

"When I was interviewed, people asked me, 'Why are you coming to Carleton?' And I said, 'Because when I see who teaches here and what is being taught, this is what I would have loved to study as a student.'"

At 39, Mr. Wainer is a mathematician by training, but he has become an expert on complex physical systems after creating a software toolkit that can be used to study everything from forest fires to traffic jams and Internet user patterns.

At the heart of Mr. Wainer's work is the idea that intricate math governs almost all of the seemingly chaotic and complex events of life.

When he first started as a graduate student, the abstract world of numbers and formulas was what interested him. But over the years, he has learned that the knowledge gained from his work can be used to solve real-life problems.

"We do a lot of work on methodology, but people want the application," observes Mr. Wainer. "They want to see what this is useful for."

In the case of gridlock, his tools can simulate swaths of urban geography, as well as the behaviour of every driver in it, allowing traffic lights to be reprogrammed to ease congestion.

The same tool can simulate the landscape and winds that affect how a forest fire spreads, as well as how firefighters react to the blaze. The resulting information can be used to plan effective firefighting techniques or predict whether a town is in the path of a fire.

Mr. Wainer has a website of more than 50 different models, all of which use advanced math to simulate complex systems. The models are widely available to researchers and private industry free of charge. As an example, a University of Ottawa graduate student is currently using one of the models to study chemical reactions in human cells.

"I have models of ants moving in the field, and I have models of bacteria spreading on the surface of raw fish. And the mathematics that we use for those things are exactly the same," says Mr. Wainer.

The son of a well-to-do family in Buenos Aires, Mr. Wainer spent his childhood steeped in numbers. His grandfather was the country's auditor general, and his father, who trained as an industrial engineer, ran a consulting business.

As a teenager, Mr. Wainer helped his father with the accounting books, and assumed responsibility for the office computer, which he learned to program. At a time when personal computers were still a novelty, he quickly got hooked and decided to pursue computer science in university.

Because the field of real-time computing was still new, Mr. Wainer taught himself much of what he knows by reading whatever textbooks he could find in Argentina.

While doing his master's degree at the University of Buenos Aires, he was recruited by a visiting scholar to the Université d'Aix-Marseille in France, where he completed a PhD. It was there that he expanded his research to include the related field of computer simulations.

But despite finishing his PhD at the top of his class, Mr. Wainer returned to Argentina with few prospects for the kind of research he wanted to do. Beginning in 1997, he taught part-time at a number of universities around the country, and accepted invitations — from the U.S., Japan, Korea — to work as a visiting scholar. But he always returned to his native country wishing advanced research opportunities were available closer to home.

Disillusionment started to set in when he noticed that some of his former students, working in Argentina's private sector, made five times the salary he did.

"They would say to me, 'You have a PhD, you're brilliant, why don't you go to industry?'" recalls Mr. Wainer. "And I would say, 'Because I love this. Why do I have to change and go to industry? I love teaching and researching.' I was happy with what I was doing but deep down, I felt there was a lack of respect for what I did."

It wasn't that Mr. Wainer wanted to get rich; he simply wanted to feel his work was valued. As it was, he was teaching at three different universities just to make ends meet.

"If my salary was half the money that my students were making in industry, I wouldn't feel so bad. And that was the general feeling of many people who were in my situation. We didn't want to get super salaries if we got to stay in Argentina with our family and friends, doing academic work that we love."

In 1999, near the height of Ottawa's tech boom, he picked up a trade magazine and noticed in an ad that Carleton was hiring computer-science professors. He didn't hesitate to apply.

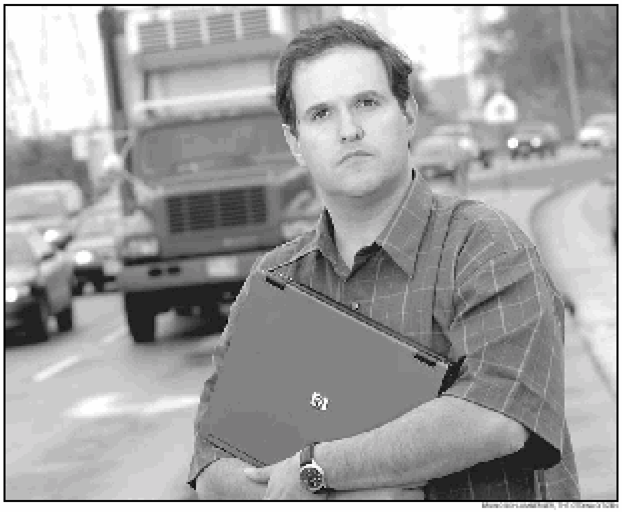
Once hired, he arrived to find a vibrant climate for eager young computer jockeys — a mood that quickly turned sour with the sudden downturn of the city's tech economy. But Mr. Wainer wasn't deterred.

"I didn't have any research support from industry when I came because I was pretty new, and then I didn't have any industrial funding after that because everything went downhill."

Things have definitely changed these days.

Mr. Wainer's research is being funded over the next five years with a $125,000 federal grant, and his lab is being outfitted with more than $300,000 from government and industry, including contributions from Hewlett Packard, IBM and Intel.

