Horizons

INSIDE HORIZONS

'The damage is unlimited. We have not seen the Internet being used like this before. The virus takes information and shows it to the world.'
Danger in Internet UseNet groups. *p55*

'I don't understand what is happening any more. It is a step backwards – why go to this type of architecture?'
Industry pours scorn on Intel's processor. *p58*

'Intel could find economics will break Moore's Law.'
Will Intel be knocked off its pedestal? David Tebbutt finds out. *p64.*

'Keeping good staff is not a losing battle'
Join *PC Pro*'s campaign to beat the IT skills gap. *p63*

The Sniffer
Fujitsu's plug for mobility goes awry, dirt on the latest Microsoft court case, and Dolly Parton fans take on a country music Web site. *p58*

Big Blue sees red

■ IBM is in the firing line from UK PC manufacturers

PC PRO EXCLUSIVE

IBM has denied allegations that it has been intimidating small and medium-sized OEMs in the UK in an effort to boost its own revenue stream.

PC Pro has learnt that Big Blue has been systematically contacting a series of UK manufacturers accusing them of infringing IBM patents that date back as far as 1983. The patents cover basic PC functions such as the ability to write to a hard disk or having a microprocessor at the heart of a PC.

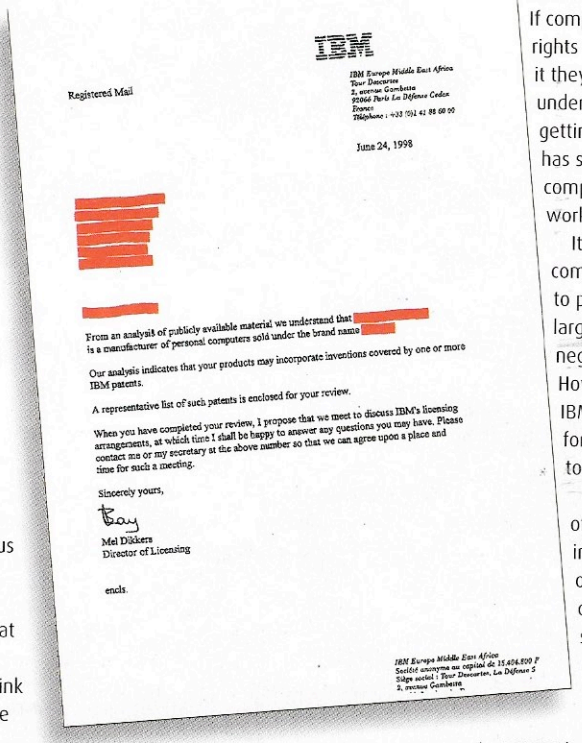
A copy of the letter faxed to *PC Pro* says, 'Our analysis indicates that your products may incorporate inventions covered by one or more IBM patents... I propose that we meet to discuss IBM's licensing arrangements at which point I shall be happy to answer any of your questions.' The letter is signed by IBM's director of licensing, Mel Dikkers.

UK manufacturers are baffled by why it has taken IBM so long to notify them and furious that they could now be facing potentially large licensing bills that IBM is reportedly planning to backdate. 'I think someone has suggested there is a pot of gold and IBM has decided to go for it,' says one technical director who declined to be named.

Other computer manufacturers including Simply Computers have already settled with IBM. Simply's chairman Paul Berry says he was called to meet with IBM and came face to face with Dikkers and a patent lawyer from the US. 'It was a bit like facing a classroom bully,' he says.

Berry is not alone. Most of the PC manufacturers that have been faced by IBM either have, or probably will, cave in without a fight. 'We were annoyed but couldn't afford to fight a company like IBM,' says another company, which requested anonymity.

Experts say that in spite of the fact that IBM is claiming valid patents the OEMs do have a reasonable defence. Patent lawyer Margaret Briffa says IBM cannot take money from the OEMs unless it takes them to court. 'There is an issue because IBM has waited so long – it has let people go on using the technology and thinking it is okay,' says Briffa, a solicitor for UK-based Briffa and Co.



IBM

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2, avenue Gambetta
92066 Paris La Défense Cedex
France
Téléphone : +33 (0)1 41 88 60 00

Registered Mail

June 24, 1998

From an analysis of publicly available material we understand that [redacted] is a manufacturer of personal computers sold under the brand name [redacted]

Our analysis indicates that your products may incorporate inventions covered by one or more IBM patents.

A representative list of such patents is enclosed for your review.

When you have completed your review, I propose that we meet to discuss IBM's licensing arrangements, at which time I shall be happy to answer any questions you may have. Please contact me or my secretary at the above number so that we can agree upon a place and time for such a meeting.

Sincerely yours,

Mel Dikkers
Director of Licensing

encls.

IBM Europe Middle East Africa
Société anonyme au capital de 15.424.800 F
Siège social : Tour Descartes, La Défense 5
2, avenue Gambetta

IBM, however, says it is only protecting its rights. 'This is something that has been going on for a long time. An awful lot of smaller scale manufacturers put together components and put them on the market without paying any licensing fees. We usually find that any PC manufacturer is using some IBM intellectual property,' says Alan Gillings, a spokesman for IBM.

'It would be prudent for them to check. There is an issue of fairness as well as IBM getting its own rights. If company A is paying licensing rights and company B is avoiding it they [company B] could undercut the market. They're getting a market subsidy. IBM has started with the bigger companies and has been working its way down,' he says.

It is not clear how much companies are being asked to pay, and settlements largely depend on individual negotiations with IBM. However, under patent law IBM could backdate payments for the last six years, according to Briffa.

Opinions vary on the impact of IBM's patent actions. 'IBM's intention is not to put people out of business. What it has to do is craftily find a way of scaling the payments,' says one vendor. However, others believe that with profit margins already tight the IBM payment could push some companies over the edge.

Another manufacturer, however, said that in some ways the IBM letter could be viewed as a compliment. 'As soon as IBM becomes interested, you know you are becoming a bigger company,' says one insider.

Peter Cochrane heads up BT's Research Laboratory at Martlesham. With a 160-strong team comprising the best brains in the business and a two per cent share of BT's annual R&D budget, Cochrane is already working and living with the technology you'll be using next century. Sarah Kidner talks time-travelling with him.

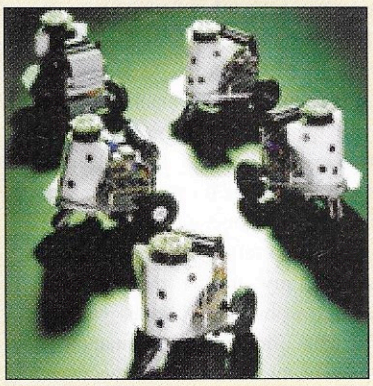
PROFESSOR PETER COCHRANE

Talking to Professor Cochrane is probably as close as you can get to time travelling without leaving the current dimension, as his vision stretches far into the 21st century and beyond. His seemingly unshakeable conviction is that anything is possible if you really put your mind to it. In fact, BT is already sitting on a host of innovations poised to blow your mind next century.

Smart jewellery

Designed for the 21st century, Peter Cochrane's signet ring is built around a chip that holds all the details of his passport, bank account, medical records and driving licence. According to Cochrane, it's set to revolutionise shopping. The ring is already a fully operational prototype, but it will be some time before you'll be trading your credit card in for the ultimate fashion accessory.

'I ought to be able to just walk into a retail store, pick up a pair of trousers and walk out. If there's a chip in the trousers as well as in the ring, then as I go through the door the trousers will sense that they're being taken and debit the money from my account.'



