NEWS FOR MEMBERS
- Career Guidance
- Deadlines & Reminders
- Education
- Ethics
- Financial Advantage
- Getting the Most from Your Membership
- History
- Presidents' Column
- Products & Services
- Students
- Women in Engineering
- Young Professionals

PEOPLE
- IEEE Awards/ Recognitions
- Member Profiles
- Member Recognitions
- Obituaries

FEEDBACK
- Letters to the Editor
- Marketplace of Ideas

RESOURCES
- The Institute Quarterly
- Region Newsletters
- Section Newsletters
- Society Newsletters

SERVICES
- About The Institute

feature story

01 August 2002 08:00 A.M.

Robots Learn How To Be Human

BY ERICA VONDERHEID
Assistant Editor, The Institute

The most important component in a system often is the least understood.

In robotics, this component is human-like intelligence, according to Takeo Kanade, IEEE Fellow and professor of computer science and robotics at Carnegie Mellon University in Pittsburgh, Pennsylvania, USA.

NASA's Robonaut acts as a second pair of hands for astronauts.

SOURCE: NASA

Kanade took part in a plenary discussion with other experts on biotechnology, information science, mechanical engineering, computer science and biology at the 2002 IEEE International Conference on Robotics and Automation held in May in Washington D.C. The participants presented new research on the relationship between humans and robots and outlined current challenges.

"Biotechnology and robotics are approaching each other," said Paolo Diario, professor of biomedical robotics and director of the advanced robotics technology and systems lab at the Scuola Superiore Sant'Anna in Pisa, Italy.

"We have the knowledge and technology to produce a better prosthesis and methods to control motion that fill the gaps in how we

Sign Up for The Institute Email Alert

interface between the artificial and the natural," he said. Diario and his colleagues are developing a robotic prosthetic hand controlled by an implant in the patient's peripheral nervous system.

One role of robots is to work in environments inhospitable to humans. NASA developed the Robonaut to assist astronauts during spacewalks, also called extra-vehicle activities. These robots, which act as an extra pair of hands, use existing tools, fit through the same doors and match the astronaut's dexterity level. The machines are operated by either a remote operator or the astronaut's hand signals and voice commands.

"There's a degree of trust in robotics that we take for granted, but is unique," said Robert Ambrose, group leader of the Robonaut project at NASA's Johnson Space Center, Houston, Texas, USA.

Biological parts are now being placed in mechanical systems, bringing humans and robots closer together, according to H. Harry Asada, IEEE Associate Member and director of the d'Arbeloff Laboratory for Information Systems and Technology at the Massachusetts Institute of Technology (MIT), Cambridge, USA. His colleagues built a fish-like robot that was powered by frog muscles.

Robots also are starting to move and function more like humans. Japan is a leader in humanoid robotic technology thanks to the Humanoid Robot Project, a research and development initiative sponsored by the Japanese Ministry of Economy, Trade and Industry. Recent developments include a tendon-driven humanoid robot with a spine-structured backbone and neck.

The learning curve

But, for all these machines to be independent and useful, they have to be intelligent.

"I propose that you cannot program intelligence into a machine, it has to be acquired over time," said IEEE Member Richard Alan Peters II, an associate

professor of electrical engineering at Vanderbilt University, Nashville, Tennessee, USA. "An intelligent robot needs an architecture for learning, a conducive environment, a teacher and time to learn," he said. Many existing technologies and processes can be combined to build intelligence, a process Peters calls "bootstrapping."

Senior Member Rosalind W. Picard, associate professor of media arts and sciences and director of affective computing research at the MIT media lab is building kinder and gentler robots and computers. Responding to the user's emotions, the machines recognize sensory information, such as heartbeat, tone of voice and facial expressions that correspond to emotions. In one project, Picard and her team took some of the procedures, guidelines and scripts that customer service professionals use to calm angry callers and programmed the materials into a robot or computer. Individuals who interacted with these systems on frustrating tasks were more willing to continue working with the machines.

Can it be done?

Not all experts believe robotics can live up to what the field's backers say.

"As a non-roboticist, I do not have any faith you can pull this off," said Penelope J. Boston, a biology professor at the University of New Mexico in Albuquerque, USA. "As we introduce devices into the organic world and vice versa, we begin to erase evolution's complexities and, in spite of our intentions to engineer certain things for certain purposes, evolution is a very powerful system with is own rationales. While we might be able to build bionic robots, engineering will not determine the destiny of these devices."

For information on next year's conference in Taipei, Taiwan, visit "http://www.icra2003.org".

■