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Q&A: Robots in the Computer Science Classroom

Microsoft partners with Georgia Tech and Bryn Mawr to form the Institute for Personal Robots in Education, designed to reinvigorate the computer-science curriculum by delivering robotics technology specifically tailored for teaching purposes and scientifically evaluated for its effectiveness.

REDMOND, Wash., July 12, 2006 — Robots are doing amazing things — and no longer just in science fiction. They're building cars, vacuuming floors, providing healthcare for the elderly, entertainment for kids and adults, even assisting in dangerous rescue missions and working in military environments.

Another place where robots can make an immediate impact is in computer science education. Published reports indicate that thousands of schools in the United States teach computer science, but far fewer schools use robotics in the computer science curriculum. Meanwhile, enrollment in computer science overall is declining, potentially impacting growth in the industry and academia. Some in the field see a need for a new approach to draw the brightest and best to computer science, and personal robots — especially in introductory courses — may be just the thing to get a new generation of students enthusiastic about careers in technology.

With that in mind, Microsoft today announced the creation of the Institute for Personal Robots in Education (IPRE) in partnership with the College of Computing at Georgia Tech in Atlanta and Bryn Mawr College, an all-women's school in Pennsylvania. For more insight into the partnership, its roots and how the participating institutions believe it will benefit students, professors and the industry, PressPass spoke with **Stewart Tansley**, program manager in External Research & Programs at Microsoft Research; **Richard DeMillo**, dean of the College of Computing at Georgia Tech; **Tucker Balch**, associate professor in the College of Computing's Interactive and Intelligent Computing division; and **Douglas Blank**, associate professor of computer science at Bryn Mawr.

PressPass: What exactly is Microsoft announcing today?

Tansley: We are announcing the creation of the Institute for Personal Robots in Education (IPRE) in partnership with the College of Computing at Georgia Tech and Bryn Mawr College. Under the agreement, Microsoft will provide Georgia Tech with US\$1 million paid over three years to develop practical new ways in which to bring robotics technology into the computer science curriculum. Through their own process, the College

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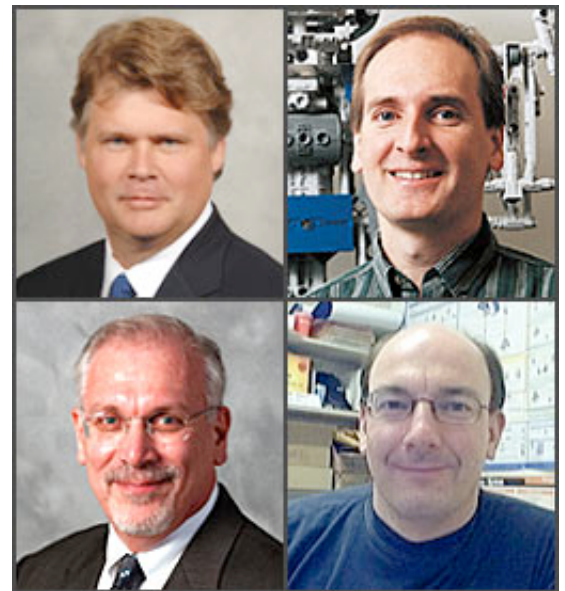
of Computing at Georgia Tech — the host institute for the initiative — will partner with Bryn Mawr College. IPRE is scheduled to open in fall, 2006. It is important to note that the College of Computing at Georgia Tech and Bryn Mawr are also contributing an additional \$1 million of their own funds to the institute.

PressPass: What does Microsoft together with these university partners hope to achieve with this?

Tansley: There's a widespread concern that the number of students entering computer science is in decline, and there are many challenges with attracting and retaining these students. This is not just a concern that Microsoft has over attracting computer scientists to come and work at Microsoft. It's something we hear from academics that we talk to and it affects the whole software ecosystem that we're just a part of. This initiative is primarily driven through trying to address that problem. Robotics excites many people who wouldn't normally consider computer science, so this is a way to bring some new energy to the field.

PressPass: Why was Georgia Tech selected to host this research?

Tansley: It was a very hard choice, but the College of Computing at Georgia Tech's qualities shone through. In order to maximize the impact of what we're doing, we decided to select a single host school, rather than spread seeds around the country at different universities. How do you pick from among the many great schools? One of the criteria of course was excellence in robotics, but we were also looking for a school with an excellent track record in curriculum innovation, because we're really trying to invigorate the computer science curriculum here. That led us to a short list of eight schools that we invited to participate in a selected RFP (request for proposals) procedure. Of those eight schools, the College of Computing at Georgia Tech emerged as the winner through an intensive and detailed selection process.