Artificial life

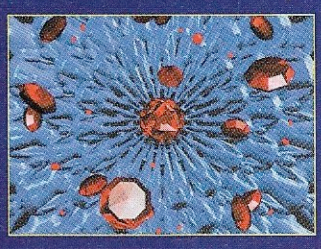
It's not just jewellery that's set to get smarter. One of the biggest projects down at the Lab is looking at artificial intelligence as a way of creating

Groups of robots organise themselves into teams and hierarchies according to the effectiveness of the results. With software learning from its own mistakes, software bugs could soon become a thing of the past.

you begin to ask whether reality is a computer simulation working somewhere else.

'When you talk to games publishers, you begin to realise that they have pretty set ideas. They're conservative and won't accept certain concepts such as angels or genetic engineering, so there's little room for much-needed new forms of interactivity. I like to think we have the edge over many games developers because we have good software engineering. The key to our success so far has been to have the weirdest art and the best technology.

'We're independent, which forces us to employ the right people and make the right choices. Organic Art has made good money, but the free demo travelled too well. People thought that was it, when there was a whole interface waiting for them. I'm in two minds about doing it again, but it generated huge amounts of fan mail from as far afield as Malaysia and Peru.



'The next version will be Audio Organic, which will be audio-driven. The music from any audio CD drives the parameters and mutations of the visual art. We're still looking for a publishing deal, but already we're working with clubs such as the Ministry of Sound to place Audio Organic in club spaces.

'The real challenge is keeping our integrity as the Organic Art brand diversifies into a variety of products. I've become more of a manager, overseeing and directing the art of the Computer Artworks team, and spend very little time doing it myself.'

software programmes, networks, telephones and machines with a degree of intelligence built in. By sensing their environment, they should be able to develop new capacities as demands change.

'I have software that is breeding, which is interchanging genes and creating adaptable behaviour. This means you'll see the network come alive – it will watch what you do and it will adapt. For example, if there's a pile-up on the M25, everyone reaches for their mobile phones within one cell and that slows the network down.'

BT has been conducting widespread trials of interactive TV. The content is digitised, compressed and stored on disk. Customers order programmes for delivery from the media server over ordinary copper telephone lines.

It doesn't stop there, though, as BT has taken artificial intelligence one step further and created machines that are solving their own problems. 'We've created solutions that a human being could never have dreamed of. We have solutions, and although we don't understand how they work, they do work. We're effectively increasing the speed of evolution,' says Cochrane.

It's already good to talk, but with artificially intelligent phones on the way it will be even better. Cochrane is at present working on smart phones that can translate English into German, Japanese and French in real time. 'Some of it's rocket science, but a lot of it's extremely simple. What we've built is a kernel of understanding inside a machine that extracts meaning from the sentence itself – at the moment we can do simple things such as phrase books,' he says. The system uses a non-linear approach that sends the English to the understanding kernel in the machine and then fans it out to all the other languages simultaneously.

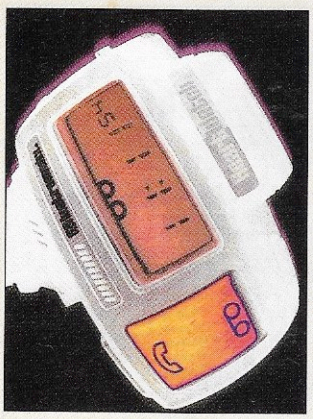
Many of us have already adapted to the idea of the cordless phone, but in the future, as AI develops, we'll also be seeing the introduction of the buttonless phone. 'We need to be able to locate things by association rather than by numbers. For example, I met a guy at a conference and as I was talking to him a waitress handed him a cup of tea and he burnt his lip. That incident lodged in my brain, so on my database he's now entered as "burnt lip",' Cochrane recalls.

Information overload

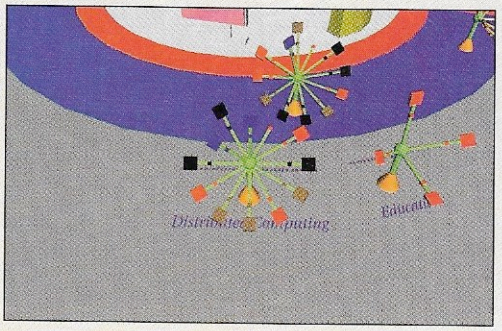
There's no doubt that Cochrane is putting a lot of faith in intelligent machines, particularly when it comes to cutting through the deluge of information that he says is the downside of the electronic revolution.

'Over the past decade my work output has gone up ten-fold. However, now I've hit the "n" stop and I can't see how to increase it any further. I've got the most powerful computers money can buy, the best networks and the best gizmos. Where's the next leap going to come from? I think it's got to be more intelligence in the machine.'

BT's solution is the development of intelligent agents that watch, learn and start communicating. The Lab has already had some success in teaching intelligent agents to distinguish between images of men and women. But, says Cochrane, the system is far from perfect. 'The machine comes to the correct answer, but by a different mechanism to us. It can distinguish between the sexes by using differentiators such as facial hair or make-up, but it can't recognise femininity yet.'



This ECG watch, developed by BT and already on sale in the US, gives heart readings and can pipe information back to the hospital using a standard phone line.



BT's information garden aims to make it easier to manage information. The objective is to develop unified 2D/3D shared, dynamic and intelligent information interfaces and representations through the sharing of Internet-based resources.

