

## A Year of Changes

It has been a year of changes. The most obvious change is our new building—Sennott Square. If you visited us for our Annual Computer Science Day last November you know how impressive this building really is. If you did not make it to campus for that event, you should plan to visit us this coming fall.

Our faculty has also changed dramatically in the last year. The last issue of LINKS introduced several new faculty members and announced the retirement of Professor Sigfried Treu. Professor Bruce Buchanan also retired within the last year; this issue of LINKS includes a tribute to him. We were also busy with a search for a new artificial intelligence faculty member.

We also hired new staff members. Kathleen Allport was hired recently as our departmental receptionist. Look for an article about her in this issue of LINKS. The technical staff added James O’Kane as a full-time employee. He is a Red Hat Certified Engineer, so his credentials are very good!

With the move to a new building, our computing environment took a leap forward. Among the changes are the installation of a gigabit ethernet throughout the department and a new machine room with several new mail, Web page, and database servers. And we are always purchasing new equipment, notably new machines for many of the graduate students.

## Sennott Square



As we settle into our new home in Sennott Square, it is also becoming an integral part of the University and Oakland. In the last few months, several retail businesses have opened on the first floor, including a Panera Bread bakery-café and a Blockbuster video store.

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## Bruce Buchanan Retires

After a distinguished career in computer science and artificial intelligence, Professor Bruce G. Buchanan recently retired from the University of Pittsburgh. While working in the Stanford Artificial Intelligence Laboratory, Bruce and his collaborators made important contributions to artificial intelligence. Their assertion—obvious in retrospect like most great ideas—was that *knowledge is important for intelligent behavior*. They drove this point home with a series of programs that embodied the knowledge of scientific and medical experts—sometimes rivaling or surpassing their abilities—and the creation of an industry centered around *expert systems*.

Bruce was born in St. Louis, Missouri, right before World War II, and moved to Hillsdale, Michigan, during the war, where he grew up. He earned his bachelor's degree in mathematics at Ohio Wesleyan University and his doctorate degree in philosophy at Michigan State University, where he only had to pay in-state tuition. After graduate school he worked at Rand Corporation and was on the faculties of Stanford University and the University of Pittsburgh. He had many graduate students through the years, was instrumental in the formation of the American Association for Artificial Intelligence, and is still one of the acknowledged leaders in artificial intelligence.

John Aronis spoke with Bruce recently. Here are parts of that conversation.

*Anything notable about your early years?*

"I loved science and mathematics in school but probably spent more time playing the clarinet and playing tennis. I idolized my older brother, who knew he wanted to be a physician, but I was unable to focus on any one thing. At one point I calculated the chances of my succeeding as the conductor of a major orchestra (close to nil since there are very few orchestras and the people leading them actually know something). I then started fielding those awkward questions about what I wanted to be by responding 'nuclear physicist,' counting on the fact that no one else in Hillsdale knew what that meant either."

*Where did you go to college?*

"I went to college at Ohio Wesleyan University, which is a small liberal arts school. I declared a major in physics, because I guessed that was how I'd learn to be a nuclear physicist, then I started on a pre-law program. After taking a few chemistry classes as pre-requisites for physics, I declared a chemistry major. German was required for chemistry majors, so after a few courses I thought about declaring a German major. I discovered philosophy in my senior year. By my senior year, the only subject I had enough credits to major in was mathematics, so that was my major."

*Any interesting stories from college?*

"I earned spending money by working for a Chinese laundry in town. The owner did his books on an abacus and taught me how to use it. As treasurer of the student government, I generated some interesting comments by using an abacus instead of a calculator."

*How did you end up at Stanford?*

"As a married graduate student with a child, I needed some income, so I interviewed for all sorts of summer jobs. One of them was at the Rand Corporation in Santa Monica, which did systems analysis, operations research, and other things that were as opaque to me as nuclear physics. Ed Feigenbaum and Paul Armer hired me. Ed told me to read the one book on artificial intelligence (his book, *Computers and Thought*). He also gave me an IPL-V manual and told me to learn to program. He and I formed a close working relationship, which grew into a close personal one, so I naturally asked him for a letter of reference when I was finishing my PhD dissertation and looking for teaching jobs in philosophy. He suggested I spend a year at Stanford instead, working on programming a computer to do science. My one-year post-doc lasted 22 years."