Top row, from left: Tucker Balch, Georgia Tech; Douglas Blank, Bryn Mawr. Bottom row, from left: Richard DeMillo, Georgia Tech; Stewart Tansley, Microsoft Research.

Balch: Research at the College of Computing at Georgia Tech shows that providing a motivating context really helps students learn computer sciences more effectively. This groundbreaking research by Mark Guzdial is part of our motivation for making big changes in curriculum and in computer science teaching at the College of Computing at Georgia Tech. In fact, we were already headed in the direction of using robots as a context to help teach introductory computer science. The students will be having fun but they will be learning computer science at the same time.

Another aspect of what we're doing here is promoting the idea of personal robots. In other words, instead of a "mainframe" robot where everybody has to come to the lab and there are five robots and you only get use one intermittently, we want everybody to have their own robot in the same way everyone has their own PC. This is why we thought teaming with Microsoft on this effort made a lot of sense.

PressPass: Please describe the personal robots that you'd like students to have?

Balch: Unfortunately for the students, it will not wash the dishes. It will be a small, mobile robot with wheels that sits on your desktop and will drive around very precisely like a well-engineered tool. You'll be able to make it move or make sounds and you can interact with it. It will also be inexpensive, reliable and will take full advantage of the student's desktop computer for developing, debugging and running programs that control the robot. We're not sure yet how we'll package it, but we want it to convey both a seriousness but also a sense of fun. We may make it available at the university bookstore shrink-wrapped with a textbook. I see it primarily as a learning tool that will enable the students to have a more engaging and interactive computer science learning experience. We expect to have working models sometime in the fall.

PressPass: What attracted Bryn Mawr to apply for this RFP with the College of Computing at Georgia Tech?

Blank: We have been working on making computer science more accessible here at Bryn Mawr for a few years. Also, when I came to Bryn Mawr I brought with me a project called "Pyro" — short for "Python Robotics." Pyro is a software platform for teaching computer science that significantly reduces the cost of learning to program robots because it has been adapted to several simulation platforms and real mobile robots. One of the goals of Pyro is to make robotics easily accessible to people that don't know anything about robotics and maybe don't know very much about computing, so it allows students to jump right in and begin exploring problems in robotics. So the Microsoft proposal was really a perfect match, and the partnership with the College of Computing at Georgia Tech and Microsoft is going to allow us to take some of the initial ideas in Pyro to the next level.

Balch: For us, bringing Bryn Mawr on board was important for two reasons. One of the most important ones is diversity. Bryn Mawr is an all women's school, and as you might expect, robotics tends to be a male-driven field. We want to make sure that what we do is accessible to everybody. Another reason is that Bryn Mawr also brings important skills and technology to the table. They've been doing robotics education for several years now. What's new about this effort is that it's education with robotics.

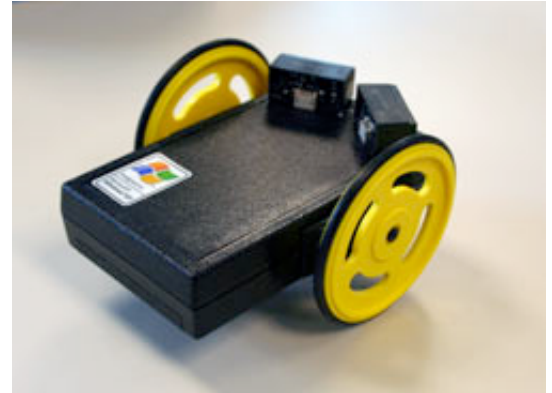
PressPass: Why is a traditionally liberal arts university like Bryn Mawr interested in computer science?

Blank: Bryn Mawr College has a rich history in archaeology, the classics and other humanity-oriented fields. On the face of it, it might seem that computer science doesn't fit with these other areas very well, but we see computer science as a way of asking and attempting to answer some of the big questions that are really at the heart of a liberal arts degree, be it in French, physics or philosophy. Big questions such as: Who are we? Where have we come from? What is consciousness? This project is especially timely because July 15 marks the 50th anniversary of the field of AI (Artificial Intelligence). Bryn Mawr's involvement in this partnership introduces the ideas and problems in AI and robotics to a very different set of students from the traditional engineering types that have worked on those problems over the past 50 years. As a result, I think we will see some very different and amazing solutions to these kinds of problems.

PressPass: Why research robotics when there are so many other areas in which computing can make a difference in the world?