All work and no play

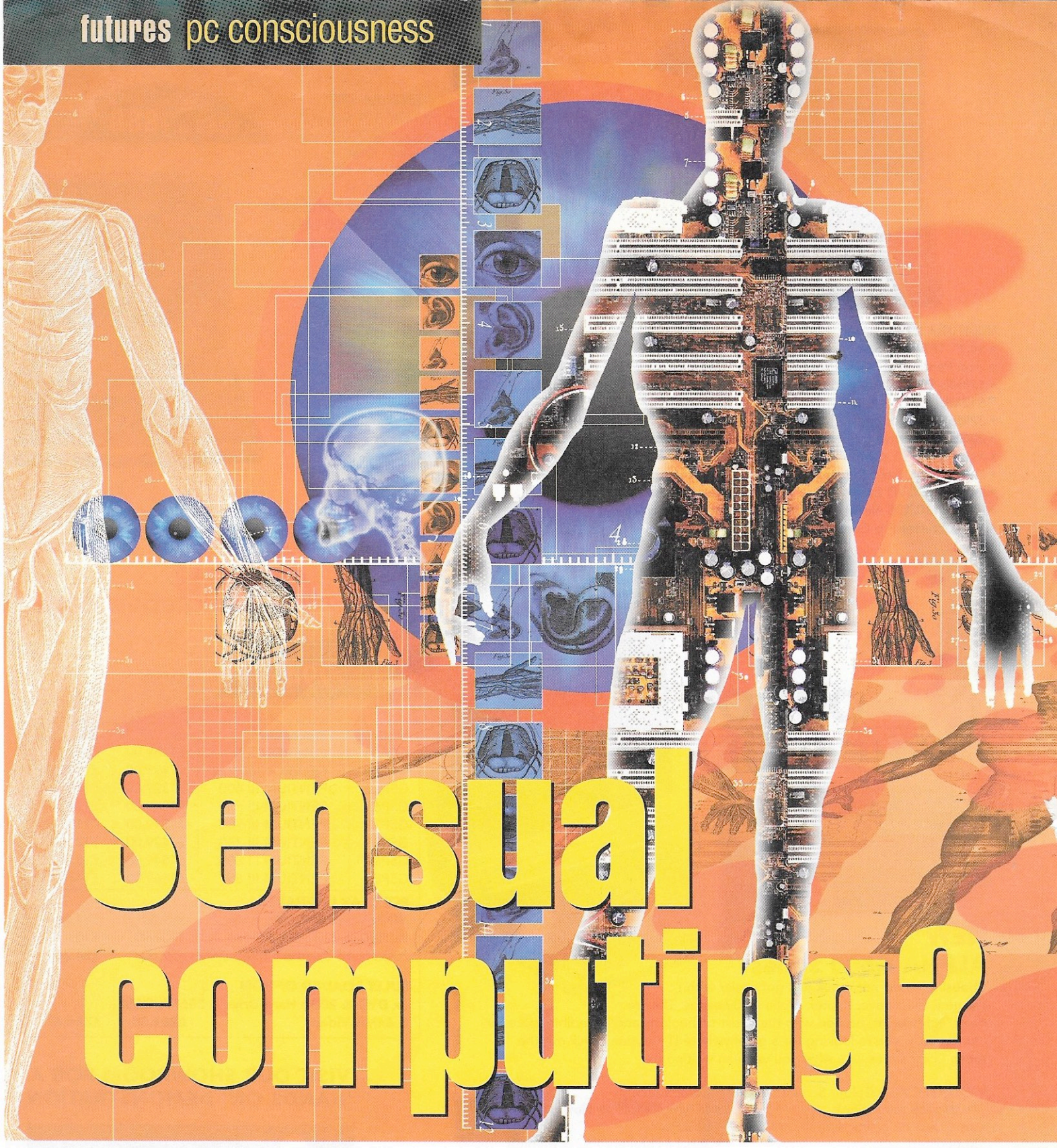
It's not all work down at the Lab, though. BT's also involved in an on-going trial that it claims will revolutionise our leisure time, in particular the way we watch TV. 'We did a couple of experiments earlier this year, one with the BBC. Using visions of heaven and hell, we put people on the Internet and broadcast TV at the same time, so that the people at home could actually influence what was happening on their TV sets. As a result, it became interactive and therefore more active.'

Beattie and biomedicine

As a person in his fifties, Cochrane has, by his own admission, a vested interest in the consequences of a demographic explosion that will see the National Health Service and care services come under increasing pressure in the next century. Fortunately, BT has its fingers in multiple pies and has made biotechnology another core focus of R&D. 'Personally, I think hospitals are very dangerous places to be. There are lots of viable alternatives. For a start, we can stop bunging up hospital wards by putting people on-line.' BT has already developed a pack for heart attack victims that monitors their progress and uploads information via a radio link back to the hospital.

And finally...

So what will the 21st century hold for us if Peter Cochrane and his futurologists have their way? Well, by the year 2015, it's likely that we will be eclipsed by a super-computer more powerful than the human brain. And if that's got visions of *Terminator* dancing in your head, don't worry – Cochrane's got it covered. 'I'd really hate one morning to find myself considered an infestation of this planet. Our inclination is to nurture life and not to destroy it. Before we let loose a bunch of artificial intelligence, we ought to be thinking through the necessity of building in a number of rules that hold your life as a human being sacrosanct.'



Sensual computing?

Will computers ever be able to see, hear, smell, touch, feel and think? Sarah Kidner investigates the technology behind the push to make computers more human

An advertisement for a private healthcare scheme proudly proclaims 'you're amazing' as its slogan, and it's true. You can listen to other human beings, understand what they're saying to you and act upon it.

The world's most advanced computers, such as IBM's champion chess-playing Deep Blue, are by comparison a long way down the evolutionary scale. 'Here we have scientific principles that were discovered in the mid-1920s and programs first implemented in the 1950s. Forty years later, we've developed something that's as good as the best human chess player. But it doesn't know how to cook, and can't pick up a newspaper and start

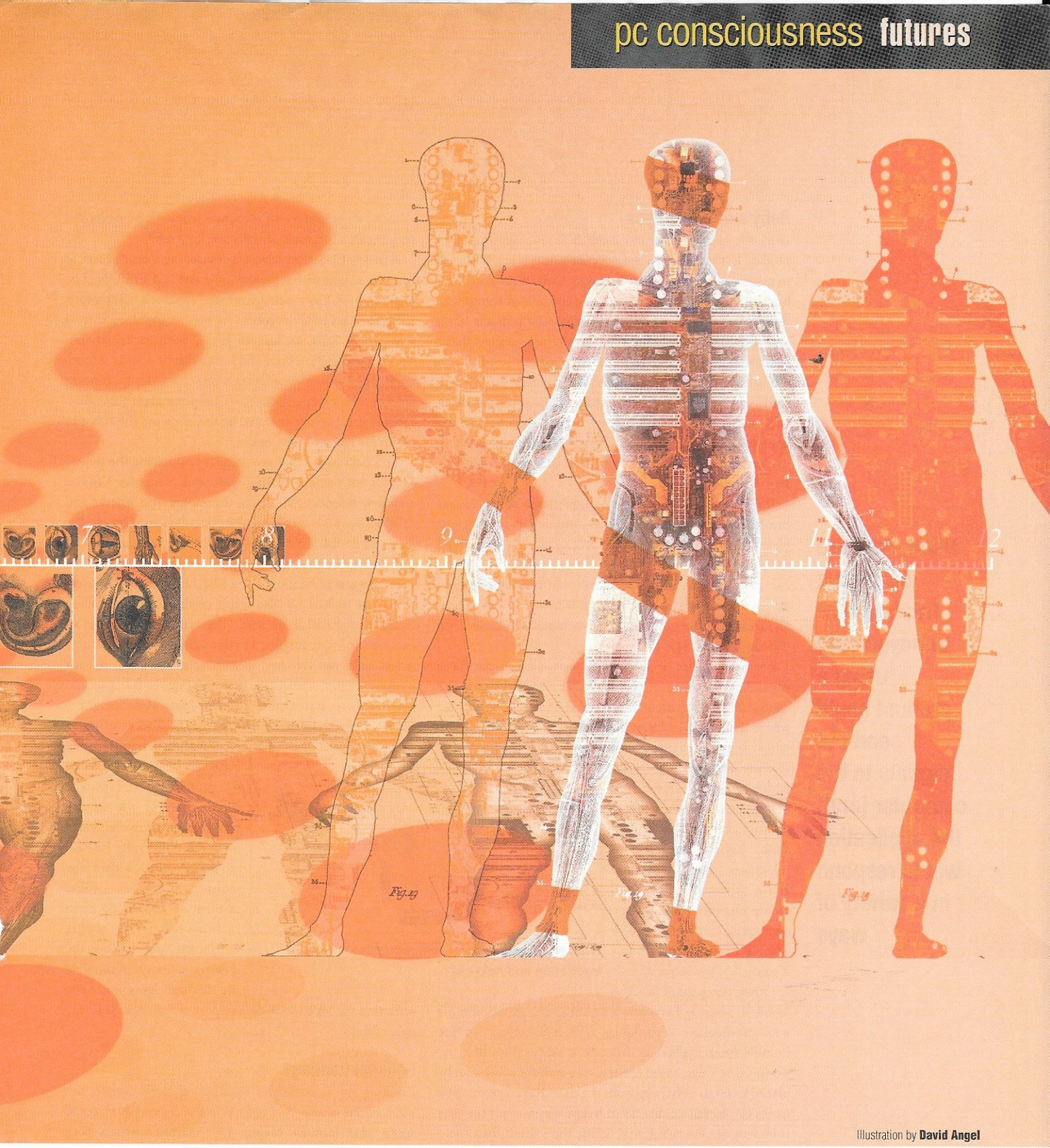


Illustration by **David Angel**

discussing current affairs,' says Professor Jordan Pollack, specialist in artificial intelligence at Brandeis University, Massachusetts.

