

Science, technology & design

Teaching Robots to be Nice

We have become accustomed to the idea of robots making widgets, but can they learn to be emotional? A research project in six countries is exploring the possibility that robots can learn emotions from humans, just as babies do, so they can respond appropriately.

Robots learn how to behave from the feedback they receive from humans, for example, kind words, or helpful behaviour, and even facial expressions. They will tune into physical movement, proximity between the human and robot, and frequency of contact.

In Japan, where 40% of the population will be elderly by 2055, scientists are looking for ways that robots can become carers. For example, a robot might cook dinner, then clear the table and wash up afterwards.

The Information and Robot Technology Research Initiative (IRT) is working on making robots a normal part of household life, with the assistance of companies like Toyota. They place sensors in robots that mimic human senses, so they are able to safely make physical contact with humans. As sensors become smaller, it will be possible to give robots a very sophisticated sense of touch.

If this sounds unnerving, robots are being used to plant and pick strawberries and do the planting and weeding in rice paddies, which saves farmers much backbreaking work and reduces the need to employ labour. Using robots in agriculture is perhaps more palatable than have them look after our aging parents. But fewer would probably argue with the appeal of having them cook dinner.

Ref: BBC (UK), 23 February 2007, 'Emotion robots learn from people'. www.bbc.co.uk Also Nikkei Weekly (Japan), 28 April 2008, 'Fielding robots'; and Nikkei Weekly, 28 July 2008, 'Will robots care for you later in life?' www.nni.nikkei.co.jp
Search words: robots, emotion, feedback, sensors, babies, adaption, senior citizens, care, household, agriculture, strawberry farming, GPS, Japan.

Trend tags: Robotics

Source integrity: ****

On the Verge of Artificial Life

The idea that science can create artificial life is disturbing, so we give it less threatening names like "synthetic biology" or the more edgy, "synbio". Yet advances in this field are progressing rapidly and some of the practical uses of this technology could be exciting and life enhancing – reducing climate change, even restoring extinct species.

A team led by Dr Craig Venter has replicated the genome of *Mycoplasma genitalium*, which genes his team first identified in 1995. His stated aims are to discover the "minimal genome", the one that is needed for survival and reproduction, and to combine genomics with technology, for example, using modified bacteria to make fuels.

One way to understand how it works is to look at computer programs and the way they use a core operating system and then add functionality. Scientists have created a synthetic chromosome, which can be transplanted into a cell to make it "boot up", like a computer. It suggests that in the near future, people will be writing DNA programs to achieve the kinds of life that they want, whether it is ethanol (Synthetic Genomics), high-tech fabrics (DuPont), or even self-flavouring and colouring yoghurt bacteria.

MIT's Registry of Standard Biological Parts is building a collection of BioBricks, which are DNA sequences with discrete and reliable functions. At a science fair last year, students were encouraged to use these BioBricks to invent new life, like "infecter detectors" and even a virus that could be used to find and kill breast cancer cells.

These discoveries are blurring the boundary between the biological and the artificial. It also begs the question of who will own the rights to these tools for making life?

Ref: The Economist (UK), 24 Jan 2008, 'Nearly there'. www.theeconomist.com Also the Washington Post (US), 17 December 2007, 'Synthetic DNA on the brink of yielding new life forms', R.Weiss. www.washingtonpost.com and Slate (US), 30 November 2007, 'Innocence and Syn', J. Lichtenstein. www.slate.com

Search words: artificial life, DNA, genomes, modified bacteria, ethanol, Dupont, synbio, bio-terror, synthetic biology, iGEM, MIT.

Trend tags: DNA, Genetics, Fake

Source integrity: *****

How Machines are Merging with Materials

Imagine that if a job needed doing around the house, you were able to quickly assemble what you needed from a shape-shifting material. No more quick trips to the hardware shop. This material is already in the making, and it comprises millions of robotic modules.

