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## The march of robots into our lives

**There's a new breed of thinking robots on the loose. They can cross deserts, fight wars and explore space - as well as read your e-mails, look out for burglars, clean your house and persuade you to join them for a work-out. Resistance is futile, says Jimmy Lee Shreeve**

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In the 1950s, science fiction writers and optimistic marketing campaigns predicted that, within a few years, we would have robots helping us around the home.

But only now is it about to become reality. The most startling development in consumer robotics came last month when Japan's Mitsubishi Heavy Industries (MHI) unveiled its Wakamaru "robot assistant", a 3ft tall, canary yellow robot with silver arms and big black eyes that scoots around at speed on a set of wheels.

The internet-linked robot might look as though has it stepped out of a sci-fi movie, but MHI insists it has a friendly personality that could make it part of the family. Wakamaru's designer, Toshiyuki Kita, says he intentionally gave the robot a cute expression and a human-like shape so that people didn't perceive it as just another "machine or terminal, but rather an independent personality".

Wakamaru will respond to the name given to it by its owner, and is able to recognise up to 10 people. With a vocabulary of 10,000 words, it will greet you in a gentle feminine voice when you arrive home, and will offer to pass on telephone messages or read out any e-mails that may have arrived. When you wake in the morning, Wakamaru will glide up to your bedside and regale you with the news headlines or weather forecast, and give you a reminder of the day's appointments. It will even invite you to join it in some light exercise.

If you are worried about security while you are away from home, Wakamaru can send you an e-mail if it detects anything moving around in the house that shouldn't be there. Alternatively, it can call up your video-enabled mobile phone, allowing you to view the situation for yourself through the camera mounted on its forehead.

Having your own cyber-assistant, however, doesn't come cheap: a limited edition of 100 Wakamaru robots has gone on sale in Tokyo for 1.5 million yen (£7,900) each, plus a monthly maintenance charge of 10,000 yen (£50).

If that's out of your price-range, don't despair. There are plenty more labour-saving gadgets about to hit the market. For around £2,500, you can automate the tedious task of vacuuming your house. Dyson's latest cleaner, currently on trial in 1,100 households in the UK, is pitched as "possibly the most intelligent domestic appliance ever made". The DC06, which comes in silver or yellow, is able to map and clean a room by itself - it doesn't need prior programming. The device's is so intelligent that it can stop itself falling down stairs and will pause if a dog or child gets too close. But the DC06 isn't fully automated. You'll still need to work up a minor sweat pressing the "on" button, choosing a speed, and hitting "go", before your room is vacuumed.

For reluctant gardeners, however, it's even easier. With Electrolux's new Automower, which sells for around £1,700 including installation, you only have to flick the "on" switch once. After that the robot can be set to operate on its own, trimming your lawn 24 hours a day, seven days a week, come rain or shine. It even recharges itself when low on power. Described as "a lawnmower that fertilises as it grazes", the clippings picked up by the Automower are mulched into tiny pieces, then dropped back on to the lawn, returning moisture and nutrients to the grass. According to Electrolux, a pin-code security system is installed to deter potential "bot-nappers".

Ever-increasing levels of automation, however, raise fitness concerns for some - the more that is done for us, the less we move about. "People are becoming more and more reliant on technology for tasks we used to perform manually, which I believe ties in with increasing levels of obesity," says "Heider" of the online fitness forum [combatfitness.co.uk](http://combatfitness.co.uk). "Automation gives people more free time, but the question is, what will they do with it - crash out in front of the TV, or will they stay active?"

Robotics experts at the Massachusetts Institute of Technology (MIT) in the US believe they have the perfect solution to deal with the fitness issue. Not surprisingly, it involves robots. They're adapting Sony's "canine entertainment robot" Aibo - a big boy's toy that retails at more than £1,000 - into a diet and exercise enforcer. MIT scientists say the robot dog will be connected by radio to your bathroom scales, a pedometer and to a personal organiser in which you record your daily intake of food. Ask "How am I?", and the dog will either jump excitedly, play funky music and flash coloured lights, or it will flop down and play a dirge - depending on whether you followed your diet and fitness programme or slumped down the couch-potato trail.

The most sophisticated robots are found in the space industry. This week, two robots - dubbed "K-9" and "Gromit" - are being showcased in the outdoor Marscape exhibition at Nasa's Ames Research Centre in California's Silicon Valley. The devices are able to perform a number of tasks without detailed human instructions, which would allow them to prepare spacecraft landing sites, build structures, mine for resources, and generally behave as all-round astronaut helpers.

"We are developing capabilities to allow humans and robots to operate competently and efficiently together in harsh, partially understood environments," says Alonso Vera of Nasa Ames. "Candidate missions for robots include constructing lunar habitats, constructing large space structures, and performing science measurements for Earth or space science."