You're also amazing in that you can see, hear, touch, taste and talk – a level of sensory perception that continues to elude today's machines. 'Computers suffer from gross sensory deprivation – the key item in the equation for intelligence in life,' says Professor Peter Cochrane, co-founder of Conceptlabs and former head of BT's research laboratory. 'I'm walking into a room right now and I'm taking in about 70Gb [of data] as I burst into the room. As things settle down I'm taking in about a gigabyte per second, but my output is only about 100bits/sec. If you look at my computer, its input is around 100bits/sec and its output is 70Gb – exactly the inverse,' he continues.

But this perceived inferiority of computers to man hasn't stopped thousands of researchers searching for the Holy Grail of computing – a tactile, intelligent and conscious computer. So how are they hoping to achieve it? Can a computer really have and respond to feelings and emotions? Can it think for itself without human intervention, and can it ultimately develop consciousness? Or are scientists simply wasting their time trying to prove what is, in essence, a redundant point? In short, just how human can computers become?

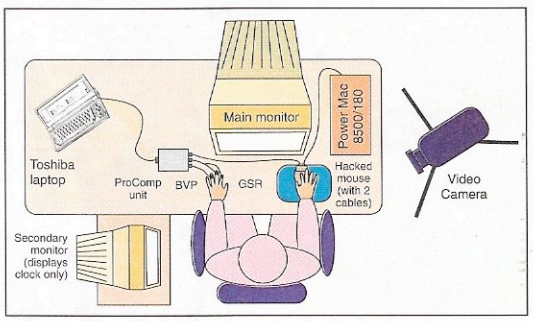
Baby's got Blue Eyes

IBM, the company behind Deep Blue, has another child prodigy in the form of a project called Blue Eyes. Its aim is to create a computer that's as easy to interact with as a human being. 'We want to enhance all kinds of computing devices with the sensorial capabilities that humans have, and use that information to create interaction that's similar to a human's,' says Myron Flickner, head of the project at IBM's Almaden Research Laboratory. One real-world application is the way IBM hopes you'll be using your mobile phone in a few years' time. 'I want to have the day where I can just pull out my cell phone, look at it and say "call John back" – that's how I'd interact with a person,' says Flickner.

It's no easy task. There are a plethora of challenges involved in something as simple-sounding as asking your phone to call back a friend or colleague. 'The first thing the phone has to do is realise it's being looked at so that it can wake up and listen and realise that it's being given a voice command. The way we do it is by recognising facial and head gestures, and we want machines to be able to do the same thing,' says Flickner.

Users who are becoming frustrated or annoyed with using a product could send out signals to the computer [and] the application would respond in a variety of ways

Flickner's team is aiming to give computers these capabilities by using technology that's non-intrusive to the user, such as video cameras and microphones. These judge where the user is looking and what they're saying both verbally and with gestures, which are analysed to determine the user's physical, emotional or informational state. For example, a television could become active when it's looked at, pick a channel from a voice command, and with a nod or a smile from the user know it's satisfied the request.



What if your computer could recognise your frustration and help out?

Other companies, such as Applied Science Laboratories (ASL), are experimenting with eye-tracking techniques as a replacement to the humble mouse. One such device is ASL's 504LRO, the world's first video-based eye-tracking system, which can be placed as far as 16ft away from the user. Basic eye tracking works by placing a camera just below the monitor the user is looking at. Using infrared lights, the system then looks for the brightest points of the eye – a process that takes around 15 seconds. Once the camera has recognised the pupil and the corneal reflex, it locks on to them, allowing the user to use their eyes as a mouse, blinking to select an operation.

ASL claims the system is so simple even a baby can use it. 'Systems are being used on children of three years old. If you're going to do that, you need magnetic head tracking, which is a sensor attached to the child's head. You deceive the system into believing that this is an eye. We have several installed in schools, which specialise in quadriplegic children. [In fact,] there's a girl at Camberwell School of Arts who uses the Eye Mouse to draw on her computer,' says Steven Oliver, a spokesperson for ASL.

Okay, so a computer can recognise when it's being looked at, but can a machine actually see for itself?

A team of US researchers is developing a crude form of computer sight with a project aptly entitled VISION. The brainchild of Lawrence Livermore Research Laboratory, VISION aims to allow robots to 'see' so that they can be sent where humans fear to tread, such as minefields, working production lines and bomb disposal areas. A non-laser-based system uses two video cameras to capture objects from two perspectives. Computer algorithms then convert this two-dimensional image, allowing the robot to see in 3D like a human being.

This isn't to say that eye contact is replacing the mouse as a way of communicating with your computer. On the contrary, scientists are busy revamping the mouse and developing more tactile, or 'haptic', devices. One of the pioneers in this field is the FEELit mouse, invented by Immersion Technology and developed by Logitech. As the name suggests, the aim of the FEELit mouse is for users to feel as well as see the result of their actions. 'When using the FEELit mouse, the cursor becomes an extension of your fingers. Anything the cursor encounters is felt as if you touched it with your hand and it feels profoundly real – textures, surfaces, liquids, frictions and magnets,' says Immersion president Louis Rosenberg.

FEELit works using a combination of hardware and software technology. When the cursor moves over a certain part of the screen, motion commands embedded there are sent to the FEELit mouse. A chip within the mouse processes these commands and sends them to two small sensors within the mouse, which move up, down or sideways to simulate the desired sensation. The sensation is dependent on support within the software applications.

Sensual healing?

Creating the sensation of touch is relatively simple, but what about actual feelings? What if a computer could sense that familiar feeling of frustration when your machine crashes or you're struggling to get to grips with an unfamiliar software program and respond accordingly? 'Users who are becoming frustrated or annoyed with using a product could send out signals to the computer [and] the application would respond in a variety of ways. For example, a computer piano tutor might change its pace and presentation based on naturally expressed signals that the user is interested, bored, confused or frustrated,' says a spokesperson for the MIT (Massachusetts Institute of Technology) media lab.

How can we get a computer to recognise emotions when it's something that we as humans find difficult? 'Typically, humans don't have direct physiological measures, but we do have some of them. If your

temperature rises then you'll blush, or if you're really sweating, people will determine that as well,' says Flickner.

Measuring these physiological challenges was the starting point for a group of MIT researchers, who set out to deliberately frustrate a group of users with computer puzzles and a hacked mouse. The users were asked to click on the correct answers to the puzzles using the mouse, with the fastest in line for a $100 (£68) prize. Unbeknown to them, the mouse was designed to stick at regular intervals, hence the frustration. At the same time, the researchers were monitoring the users via a sensor on their hand and shoulder in the belief that the mouse's failure would produce a physiological response.

These results were used by another MIT researcher, Raul Fernandez, as the basis for developing a system that learns the typical physiological signs of frustration. Fernandez's system uses hidden Markov models as its basis. These are based on Andrei Markov's probability theory, where the probability of an event occurring depends upon the fact that a preceding event occurred; in other words, frustration causes a physiological response. Using this, it was possible to develop a set of software algorithms for analysing the physical warning signs of frustration, which Fernandez claimed was a success with 21 out of 24 subjects.