The US Defence Department has given a team of US researchers \$US4 million to spend on creating cell-like robotic modules that can rearrange themselves like Lego into whatever shape is desired. One researcher has already created a 15-module robot on two legs that could be kicked apart into three pieces, each one made up of modules and a camera. Observers watched it crawl across the floor, reassemble itself, and then walk away.

One question is how the modules should be arranged in the first place, for example, a snake of modules or like the atoms in a crystal. It might be simpler to remove modules from an existing structure than to have to add lots of modules and move them around.

An engineer at University of Washington is attempting to copy the way molecules form living cells and cells form tissues by creating simple designs that build to become more complex. However, getting modules to "talk" to each other and decide on how to behave is a challenge scientists seem to love. Personally, I'm looking forward to the universal toolbox.

Ref: New Scientist (UK), 26 April 2008, 'The mod squad', J. Hecht. www.newscientist.com

Search words: shape-shifting, robots, claytronics, modules, electromagnets, self-repair, self-replication, universal toolkit.

Trend tags: Nanotechnology, robotics

Source integrity: *****

Sniffing Out Sin

Some say that smell is the neglected sense, but it is already part of regular surveillance around the world. It is not just that dogs are used to smell drugs; they are now used to smell people. As well as dogs, different countries are contemplating training bees, moths, wasps, cockroaches and even jackals crossed with dogs.

The German police has a database of the scents of human activists and China has a "scent bank" of odours at crime scenes. What does all this mean for privacy?

Lawyers are already concerned about the use of sniffer dogs because of their inaccuracy. A Privacy Ombudsman in Australia in 2006 reported that 74% of people searched by dogs were not in possession of illegal drugs. In their defence, police say they smell the area surrounding the individual, which respects privacy by removing the need to search them. However, if a certain smell is detected, then that individual is immediately linked with it and searched.

People's scent will change according to whether they are fearful, guilty, suffering from schizophrenia or even according to their skin colour. So there is still much to learn from this sense and, inevitably, privacy will suffer because there are few things more intimate than our personal odours.

Ref: The Guardian Weekly (UK), 11 April 2008, 'What do noses really know?', A.Marks.
www.guardianweekly.com

Search words: olfactory surveillance, nose, smell, police dogs, border controls, intelligence, drugs, privacy, sniff.

Source integrity: *****

Falsify or demystify

One of the defining tenets of good science, as claimed by Karl Popper in *The Logic of Scientific Discovery*, is that its claims are capable of being falsified. If they can't be falsified, then they are merely pseudoscience. As scientists debate the presence of black holes, the multiverse and the events before the big bang, this tenet becomes very difficult to justify.

Does this mean that the falsification claim is wrong, or that science needs to be redefined? It could be argued that the multiverse or black holes cannot be falsified because they are unobservable. However, the theories on which they are based – quantum theory and general relativity – are falsifiable.

Perhaps it is wrong to look at a scientist's work in negative terms – ready to disprove them rather than looking at all the way that theories work. Newton's theory of gravity was repeatedly falsified by certain observations, yet scientists are not going to reject the theory. Perhaps it is time to reject the capture of scientific process using deductive logic in favour of a more subtle approach – degrees of belief and probability.

The Bayesian view is that if we accumulate positive evidence for a theory, then we are in fact "truthifying" what we know. It is based on mathematics and compares the probability of getting the observed results on the basis of each theory available. The theory with the highest probability is the one favoured.

Looked at this way, the multiverse is scientific because it is based on theories with compelling evidence. Even the silliest of theories may never be proved wrong, but the weight of evidence will certainly keep them from having an impact. This change of philosophy from aiming to disprove to further proving may well say something about scientific culture today as opposed to its early murmurings many centuries ago.

Ref: New Scientist (UK), 10 May 2008, 'Some swans are grey', R. Matthews.
www.newscientist.com

Search words: truth, falsifiable, black swan, Pierre Duhem, Einstein, Karl Popper, black holes, multiverse, cosmology.

Trend tags: Truth

Source integrity: *****