As their software and hardware become more robust, "spacebots" like K-9 and Gromit are expected to assist humans in many other activities aloft, and may eventually take over many astronaut-health-monitoring duties.

Not surprisingly, the US military has also seen the potential of robots - and has already shipped a squadron of robot soldiers to Iraq and Afghanistan, where they are on standby to deal with insurgents. But as yet these devices aren't quite the killing automatons seen in the Terminator movies; they're effectively remote-controlled soldiers. A human operator hides in the next street, controlling the robot from a computer screen. Like a child at a PlayStation console, the soldier presses buttons to open fire and buttons to move forward, backwards and sideways. The big advantage is that, if the robot gets hit, the only loss is money, not human life.

The American military's desire for driverless vehicles was stimulated at the weekend when a Stanford University team won a \$2m prize for sending a modified Volkswagen across 132 miles of Nevada desert, guided only by sensors and computers. In all, 23 vehicles were sent into the Mojave Desert in a race sponsored by the Pentagon's Defense Advanced Research Projects Agency.

But the latest generation of robots are not just about taking over chores or going into danger zones. The toy firm Wow Wee - the makers of last year's million-selling robot with attitude, Robosapien - have come up with Roboraptor, a battery-powered cyber-dinosaur that retails for around £90.

Developed by Mark Tilden, a former Nasa robotic physicist turned toy-maker, and a team of designers in China, the 32in-long creature with piercing blue eyes is activated using a wireless controller familiar to video-game players. The Roboraptor sees, hears and feels the environment around it using touch, sound and infrared sensors - the latter to detect and avoid obstacles. It can perform 40 pre-programmed functions, including biting, walking and playing tug-of-war.

But what about the future? Are robots set to enter our lives in a big way? Joel Burdick, a mechanical engineer and the director of robotics at the California Institute of Technology in Pasadena, believes they are, but only when five crucial technological hurdles are cleared: computing power, sensor technology, power supply, motors, and smarts (meaning software and programming).

"Computing power and sensor technologies are both rapidly improving and dropping in price," he says. "But significant breakthroughs are needed in other areas - for example, current robots last about an hour on a full charge and the motors, or actuators, are very expensive." As for the smarts, he compares their development to computer operating systems: "At first they were no good, but they are getting better and better," he says.

### **Asimov's legacy**

The term robot comes from the Czech word *robota*, meaning "forced labour". Modern use of the term stems from the play *R.U.R.*, written in 1920 by the Czech author Karel Capek, which depicts society as having become dependent on robots that are able to do all the mental and physical work. The word "robotics" also comes from science fiction. It first appeared in the short story "Runaround" (1942) by Isaac Asimov, which was later included in his classic *I, Robot*. Asimov's robot stories also introduced the idea of a "positronic brain" (as used by the character Data in *Star Trek*) and the "three laws of robotics", which state:

1: A robot may not injure a human being, or, through inaction, allow a human being to come to harm, unless this would

violate a higher order law.

2: A robot must obey orders given it by human beings, except where such orders would conflict with a higher order law.

3: A robot must protect its own existence as long as such protection does not conflict with a higher order law.

### **Mighty machines**

#### **Wakamaru**

Not just a personal assistant, this three-feet-tall, internet-linked yellow robot with big black eyes is also pitched as a companion for all the family. "We have tried to create a robot you can have a relationship with," says the technical team leader, Ken Onishi, of Japan's Mitsubishi Heavy Industries (MHI).

It was named after a young Japanese samurai, Minamoto Yoshitsune, whose childhood name was "Ushi-wakamaru". The sensors on the robot's forehead, say MHI, are reminiscent of Yoshitsune's eyebrows.

#### **Dyson DC06**

Dyson claims that this vacuum is the most intelligent domestic appliance ever. No programming is involved: its built-in intelligence enables it to navigate around an uncharted room, avoiding obstacles. Pundits say that such advancements could mean that, in the future, no human will have to do their own housework.

#### **Electrolux Automower**

This automated lawnmower cuts your grass all by itself, 24 hours a day, rain or shine. Environmentalists will be happy too: the Automower is emission-free and operates silently, plus its built-in mulching system leaves only small grass-clippings, which act as a natural fertilisers.

#### **Sony Aibo**

The latest version of Sony's "canine entertainment" device gives the robot dog the ability to blog its own photo diary and read website content aloud. Aibo also remembers the location of its favourite place, and you can even talk to it using simple dialogue. Boffins at the Massachusetts Institute of Technology (MIT) in the US are even converting it into a diet and exercise enforcer.

#### **Roboraptor**

The toy firm Wow Wee's latest offering is a battery-powered cyber-dinosaur that bites and moves like the velociraptor on *Walking with Dinosaurs*. The 32-inch-long Roboraptor sees, hears and "feels" the environment using touch, sound and infrared sensors - and is set to be one of the hits of Christmas.

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