Similarly, IBM's Blue Eyes system includes an 'emotion mouse' that gauges emotional responses from the user using physiological signals such as temperature changes and increases in pulse rate. 'It's just another sensorial technique that we want to capture and drive that [human-computer] interaction,' says Flickner.

MIT has a similar system consisting of a set of four biosensors: a BVP or Blood Volume Pulse, for measuring blood pressure; a Galvanic Skin Response, which monitors sweat glands; an EMG (Electromyogram) for measuring muscular activity; and a Respirator for measuring breathing. Linking the systems together is a ProComp Encoder Unit, which is a receiver that turns the signals into digital form so they can be processed by a computer. 'With intelligent annotation from the user – comments such as "begin work", "end work" or "meet with supervisor" – the stress profile could be sorted by activity and presented to the user in a format which communicates the relative levels of stress,' says Jennifer Healey, a former MIT student.

Monitoring all of these at once can prove counter-productive, however. 'A difficult challenge of affective computing research is to determine which features of the sensor information could be considered salient, both to reduce the amount of data that's stored and transmitted, and to improve the analysis of the data,' says Healey. Separating them has other benefits too, like allowing the creation of smaller and less intrusive wearable computers, which can alert the user to excessive

Talking sense

Speech has long been the Holy Grail of alternative user interfaces. After all, it would be great if you could just talk to your computer and get it to check your email, bring up a Word document or print. But unfortunately it isn't that easy. Companies such as Microsoft, Lernout & Hauspie and Dragon Systems have been trying to crack the problem for years and have made great strides, but it's still a far cry from our own natural language capabilities.

'People are still better at recognising speech in general environments. If you're at a party, you can carry on a conversation with someone even though the acoustics of their voice are less than the acoustics of the people around you. That's because you're using a lot of visual cues as well – you can resolve that with the acoustic information and work out what it is that the person is trying to say,' says Chris Bishop, a researcher at Microsoft's Cambridge Laboratory.

It's for this reason that Microsoft researchers are aiming to create computers that can simultaneously process audio and video. 'One of the areas of research that we're pursuing is the idea of taking information from different sources, by combining audio and visual information in order to be able to extract information that couldn't be extracted from either source alone,' says Bishop. One possibility is teaching a computer to recognise gestures. 'We know that human arms don't move in arbitrary ways; they're jointed and only have certain types of movement. If you have a video sequence of people making gestures, the computer can learn the different types,' adds Bishop.

Another possible solution is to shift the emphasis from the client to the server side of computing. While it might be great to be able to talk to your handheld PC or desktop computer, these devices have limited computing power and it's not enough for a task that's as intensive as voice recognition. 'We'll all have laptops, personal organisers and mobile phones that will be permanently connected to a server using wireless such as Bluetooth. You're using a pretty dumb device to access a server, which is smart. It can learn who you are, because you always use the same mobile phone and load modules that it's learnt from previous conversations, [such as] the way you pronounce things or the kind of background noise that it often encounters with you,' says Professor Stephen Young, a voice recognition expert at Cambridge University.

Compromise is also likely to play a crucial role in the future of voice recognition. 'A few years ago, people wanted to add more and more into the interface of their computers. Right now a lot of companies don't see that as very interesting. What they see as interesting is the Web, and being able to access it from any kind of device. The Web has shown us that people are prepared to compromise, as there's nothing particularly natural about the way you use it,' says Young. On that premise, rather than aiming for an intelligent computer that will understand what you're saying, the emphasis will be on the user to learn a set of limited voice commands. 'If you constrain the context, then we already have good voice recognition technology – we can back off some of the technological challenges using a restricted vocabulary,' says Bishop.

IT's watching

Consumer devices are increasingly bringing covert surveillance into the home, discovers Sarah Kidner

Are you watching TV or is it watching you? In today's high-tech society it's likely that the consumer devices in your home – such as your TV, PC and even the software installed on your computer – are monitoring your viewing habits.

Digital TV company TiVo, for example, was recently berated for collecting data about its customers' viewing habits. An undercover investigation by the Privacy Foundation discovered series of numbers and letters such as 980389559/WatchTV/recorded/KDVR/3134603/980127000 being fed back to TiVo HQ. 'This record can be interpreted as "on Wednesday January 24 2001 at 7.26pm the viewer began watching an episode of *King of the Hill*",' claims the Privacy Foundation.

TiVo isn't alone, according to privacy experts. 'The amount of appliances and software being brought onto the market is astounding. All these video-on-demand channels have information on what you're watching,' said Jason Catlett, president of Junkbusters.com. Creative's Nomad Jukebox similarly uses ripper software that 'phones home' with the name of the artist and song downloaded to your MP3 player. Sony spin-off eMarker is another culprit. The device records the time and date you hear an unknown song that you like on the radio. Later, simply plug the device into your PC, upload it to the Web site and it will match that information with the playlist of the radio station. But you can expect to be bombarded with offers to buy the songs.

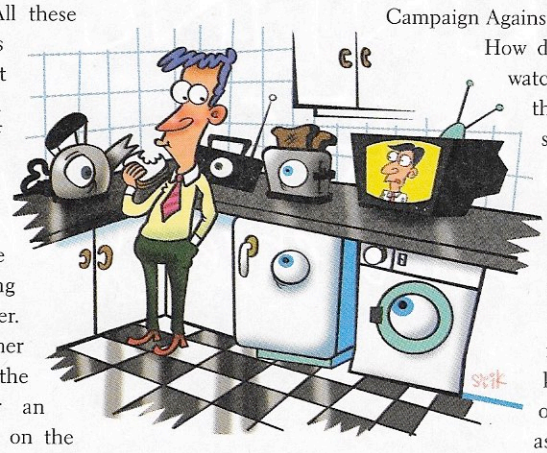


Illustration by Bill 'Stik' Greenhead

In America, a Web personalisation company called Touch Clarity is developing software that will watch and interpret your Internet 'body language' in a bid to second-guess your buying decisions. Web consultancy firm Agence Virtuelle takes a different approach, opting to 'listen in' on the airwaves using software agents or RumorBots. The agents trawl newsgroups looking for trends or Internet porn.

Business software will come with added extras too. Microsoft's Windows XP and Office XP will include 'product activation', which records how many times you have used the program or how long you've had it installed on your PC. If you don't register within Microsoft's limits the program's ability will become restricted.

Experts say it smacks of Big Brother. 'It's spooky for a company to know exactly what you're watching and at what times. Sometimes you just want to be left alone. Why don't we just set up a surveillance camera in people's homes?' said Bobson Wong, executive director of the Digital Freedom Network.

Others are watching your Internet viewing. The government is mooting controversial plans for a 'child-friendly PC', which will watch and record Web sites visited.

The child-friendly PC has dangers of a different kind. 'I don't like the term "child-friendly PC" because it implies that if you get one of these it will be safe to let your child loose on it – that's wrong. It should be seen as a tool to help you manage your child's experience, not as an easy way of absolving parents of their responsibility,' said Malcolm Hutty, director of the Campaign Against Censorship.

How do you know if a device is watching you? There are signs that should arouse suspicion, such as receiving lots of unsolicited email. 'If someone is going to use information for marketing purposes it's pretty hard without people being aware of it: at some stage individuals will have some knowledge or suspicion of that,' said Phil Jones, assistant information commissioner for the Information Commissioner's Office.