*Describe the atmosphere at Stanford.*

"The Dendral Project had been started by Ed Feigenbaum and Joshua Lederberg (the Nobel Prize-winning molecular geneticist) and included one other programmer, Georgia Sutherland. She and the people at the AI Lab taught me Lisp, which we ran on a PDP-6 with 32K of memory. The at-

mosphere was electric. Both Feigenbaum and Lederberg were inspiring in their brilliance but tolerant of all the things I didn't know. Because they took my hard-earned successes at programming as a matter of course, I felt very humble. I didn't realize the magnitude of the task they had set and I assumed they would never ask me to work on something that was impossible, so Georgia and I chipped away at the problem and created a credible prototype. Later we hired a group of very talented chemists and mathematicians who grounded the program in new combinatorial graph theory they had to invent. I love working with smart people like that.

"The AI Lab was filled with people smarter than I was. Raj Reddy had just finished his dissertation and was there doing speech understanding research. Arthur Samuel was working on new representations for his checker-playing and learning programs. Ken Colby was working on the Parry simulation of paranoia, John Chowning was working on music synthesis, Tony Hearn was writing programs for symbolic mathematics, and John McCarthy and Les Earnest were directing robot projects."

*Who were your collaborators at Stanford?*

"Bob Englemore and Tom Rindfleisch joined the Dendral Project in the early 1970s and we became close friends and collaborators. Tom Mitchell worked with me on the Meta-Dendral learning program, and later conceptualized what we were doing much more elegantly than I had been able to do.

"Ted Shortliffe was a medical student and we quickly learned that we could work well together. His research on Mycin forced me to learn something about medical diagnosis. The Mycin project grew to include some wonderfully brilliant people, like Randy Davis, Greg Cooper, and Carli Scott. Russ Altman, Bruce Duncan, Barbara Hayes-Roth, Jim Brinkley, and others were involved with me on the Protean Project, in which we were building an opportunistic reasoning system that constructs three-dimensional models of proteins in solution from NMR data.

"Out of the Mycin project, and Randy Davis and Bill vanMelle in particular, grew the

idea of an expert system shell. It was new enough that a number of us formed the first expert systems company, Teknowledge, and hired as many smart people as we could afford. At one point, I had taken a leave from Stanford to manage the company and a friend at IBM Watson Labs complained to me that IBM couldn't hire enough talented AI scientists because Teknowledge was hiring them all."

*What brought you to Pittsburgh?*

"After 22 years at Stanford, Sally, my wife, and I were beginning to feel that it might be time to find some new challenges, but two-career planning has never been easy. Pitt had two interesting jobs and we came. It was Allen Newell (at CMU) who initially suggested to me that I apply for the job. Jerry Massey was here in the philosophy department and was very positive about the intellectual atmosphere at Pitt for philosophers of science. S.K. Chang was chair of the CS department, which already had a long and distinguished history, and S.K. expressed great interest in interdisciplinary research. But it was Tom Detre (vice chancellor for the health sciences) who was most persuasive, which will come as no surprise to anyone who knows him."

*Who were your collaborators at Pitt?*

"Foster Provost was my first Pitt graduate student, and was in the CSD, but others have been from intelligent systems, medical informatics, electrical engineering, history and philosophy of science, information science, and biology. The faculty colleagues I have collaborated with the most have been Greg Cooper (medical informatics and intelligent systems), Herb Rosenkranz (public health), John Rosenberg (biology), and John Aronis (computer science)."

*What role did you play in creating AAI?*

"The idea of creating a national organization for AI was Raj Reddy's, the year he was general chair for the international meeting and I was program chair. He recruited me and two others involved in the international meeting to help him get it going. I started out as membership chair, then was asked to be secretary-treasurer, which I did for seven years. I was elected president, which involves two years as president-elect, two years

as president, and the last two years as past-president. I am also glad to have introduced good accounting practices to the organization before there was any scandal, and I feel good about moving the money in the treasury from cash and CDs into managed equity and bond accounts in time to see some significant appreciation.”

*What is the state of AI today?*

“The grand goal of AI—to understand the nature of intelligent thought and action in humans and machines—will not be realized any time soon. But there has been significant progress in programming computers to behave intelligently. In part this is due to having larger and faster computers to work with. But it is also due to increased understanding of some fundamental issues such as the relative roles of knowledge and inference, uncertain reasoning, representations of semantic information, and meta-level reasoning.

“Scientific activity has been described as either descriptive (describing and organizing) or prescriptive (making predictions from theories). Between those two extremes are many levels of observational, experimental, and theoretical work. We probably do not have the right set of concepts for explaining intelligence yet. However, I believe we will only discover useful new concepts through experimentation with the design and implementation of working programs. I’ve been known to favor experimental work because I think it is more fruitful at this stage, not to mention the fact that I find it more satisfying. I think we will proceed faster if we have data about what works and what doesn’t than if we start with a blank sheet and an idea about what might work.”