For a guy who likes nothing better than to crunch numbers, life is good. "I like the focus of what we're doing here," says Mr. Wainer. "This is where I've always wanted to be."



Gabriel Wainer, a computer scientist at Carleton University, is trying to solve a problem that has long eluded his peers: How to simplify the design of large, intricate computer systems while improving the efficiency and accuracy of the software that controls them.

CARLETON UNIVERSITY AT A GLANCE

Full-time students: 18,720
Part-time students: 3,985
Faculty: 776 full-time, 424 part-time
English-speaking students: 16,985
French-speaking students: 533
Other: 4,728
Not reported: 1,339
Geographic origins: 21,153 Canadian, 2,433 foreign
Leading origins of Canadian students: Ontario, Quebec, British Columbia
Leading origins of foreign students: China, Iran, India, U.S.
President: Richard Van Loon
Operating budget: $240 million
Research budget: $86 million

Graduate puts her studies to work to help fight human trafficking

BY MEAGAN FITZPATRICK

Jennifer Cameron hops on her bicycle and treks through the rain and mud to get to her job in Vientiane, the capital of Laos.

Once she gets there, she works on solving one of the most complex human rights issues, the trafficking of human beings. It's a challenging task to begin with, made even more difficult when working in a foreign language.

Despite the challenges, the recent graduate from the Norman Paterson School of International Affairs at Carleton University feels fortunate to have her job as a consultant with the International Labour Organization.

"I've been lucky enough to get a job working in exactly what I studied," said Ms. Cameron in a recent interview by e-mail. "That's pretty lucky."

She left for the small south east Asian nation in January shortly after defending her thesis, which was on human trafficking prevention in Thailand and Cambodia.

Her interest in the issue dates back to the first time the 30-year-old Nova Scotia native lived in Laos, from 1999 to 2001.

After graduating from Trent University with a degree in political studies and modern languages in 1997, Ms. Cameron embarked on her first year of many living in Asia, and taught English in Korea.

When that job came to an end, she travelled through Thailand, Nepal, Vietnam and China before coming home to Canada. But she had been bitten by the travel bug and almost immediately returned to Asia. She spent two years teaching English in Laos and also designed funding proposals which then led to a string of other contracts in the development field.

She researched, documented and wrote reports on child labour and gender issues for a host of agencies including the ILO, Save the Children Australia, the United Nations Development Program, and the International Federation of the Red Cross and Red Crescent Societies. It was during that time that Ms. Cameron came to understand the worldwide problem of human trafficking.

But it wasn't all work and no play during those years. Ms. Cameron brought her passion for rugby with her to Asia and played on an expatriate women's touch rugby team and also participated in a long boat racing team.

Doing development work in Laos was challenging Ms. Cameron, leaving her with questions to which she had no answers.

"So I figured that perhaps I should probably go back to school and try to get some more information and perspective. I also wanted to improve my research and analysis skills, and see how people were thinking about and talking about international politics and development in Canada," said Ms. Cameron, who grew up in Dartmouth.

She was accepted at the Norman Paterson School of International Affairs and began her master's degree in the fall of 2002. "I learned a lot, but the things I really liked best happened outside of lecture rooms. I appreciated the attention and time that the professors gave outside of class. I particularly enjoyed the opportunities I had to talk with classmates. There were people with a lot of different backgrounds, experiences, opinions and perspectives," said Ms. Cameron.

Ms. Cameron also appreciates a scholarship and research travel grant named in honour of the late Bill McWhinney, a man who served Canada and worked in international development for more than 30 years. Winning the scholarship, valued at $10,000 over two years, allowed Ms. Cameron to travel to Thailand and Cambodia to collect primary research for her thesis, an invaluable experience for her.

"It was also incredible to get to know a bit more about Bill McWhinney himself and to meet some of his friends, family and colleagues," said Ms. Cameron. "He did a lot for getting Canadians, especially young Canadians, interested in development."

Her challenge for now — aside from cycling to work in the rainy season — is doing a lot of work in a short period of time.

During her eight-month contract her tasks include writing and editing project proposals and progress reports, organizing meetings, researching and documenting effective methods for preventing human trafficking.

"Sometimes, it's really draining," says Ms. Cameron. "Though I work with the concepts, case studies, responses and news every day of the human rights abuses, indignities and horrors associated with trafficking, I'm definitely not immune."

Jennifer Cameron travelled to Thailand and Cambodia to collect research for her thesis.

THE CLASS OF 2005

Class size: 3,078, 8% larger than 2004
Degrees: 2,524 bachelors, 474 masters, 37 PhDs, 33 certificates and diplomas
Base annual tuition: $4,152
Geographic origin: 92% Canadian or permanent residents; 8% foreign students
Gender: 46.2% male; 53.8% female
Largest program: Psychology
Smallest program: Sonic design
Honorary degree recipients: Dave Smith, restaurateur and philanthropist; Marc-André Hamelin, pianist; Robert Laughton, lawyer; Bob McDonald, journalist and broadcaster; Sonja Bata, businesswoman and philanthropist; Roy Romanow, former Saskatchewan premier; Paul Okalik, Nunavut premier.