'Why don't we just set up a surveillance camera in people's homes?'

The simple answer is that there's no real way of telling. 'Most consumers have no idea of the types of surveillance systems being built in to these types of devices,' said Catlett.

The only way you'll know who's watching you is if the company tells you – and even then the information can be misleading. 'This should be explained to consumers in a clear way – not some hard-to-explain privacy notice that pops up as a disclaimer,' said Wong.

Others believe this clarification will only happen if governments force tighter legislation on technology companies. Until then it's down to you. Happy viewing.

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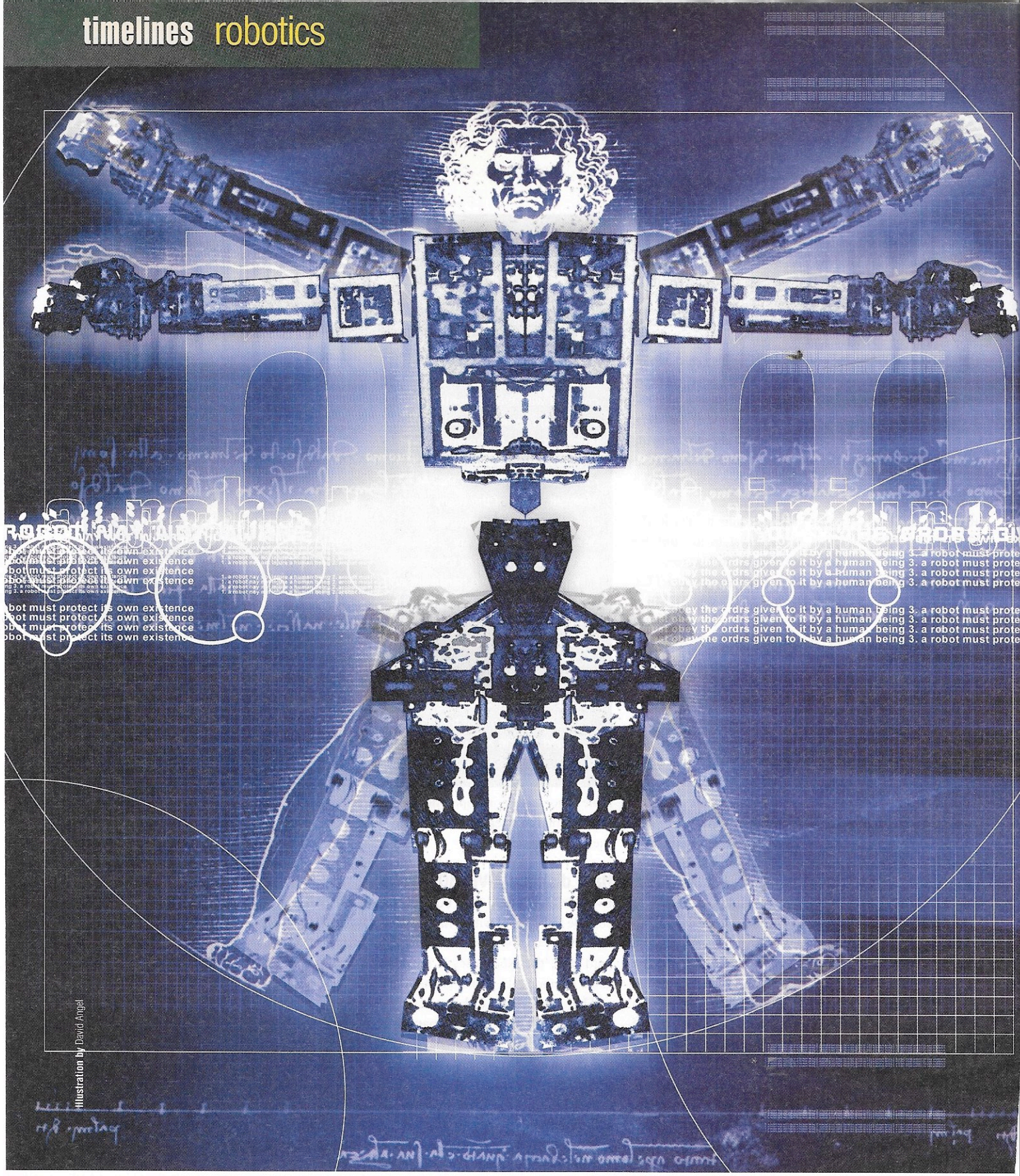


Illustration by David Angel

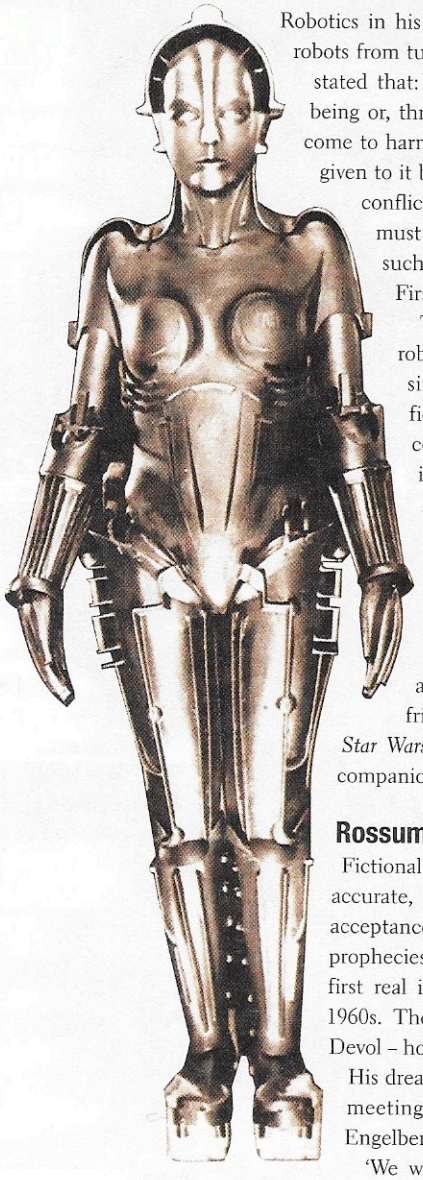
A history of robotics

Sarah Kidner explores our fascination with robots, looks at their past and ponders the robotic future

What have a Czech playwright, 15th century artist Leonardo da Vinci and the future of space travel got in common? The improbable answer is robotics.

The Czech playwright in question is Karel Capek (pronounced Cho'pek), who first coined the term 'robota' in his 1920s play *Rossum's Universal Robot*. The play charts the fortunes of inventor Rossum, who creates mechanical beings to replace humans for some of the more unpalatable jobs on a production line in his factory. The robots take over the world at the play's conclusion. Although the concept of robots has fascinated man since the dawn of intelligent thought, we're going to concentrate on the developments since the term 'robots' was coined.

Isaac Asimov put forward a cautionary view of robots some 20 years after Capek's play when he proposed the Three Laws of ➔



Robotics in his story *Runaround*. Designed to prevent robots from turning on their creators, the Three Laws stated that: first, a robot may not injure a human being or, through inaction, allow a human being to come to harm; second, a robot must obey the orders given to it by human beings (except where it would conflict with the First Law); and third, a robot must protect its own existence (as long as such protection doesn't conflict with the First or Second Law).