*Why should CS students consider AI?*

“The challenge of AI—to discover the nature of intelligence—is as exciting as the grand challenge of biology—to discover the nature of life—or of other sciences. But the 50-year history of AI is still short enough that an individual can make significant contributions.”

Bruce has had a huge impact on the field of artificial intelligence, through his own research, his collaborations with other scientists, and his students. As he leaves his faculty position at Pitt for a new home on an island off the coast of Seattle, people who know him and worked with

him see a friend leaving and hope he stays involved with us, both professionally and personally.

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## **Kathleen Allport**

Kathleen Allport has joined the department as a receptionist and will also be in charge of departmental travel arrangements. She started at the University in October 2001 working in the FAS dean’s office. She joined the CS department in September 2002.

In addition to her full-time job here, and a family (children Carrie, who is 28, and Brian, who is 24), Kathleen volunteers to work with the elderly. Kathleen had a close relationship with her grandfather—helping to take care of him and listening to his stories after her grandmother died. When he passed away, she began to help care for other elderly people (she calls them “my ladies”) in her area. She often performs household tasks for them, but usually just sits and listens to them. She says that “if you just take the time and listen, our senior citizens can teach us so much!”

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## **Mellon Fellowships**

Congratulations to Nevine Aboughazaleh, Mohamed Sharaf, and Dakai Zhu. They received Andrew Mellon Predoctoral Fellowships for the academic year (2003–2004). These fellowships are awarded to students of exceptional ability and promise who are enrolled or wish to enroll at the University of Pittsburgh in programs leading to the PhD in various fields of the humanities, the natural sciences, and the social sciences.

## Molly Des Jardin

Molly Des Jardin is hard to label. Computer science major, history major, Asian studies student, Japanese language student, and artist—all describe her. Adding to the list, last fall she was named the Outstanding Computer Science Undergraduate Student for the 2001–2002 academic year.

Molly's interest in computers began early. As a ten-year-old girl growing up in Rochester, New York, she was interested in computers and was naturally drawn to computer games. It was not long before she was trying to build her own games in BASIC on her 1982 Amiga. She still has that computer, but quickly moved onto more powerful machines and languages. Learning to program C++ in high school solidified her interest in computer science, but she also developed other interests at that time.

When it was time to select a college, Molly wanted a medium-sized university with a wide variety of departments that would allow her to pursue all of her interests. She also wanted an urban campus far enough away from home to foster her independence. The University of Pittsburgh fit her needs perfectly. During her time here, she pursued many of her interests, and excelled in more than one area.

Although she had considered computer science in high school, she was not sure if she would pursue it in college. When she found her computer science classes at Pitt were interesting and challenging, she became convinced that it was the right major for her. Her most interesting classes in computer science were Operating Systems, which she says was also the most difficult course she took, and the Artificial Intelligence electives. She was also particularly interested in the Artificial Intelligence programming course, and enjoyed the opportunity to apply the theory to real-life problems.

Most computer science majors have enough to do with one major, but Molly decided to also major in history and pursue the Asian Studies Certificate. Her concentration is in premodern Japanese history. She also took four

years of Japanese language. During the summer between her junior and senior years she took a Japanese language immersion course for nine weeks at Middlebury College in Vermont. She says that was probably the most intense and demanding experience of her life, but it was also one of the most fun and rewarding, and it gave her an opportunity to make some of her closest friends. Outside of school, Molly always had a strong interest in art and participated in one art show put on by the Campus Women's Organization at Pitt. She is in the History Honor Society and is working on an honors degree in history.

A quick look around the Department of Computer Science reveals that most of us are men. Some women feel daunted by this fact, but Molly took it in stride. Although she heard the sentiment that women can't possibly understand something like computer science expressed in other places, she never heard it from her fellow students at Pitt or anyone else in the Department of Computer Science.

Molly has been accepted into the Japan Exchange and Teaching Programme and will be an assistant English teacher in Japan for one year. After a break from the academic world, she plans to apply to PhD programs in history or Japanese language and literature. She hopes to teach and do research in Japanese history or literature in a college environment.

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Professor Mary Lou Soffa was named a Girl Scouts of America Woman of Distinction. She was given this award in recognition of her "extraordinary achievement and leadership" in mathematics and technology. Although awardees do not have to have been associated with the Girl Scouts, Dr. Soffa was a Girl Scout Troop Leader for a number of years.

## He Programs, She Programs

Are men and women different? Of course they are, on the surface. But are they *really* different? Do they think differently? Many people have asked this question; funded by a grant from the National Science Foundation, Mary Lou Soffa (computer science) and Sandra Katz (Learning Research and Development Center) are trying to answer it, at least with respect to how men and women learn to program and solve problems.

