

Home

News

Money

Sports

Life

Tech

Main Categories

Tech briefs

Web Guide

Tech Investor

Product reviews

More Tech

Columnists

Shareware Shelf

Talk Today

Weather

Site Web  
By LYCOS

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## Robot science puts on a friendly face

By Edward C. Baig, USA TODAY

PITTSBURGH — Picture a robot that sets the table, serves dinner and clears everything away when the family is finished eating. Or a washing machine that not only cleans clothes but also presses and folds them — and sews missing buttons. Or an obedient shopping cart that lugs groceries up the stairs.



Teams of autonomous Sony Aibo robot dogs soon will square off in a soccer match in Pittsburgh.

By John Heller, AP

These scenarios may seem to be straight out of *Star Wars* or *The Jetsons*. But in labs around the globe, researchers are devising a slacker's paradise in which loyal servants and other brainy machines tackle mundane chores, freeing us up for more fulfilling activities.

Robots already are being schooled on cooperation. Carnegie Mellon University, a hotbed of robotics innovation, this week hosts the first RoboCup American Open. Teams of autonomous (though human-programmed) soccer-playing Sony Aibo pups are battling for machine supremacy. Long-term scientific goal: to create robots that will beat the human soccer champs by 2050. (Related item: [This game's goal? Science.](#))

"Robotics is making breakthroughs but infiltrating society in small steps," says University of Southern California professor Maja Mataric.

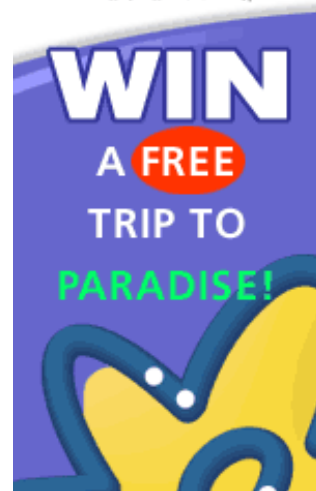
Even George Jetson might get a kick out of what's here and coming. Take Pearl (short for Personal Robotic Assistants for the Elderly), a "nurse-bot" and the stepchild of researchers at Carnegie Mellon and the University of Pittsburgh. She has cameras for eyes, a computer screen for a chest and a tray or basket in which she can carry items to an elderly or disabled person. The 4-foot-5 machine already has been tested in nursing homes; she has ultimate designs on helping seniors in conventional homes.

Then there's Grace (Graduate Robot Attending ConferencE), Pearl's 6-foot Carnegie Mellon cousin, developed along with researchers from the Naval Research Laboratory, defense contractor Metrica, Northwestern University and Swarthmore.

Last July, Grace was able to register at an artificial-intelligence conference in Edmonton, Canada. Without human assistance, Grace, who sports an animated computer screen for a face, signed in at registration, schmoozed with attendees, navigated to a conference room, made it to the speaker's podium and gave a PowerPoint presentation about herself. Total time: about an hour.



Your Click-it to Paradise



"People are drawn to the fact that the robot has a very expressive face," says Carnegie Mellon's Reid Simmons. "Simple things like moving her lips when she talks, blinking at regular intervals, smiling and raising her eyebrows add to the aura of believability that there is something there besides a program."

Corporations also are siring robots. Honda's humanoid ASIMO (Advanced Step in Innovation Mobility) is an apprentice customer service clerk in a Japanese department store. Sony's Aibo is providing poop-free companionship around the world. Fujitsu's foot-high MARON-1 can remotely turn on electronic appliances via cell phone. Evolution Robotics' prototype ER-2 might play games with your kid or patrol your property.