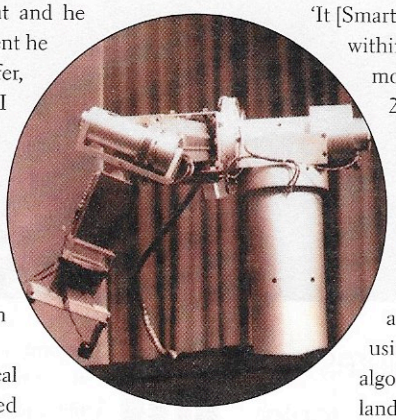
Together, these stories reflect the way robots have penetrated the human psyche since they stepped between science fiction and fact. Robots have been, and continue to be, depicted as a destructive influence in fiction, from Mary Shelley's *Frankenstein*, where the monster turns on its creator, to Stanley Kubrick's *HAL* and more recent examples such as *Terminator* and *The Matrix*, where the machines have once more taken over the world. Asimov also has his disciples, and there are plenty of depictions of friendly, helpful, intelligent robots, such as *Star Wars*' R2D2 and C3PO, *Dr Who*'s faithful companion K9, and *Red Dwarf*'s lovable Kryten.

Rossum's universal reality

Fictional depictions such as these are startlingly accurate, since sci-fi has paved the way for our acceptance of each generation of robots. Capek's prophecies were fulfilled when robots made their first real impression on the factory floor in the 1960s. The inventor – not Rossum, but George Devol – holds the first patent for a robotics device. His dream was realised as the result of a chance meeting with fellow American Joseph Engelberger at a cocktail party in 1956.

'We were chewing the fat and he [Devol] started telling me about a patent he had called Programmed Article Transfer, and I said: 'It sounds like a robot.' I happened to say I was at Columbia University some years after Isaac Asimov and I that was a robotics enthusiast. I always joke and say that, even soberly, the morning after the cocktail party it still sounded like a good idea,' reminisced Engelberger in an interview with *PC Pro*.

Devol's design was for a mechanical arm, but with a twist, recalled Engelberger. 'It imagined technology that would let you program a tool effectively. Instead of saying, 'I have a machine that makes this part, period,' it asked what the people in the factories were doing – taking from here and putting to there. In a stylised world like a factory, you can take a machine, lead it around and it repeats what you taught it,' said Engelberger.



■ **The Stanford Arm blasted robots into outer space.**

Devol's design was brought to life using a series of transistors, big magnetic memory and servo drives which, in his own words, used 'World War II' technology. Engelberger would later form a company called Unimation (Universal Automation) to market the programmable arm. He struck gold in the 1960s, when General Motors licensed the arm to run a die-casting machine.

A die-casting machine is the device that manufactures individual car parts by pouring hot, melted aluminium into a mould. When the die opens up, it reveals a perfectly moulded part, but it's still hot. The Unimate's job was to remove the part, quench it in water and put it into a press. 'That was the first job that any industrial robot performed,' said Engelberger.

Uncharted territory

Reaching the places where human beings can't travel would later propel robotic arms millions of miles away from the factory floor. It started with the creation of the six-jointed, robotic Stanford Arm, the first created exclusively for computerised control. The arm's aim was to emulate human reach, and in 1970 a pair of the arms were mounted on a table and, in concert with a camera, scanned for and stacked objects on the table. Four years later, Stanford University's Professor Scheinman, the arm's inventor, launched Vicarm to take it to market – it was soon to go farther than he could have imagined.

A partnership with NASA saw the Stanford Arm mounted into the Viking I and Viking II landers on missions to Mars. The arm's purpose, together with two 360-degree mounted cameras, was to scan and collect samples from the planet's crust for meteorological, seismological, magnetic and physical analysis. Viking I operated until 1982, when a faulty command resulted in a loss of contact.

Future missions to Mars will also rely on robotics. The Smart Lander, for example, blasts off in 2007 and will be the first device capable of manoeuvring autonomously.

'It [Smart Lander] will be able to manoeuvre to within 5km of its targets, previously the most accurate has been to within 100 to 200km. This will allow scientists to target more hazardous terrain [and] the opportunity to perform "in situ" science,' said Mary Kae Lockwood, a spokesperson for NASA.

This degree of accuracy is owed to the Smart Lander's ability to 'see' and interpret the planet's surface using scanning software and a software algorithm. Once it's found a safe place to land, a parachute, which is able to steer itself into land using its built-in thrusting systems, detaches from the device.

'This is the first time ever that we've been able to manoeuvre in this way. We're using an aerodynamic force to move through the atmosphere and move left and right, and it's all autonomous,' said Lockwood.

In the longer term, we could see robotic 'people' acting

as advance space parties to NASA's $18 billion (£12.5bn) space station. In 1998, robotocist Mark Rosheim presented NASA with an 'anthrobot', or humanoid robot, created from 500-year-old sketches by Leonardo da Vinci shortly before he painted The Last Supper in 1498. It took him five years to bring the sketches to life using a computer program. 'His anatomical drawings are unique and they gave me the information needed to emulate the complex joints and muscles of the human body,' said Rosheim. NASA could use the robotic astronauts to check and repair systems on the space station prior to the arrival of their human counterparts.

Walking with robots

Humanoid robots aren't a new concept. Perhaps the first appearance of a humanoid robot was Electro, who appeared at the 1939 World Trade Fair in New York. Electro danced, counted to ten, smoked and raved about some of Westinghouse's products. Electro also had a dog, which walked, sat on its hind legs and barked (long before Sony's AIBO was a twinkle in its inventor's eye).

In the 1960s, the fair acted as a showcase for Walt Disney's Animatronics, or externally controlled puppets using technology created to put man on the moon: the small valves used in rocket motors and an inertial navigation system.

The legacy of these entertainment robots lives on. Electronics giant Sony joined the robotics revolution in the early 1990s, with the release of AIBO, the robotic pooch now synonymous with robot entertainment. The original AIBO barked, but couldn't hear, cocked its leg without making a mess of the carpet and sulked but wouldn't die – unless it ran out of battery power. It consisted of 18 joints producing 250 types of movement, and could play ball and move its head, body and all of its legs. Since then, Sony has released a second-generation AIBO, the ERS-220, which emits pulsating lights and sound and, when stimulated, goes into Boost mode, illuminating its path with a retractable headlight and becoming more energetic. It's also capable of limited communication responding to up to 75 different voice commands.

In 2001, Sony released a prototype humanoid robot, which stands just 20in tall and performs basic movements such as standing, kicking and dancing. Like the AIBO, Sony's Dream Robot has basic voice and image recognition built in.

Artificial man

Earlier walking robots had a more serious side: to discover more about the human brain. Shakey, for example, emerged from the Stanford Research Institute (now SRI's artificial intelligence centre) in 1972 and differed from Electro in key respects. It was mobile, spatially aware and could move around without bumping into things. Shakey's 'eyes' consisted of a TV camera, and his sense of touch was provided by a series of bump sensors, both of which were connected to his robot brain: DEC PDP-10 and PDP-15 computers. Shakey's software also allowed him to plan routes, turn and to 'remember' where he'd been.

Shakey's influence can be seen today in robots such as Carnegie Mellon University's tour guide, Minerva. The robot roams autonomously through the daily crowds at the Smithsonian's National Museum of American history and perceives her surroundings through cameras, laser range finders and ultrasonic sensors: this information is interpreted by on-board computers. Minerva actively approaches visitors to the museum, offers tours and leads them from exhibit to exhibit. When she's happy, she smiles and sings at people; however, if her way becomes blocked too often, she can, like us, become frustrated and will frown and honk her horn.

