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Summit mulls robotics' role

Scientists look past mimicking humans in future designs

By Paul Voosen
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Robots clean up after all sorts of human messes. They vacuum our floors. They mow our lawns. And, someday, they may defuse our minefields.

While it may sound futuristic, minesweeping is one of the principle applications that Libor Přeučil, director of the mobile robotics division at Czech Technical University's Gerstner Laboratory, foresees for the robotics technology his team is developing.

On a recent visit to the lab, four small, blue, wheeled robots, each arrayed with a complexity of range finders and ultrasound sensors, sat dormant at Přeučil's feet. When active, the robots are able to collaborate on mapping a room, wheeling separate ways, building a joint vision of their surroundings. No single robot leads the team: Decisions are made through a bidding system — robot democracy.

"If you lose one of the robots due to a malfunction or dead batteries ... the others in the swarm can overtake its duty to fulfill the task as a whole," Přeučil said.

Gerstner has several projects with the U.S. Defense Department, and Přeučil can envision a time when a swarm of robots is set loose on abandoned mine fields, the robots covering for peers blown up by lurking charges.

Such small, intelligent robots are one way European researchers are pushing past a dual vision of robotics that has long seized the popular mind: Either robots are humanoid-shaped machines that ape our actions, as Hollywood would have us believe, or they are the mechanical arms working with precision in automobile factories.

Gathered in Prague — famously the home of the word "robot," as coined by the Czech playwright Karel Čapek — for the annual meeting of the European Robotics Research Network (EURON), some of Europe's top robotics scientists said that the field is nearing the point where robots will become an everyday presence.

Babysitter bots

Worldwide there are already more than 2 million robots in the home, almost all of which are vacuum cleaners, according to an annual world robotics survey.

"We feel there is a strong possibility for this technology to penetrate everyday life," said Přeučil, who served as host at the EURON meeting, which took place March 28 at the Diplomat Hotel.

As robots enter the commercial realm, the public will have to revise its expectations. The two-armed, bipedal robot in our minds would be impractical for most tasks, said Bruno Siciliano, a prominent Italian scientist who is president of the IEEE Robotics and Automation Society.

"[Imagine] a robot that would be a babysitter," he said. "Isn't it much safer to have it as a mobile platform maybe with some arms? Something like a biped would be very unsafe and unstable."

Reproducing the human form is especially influential in Japan and Korea, which invest some of the most money worldwide into robotics research. While Asian engineers have designed some excellent robots, capable of dancing and walking, these machines "can't do anything useful," said Herman Bruyninckx, a Belgian researcher who serves as EURON's network coordinator.

"A machine does not walk efficiently when it walks like a human," he said. "[And] by giving it the shape of a human, it suggests a lot of intelligence in the mind of people seeing it work."

Often, robots that appear to exhibit the most intelligence — for example, a rig Přeučil set up to follow someone wearing a red shirt — are actually the simplest, possessing no capability to learn. Such ability to function autonomously and grow is the Holy Grail of robotics.

"Ninety-nine percent of robotics people are working on the software and cognition part, making machines intelligent," Bruyninckx said.

In this research, what should not be expected is a eureka moment where a scientist suddenly develops a self-aware thinking machine. Rather, it will be a progression, as scientists better understand how to mirror human cognition.

There are no longer computer power bottlenecks in the push to develop cognition, Bruyninckx said.

"Sensors and computers are more powerful than we can make use of," he said. "It is the creativity of the humans that is lacking now."

Softening the hardware

Such human limits can be overcome by tapping more brains, said Siciliano, whose lab is collaborating with German, Italian, French and British partners. Their projects and Bruyninckx's research focus on improving robot interaction with humans.

What has defined industrial robots for decades is their indifference to the world beyond their programmed tasks. This obliviousness means that these robots, which can generate a huge amount of force, are extremely hazardous.

"[These robots] have been used in segmented and protected areas because they are very dangerous," Siciliano said. "Since they don't sense much about the environment, they may harm, injure or kill someone."

Researchers are developing robots loaded with sensors to avoid crippling blows. Siciliano told the story of a German scientist who allowed one of these new robotic arms to strike his head at 1.5 meters per second.

"A traditional arm would kill a person at that speed," Siciliano said. The researcher was unharmed.



JAN PREROVSKY/THE PRAGUE POST

The mobile robots at Gerstner Laboratory work collaboratively to scout out unfamiliar environments.

[enlarge](#)

More than meets the eye

Robots aren't stuck on the assembly line anymore. A sampler of notable bots:

HRP-2 This humanoid robot, designed by Japanese researchers, is used to preserve and perform folk dances such as the Aizu-Bandaian, which are waning in popularity with a younger generation

Dexmart Project aims to allow two-armed robots to skillfully manipulate objects with human-size hands. Its ultimate goal? A robot that can thread a needle

ASIMO This hobbit-size robot, made by Honda and most recently revised in 2005, is designed to work in offices, yielding to humans when walking and coordinating its actions with other ASIMOs

iRobot Create After seeing their robotic vacuum, the Roomba, hacked to sing Christmas carols and shoot toy guns, iRobot released this robotics platform, equipped with 32 sensors for aspiring mad scientists

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Compared with static industrial robots, mobile robots are weaklings. Drastic improvements will have to be made in hardware for mobile robots to do serious work, Bruyninckx said.

"We need a hardware revolution, not an evolution," he said. "We're still two orders of magnitude lacking between what a human ... can do and what a robot can do."

Bleeding-edge hardware is expensive, one of the reasons the Gerstner Laboratory has focused on small robots. Much of the rest of their research must be done in simulation, which has its limits, according to Přeučil.

"Reality is always much more complex than any model you can achieve," he said.

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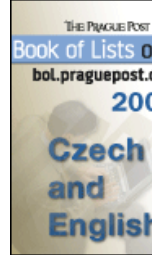
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