The future came early last year with the debut of the Roomba Intelligent FloorVac from iRobot. With little human supervision, this dynamo spirals around rooms scooping up debris, at a breakthrough \$200 price. iRobot CEO Colin Angle says Roomba has moved beyond gadget retailers and is selling well in such mass-market merchandisers as Bed Bath & Beyond, reflecting its acceptance as a useful appliance

Yet for all the advances in processing power, speech and facial recognition, the march to a Jetsonian home is fraught with obstacles. Robots need to be taught locomotion *and* perception. We don't want lawnmower robots that cut grass like goats, leaving unseemly patches. And though we may marvel that a powerful computer such as Deep Junior can challenge chess master Garry Kasparov, Junior cannot walk onto a stage or physically pick up a pawn.

"We have to accept robots with limitations," says Mellon's Manuela Veloso. Adds colleague Illah Nourbakhsh, "How does a robot tell the difference between a shoe and somebody standing in a shoe?"

Commercial considerations also count: Will robots generate a return on investment? "I believe there is a low-paid human who folds clothes cheaper than any robot we could make," says Brandeis professor Jordan Pollack.

What's more, science fiction may engender unrealistic expectations. Consumers may pine for their own personal R2-D2 or the *Jetsons'* caring maid, Rosie. But most of the automatons that have made their mark in society handle repetitive tasks on factory floors or in places humans cannot or should not go. (Robots helped search for bodies in the rubble after 9/11.)

Lots of smart people think robots will minister backstage. Many innovations to simplify our lives will be seamlessly embedded in appliances and built into networking, maintains iRobot co-founder Rodney Brooks, director of MIT's Artificial Intelligence Laboratory.

Broadly speaking, there is a battle between making the home smarter and making things smart inside the home. At the Philips HomeLab in the Netherlands, rooms sense your mood and anticipate what to do next; this is known as Ambient Intelligence.

Zonked after work? Lie on the couch, hum a tune and have your ambient-intelligent den deliver the song and dim the lights to provide a perfect setting. The room might respond to spoken commands, your voice tone or gestures.

"We often say the home of the future will look much more like the home of the past than the home of the present," maintains Emile Aarts, scientific director of Philips Research Laboratories. "Today there are big boxes for TVs and PCs. We dream of a world in which all those boxes disappear but their functions remain."

Aarts believes any flat surface — a wall, table, window or mirror — can double as a TV, PC screen or art display. Later this year, Philips will be supplying an undisclosed Las Vegas hotel with an early version of the mirror; eventually it might be in your own bathroom, displaying your weight when you step on a scale or a cartoon when the kids pick up toothbrushes.

Aarts also expects a virtual "Victorian butler" to be more beneficial than a robot. This avatar could unlock the front door upon recognizing you, alert you to who else is in the house, and look up stuff on the Net.

But physical robots still have their boosters. Carnegie Mellon's Hans Moravec has mapped out a future well

into the new century, drawing a strong parallel between robot intelligence (measured by computer processing power) and biological intelligence:

- Between now and around 2015, Moravec envisions machines that will evolve far beyond Roomba. A more advanced vacuum cleaner will schedule and predetermine cleaning routes and empty its own dust bags.
- By 2020, machines will be first-generation "universal robots" that could prepare an egg, put out the dishes and clean the table. At this stage, robots execute applications with "reptilian inflexibility," Moravec says, unable to deal with unexpected contingencies.
- A decade later, Moravec's second-generation universal robot would possess cognitive abilities: "Instead of having a program that says 'do this, do this and do this,' it says 'do this *or* this, or this *or* this.' "
- By the time the third-generation universal robot appears in 2040, it takes on the ability to like, dislike, model behaviors and mentally rehearse what it needs to do. It can handle simple conversation. Says Moravec: "All it knows about is a specific place, specific object, specific people and specific actions. You can't ask it, 'What do you think about the situation in Iraq?' "
- Tinkering with a fourth-generation robot's psyche might prove menacing. In 2050, Moravec says robots gain the brainpower of humans. Robots will be able to engage in abstract thought and reasoning. And they likely will do people tasks better than people, possibly creating a wave of automations that might displace humans from their livelihoods.

It's a scary, *Terminator*-like proposition. We want robots to relieve our tedium and serve us. The last thing a human wants is to be beholden to a machine.

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