Tansley: We've seen that robotics brings

Tansley: We've seen that robotics brings a consistent excitement in its many manifestations. It's not just about sci-fi androids. You can see robots becoming more common in the home today — for example, the robotic vacuum cleaner that's become very popular. Industrial robots have been common for many years, and while this is not a main driver for us, industrial robots are an important area. The concept of a robotic arm — a personal robot — is something that has factored into our plans with the College of Computing at Georgia Tech. Perhaps the more interesting, contemporary robots for many people are the mobile robots that roll around, crawl around, even run around. These are the ones that will attract people into computer science through robotics. Many interesting applications are emerging for these robots, including healthcare for the elderly, toys, entertainment, as well as rescue and military robots that get sent into dangerous areas. There's even a robotic dinosaur on the way. In the computer science class work that we're doing with the College of Computing at Georgia Tech and Bryn Mawr, we are not looking for a robot to perform a specific application at this time. It is applied research, not fundamental research in robotics per se. This is about using contemporary technology with a little bit of innovation to really apply this technology to the teaching of computer science.



A Georgia Tech "personal robot."

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DeMillo: We are poised on the edge of a robotics revolution because all the necessary component technologies are there, and a key element that we think is going to make that happen is personal robots. That is the overarching theme of our recently announced Robotics and Intelligent Machines Center at Georgia Tech (RIM@GT) — robots that work with people. And now, IPRE as a branch of RIM is using personal robots for education. By weaving robotics in with education, we're both going to be educating people more effectively but also laying the groundwork for this personal robot revolution.

Balch: We want to use robots as a means for educating people all the way from kindergarten through graduate school. This initial effort with Microsoft is targeted at introductory computer science education, but we see it as easily being much broader and we want to build on what we expect will be a great success with this project.

PressPass: Will the robotics research influence Microsoft products?

Tansley: That's not the primary goal of the initiative in any way. It's a much more strategic initiative. There is work that is related though. This initiative will use a new Microsoft product launched in June called the Microsoft Robotics Studio, which is software specifically designed for all sorts of different styles and classes of robots and robot applications. This has arisen through a recognition that Microsoft has some innovative technology that would be very useful for roboticists and in listening to roboticists they really welcome this technology. Together with the College of Computing at Georgia Tech and Bryn Mawr College, we will be using Microsoft Robotics Studio to help define this educational platform. Through that use, there will be feedback on the Microsoft Robotics Studio, so it will influence the evolution of that product indirectly.

PressPass: How is the robotics industry receiving news of this development?

Tansley: Because this is an explicit application of robotics technology, we're very optimistic that this will be seen as a further enhancement to the robotics community — not least also because it follows so soon after our Microsoft Robotics Studio product announcement. We think that IPRE really reinforces Microsoft's new presence and commitment to the robotics community.

PressPass: Does Microsoft plan to fund other university robotics programs?

Tansley: There are no plans for that at the moment. In conjunction with the Microsoft Robotics Studio announcement in June, there was a smaller but notable initiative set up with Carnegie Mellon University called the Center for Innovative Robotics. There's no relationship between this and IPRE at the College of Computing at Georgia Tech presently, but we will look for other opportunities in the future as our plans develop.

PressPass: What is Microsoft's long-term vision in this field?

Tansley: As far as the application of robotics to the teaching of computer science is concerned, we're trying to bring measurable gains in computer science enrollment and retention through the deployment of robotics technology in computer science introductory courses. Our vision is to make this a proven approach for professors in academia both in the United States and beyond to much more easily and practically use robotics in their teaching than they can do today. Additionally, we don't feel that robotics is being commonly used when you consider the whole scope of computer science teaching. The vision ultimately then is that robotics will become a means of choice to teach computer science. It will become a preferable way to teach computer science and it will be used pervasively.

DeMillo: We were very taken when Bill Gates started talking about robotics as a vehicle for attracting people to computing. The fact that Microsoft had a strategic commitment to doing things in this way and the College of Computing at Georgia Tech was well down the path was really a great accident, and we look forward to having a great success here. We're one of the few research universities — maybe the only one — for whom enrollment in computing has increased across the board, including with women coming into computing. We're passionate about accelerating that trend and we're thrilled to partner with Microsoft.

Tansley: I would like to reiterate how excited we are to be working with such a great school as the College of Computing at Georgia Tech and their partners Bryn Mawr College. Bryn Mawr brings expertise in perhaps the leading educational robotics platform today through the Pyro initiative that was funded by the National Science Foundation. The synergy of the Microsoft Robotics Studio, the Pyro software at Bryn Mawr College and the phenomenal new Threads curriculum at the College of Computing at Georgia Tech will result in very powerful solutions for professors teaching computer science in the years to come.

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