Surveys, questionnaires, and interviews can often illuminate broad social issues and trends that affect academic performance. But uncovering problem-solving behavior generally requires detailed cognitive studies and many hours of analysis. Working with John Aronis (computer science), Katz and Soffa logged all of the actions that 65 computer science students made as they worked through a programming tutorial. They found that both of the sexes experimented with new code and ideas as they learned. However, male and female students differed significantly with respect to the types of tutorial materials and topics they experimented with and the degree to which they experimented. For example, male students were more likely to create their own practice exercises and to modify tutorial-provided example programs. Female students were more likely than males to modify the functionality of suggested practice exercises, and work with examples provided by the tutorial.

Is experimentation helpful for learning to program? Many computer science teachers encourage students to try things out “hands on,” to experiment in similar ways as described above: that is, to type in textbook-provided examples, modify those examples, test them on various inputs, try recommended programming exercises, etc. The study by Katz and colleagues provides empirical support for this practice. They found a significant correlation between these forms of experimentation and two measures of achievement: students’ gain in scores on a test they took before and after the tutorial, and students’ final grade in an introductory course for computer science majors. Interestingly, students with the most prior

programming experience tended to experiment more than less experienced students. These findings suggest that the tendency to experiment, and an appreciation for its value, may develop over time, so instructors should encourage experimentation from the earliest courses on.

Of course, like most scientific research, this work raises more questions than it answers. Does experimentation itself lead to success, or do experimenters possess some other quality that makes them successful? Does experimentation and success in the introductory course translate into long-term success in computer science? Can we teach students to experiment? If we do, will it help to make them successful? Finally, why do men and women approach programming so differently?

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## PittACM in Montreal

The second annual Computer Science Games at McGill University in Montreal, Quebec, were held in mid-March. It was their second competition, and the University of Pittsburgh’s debut. Our ACM chapter sent a team of eight computer science and computer engineering majors to compete in the games. Three of the chapter’s officers—Jason Godesky, Nicholas Swierczek, and Jason Mars—led a talented team of the department’s finest, including CS majors Eugene Libster, Jason Kessler, Tarik Mahmood, Dave Allison, and computer engineering major Chris Wilson. We placed strongly in the Web design competition, and held our own throughout the academic competitions.

The trip to Montreal was a great event for everyone involved, and the University was well represented. The Department of Computer Science provided transportation, and Dr. Ramirez and his wife, Michelle, accompanied the team to Canada.

## Accolades

The English translation of Professor S.K. Chang's science fiction trilogy, *The City Trilogy*, was published by Columbia University Press in April 2003.

Professor S.K. Chang received an honorary professorship from National Chiao Tung University, which is one of the leading universities in Taiwan, Republic of China. The ceremony took place on March 5, 2003, at the Library of National Chiao Tung University in Hsinchu, Taiwan.

The Utopiales International Science Fiction Festival in Nantes (France) is one of the biggest SF events in Europe. This year they selected Professor S.K. Chang's sci-fi short story *The Returning* for publication in the festival's yearly anthology. Professor Chang is invited as an honorary guest of the Science Fiction Festival. Professor Chang is also invited to the University of Cambridge, U.K., in July as a resident author in its summer sci-fi literature workshop.

Professor Alexandros Labrinidis recently became an associate information director for ACM's Specialist Interest Group on Management of Data.

Professor Mary Lou Soffa has been awarded the ACM/SIGPLAN Distinguished Service Award in 2003. This award is given in recognition of contributions in conferences, publications, and SIGPLAN activities.

Professor Mary Lou Soffa will be the keynote speaker at the Compiler Construction Conference in Barcelona, Spain, in March 2004. The conference is sponsored by The European Joint Conferences on Theory and Practice of Software (ETAPS).

Professor Mary Lou Soffa was a co-author (along with Ras Bodik and Rajiv Gupta, who both earned their PhDs from this department) of the paper "Complete Removal of Redundant Expressions," which was selected as one of the 50 most influential papers in *Programming Language Design and Implementation (PLDI)* in 20 years. The paper was published in 1998. Rajiv is a professor in the Department of Computer Science at the University of Arizona and Ras is an assistant professor in the Department of Computer Science at the University of California, Berkeley.

The winner of the third annual graduate research competition is Cosmin Rusu for his work on Maximizing the System Value while Satisfying Time and Energy Constraints. His work is supervised by Professor Melhem and Professor Mosse.

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If you are in a position to consider making a contribution to support the programs of the Department of Computer Science, please contact Department Chair Dr. Rami Melhem at the Department of Computer Science, University of Pittsburgh, Pittsburgh, PA 15260, or e-mail him at [melhem@cs.pitt.edu](mailto:melhem@cs.pitt.edu).

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