Shakey was closely followed, in 1974, by a life-size, humanoid robot called WABOT-1, created by Tokyo's Waseda University (WAseda roBOT). WABOT-1 had limb control, a vision system and a conversation system, and was capable of holding a conversation in Japanese. It could also measure distances and directions to objects using external receptors, artificial ears and eyes and an artificial mouth. By 1984, Waseda had produced WABOT-2, which read music and plays an electronic organ at the Tsukuba Science Expo.

These robots were the product of a new field of research: Artificial Intelligence (AI). Alan M Turing inspired the field of AI in 1950 when he published his,

Robotic timeline

Robots have obsessed man since time began, understandably, according to American robotic expert Mark Rosheim. The challenge to make something that imitates a life form goes back to the dawn of man. 'It's the maternal instinct coming out – men can't have babies and this is the closest that we can get to making life forms,' he said. Pinpointing the dawn of robotics is, indeed, an impossible task, but after some digging in the archives *PC Pro* has unearthed some of the key turning points in the evolution of mechanoid man.

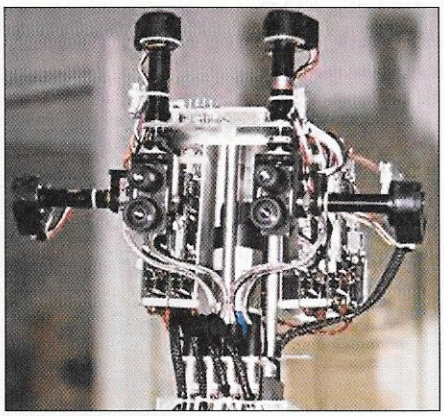
1921 The term 'robot' is first used in a play called *Rossum's Universal Robots*.
1939 Move over AIBO: New York's World Trade Fair plays host to a robotic man and dog.
1942 Isaac Asimov writes *Runaround* and proposes the Three Laws of Robotics.
1956 A historic meeting at a cocktail party is the catalyst for factory automation.
1950 Alan M Turing's paper prompts the search for artificial life.
1959 MIT establishes its AI Lab, which will eventually give birth to Cog.
1963 Stanford University forms an AI Lab, the birthplace of Shakey.
1965 Carnegie Mellon University creates the Robotics Institute.
1968 Kawasaki Heavy Industries licenses a robotic arm, prompting a robotics explosion.
1968 Shakey, the first intelligent mobile robot, arrives.
1976 Robot arms blast off into space on the Viking missions to Mars.
1986 Honda launches a project for a humanoid robot.
1993 MIT begins building Cog, which is being raised and educated like a human.
1996 Honda unveils the P-2, a prototype of its walking robot.
1998 NASA is presented with a humanoid astronaut, which could eventually travel to Mars.
2003 NASA plans to send two separate robot missions to Mars.
2007 NASA's Smart Lander could launch on mission to Mars.

Future missions to Mars will rely on robotics

➔

For interaction, it's good to have something that looks vaguely human [because] we rely on social cues for communication

now famous, paper *Computing Machinery and Intelligence*, which posed the question: 'Can machines think?' In the paper, he describes a way in which humans can test the level of artificial intelligence in a machine, known today as the Turing Test. In its most basic form, a human judge sits at a computer posing written questions. The judge must then decide whether they're communicating with another human being or an AI program.



■ **Cog's ultimate aim is to promote human communication with computers, by being as lifelike as possible.**

One of the early products of his paper was the now equally famous AI Laboratory at the Massachusetts Institute of Technology. The Lab is responsible for Cog, an ongoing project to create a mechanical torso that's as human-like as possible. Cog already has an artificial 'skeleton' comprised of more than 20 actuated joints, and twice as many sensors, ranging from torque sensors on motors to the four cameras composing the eyes. The aim is to create an artificial 'nervous system' for Cog, so that it can recognise which of the impulses from its 'brain' controls functions such as moving an arm or leg. Once Cog has learnt this, it's hoped it will be able to move its limbs based on the desired effect.

Humanoid home help?

But there's another, equally important, purpose to making humanoids such as Cog 'human' – interaction with other human beings. 'For human/robot interaction, it's good to have something that looks vaguely human [because] we rely on social cues for communication,' said Chuck Thorpe, a robotics expert from CMU. This premise is the basis of CMU's nursing robot Flo (after Florence Nightingale), which has a 'face' that's designed to show emotions. The eyes double as cameras, which can process and relay images from an elderly person's home over the Internet. She also has a touch-screen mounted at the right height for someone seated.

'One of the advantages of such a robot is that it has a thick skin; many people become cantankerous when they reach their eighties,' said Engelberger, whose latest cause célèbre is to create a robotic home help. 'Many elderly people have someone living with them, but will still try to move from the television to go to the bathroom by themselves. If you had a robot, you wouldn't care how many times you asked them to help you to the bathroom,' said Engelberger.

Such a robot would also demand less financial and emotional consideration than a human being. 'In the US, it would rent at the same price as an upscale automobile – around $500 (£347) per month – and work 24 hours a day. That's less than a dollar an hour for the robot. I had someone live with my mother and it cost $140 (£97) per day and you have to give them eight hours off, transportation and clothe and feed them,' he added.

Japanese giant Honda has been working to realise such a vision since 1986, when it began research on the Honda Asimo. Since the robot had to be capable of moving through furnished rooms and going up and downstairs, a key part of the project focused on the way in which the machine would walk. The result was iWalk (intelligent Real-time Flexible Walking) technology, which, like Cog, is capable of 'predicted movement control'.

Honda finally released the first working version of the Asimo, a 6ft, 462lb Honda Asimo, in 2000, and it could walk forwards and backwards, climb stairs, keep its balance if given a shove, and respond to voice and radio commands.

Back to the factory floor

Humanoid robots could also take robotics back to the factory floor in the 21st century. 'There's a very pragmatic engineering reason to build humanoid robots, and that's because most of our environment has been designed for humans. If you want a robot to go up and down walkways in a nuclear power plant, then it's reasonable to design it about the same size and shape as a human,' said Thorpe.

'What seems to be happening is that two different

Robot fact and fiction

Perhaps the ultimate – and original – robot story is the play *Rossum's Universal Robots*, created by Karel Capek. The play begins with the idealistic Helena arriving at the Rossum's remote island factory on a mission to liberate the robots, which can remember everything but think of nothing new, and convinces a scientist to moderate the robots so that their 'souls' can develop. The robots issue a decree to wipe out the human race, leaving Alquist – the only human left at the factory who continues to work with his hands.

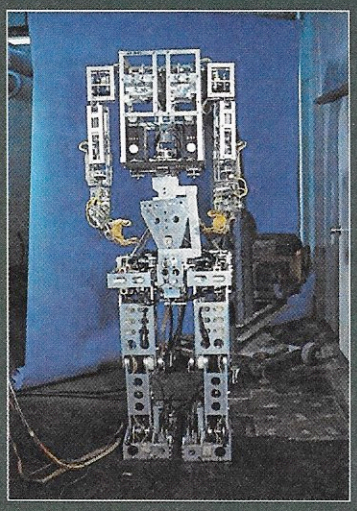
The play is historic for many reasons, not least because it was responsible for coining the word 'robota' or robot. Secondly, it reflects human's inherent fear of being replaced by humanoid robots, and correctly anticipates that robots will first appear on the factory floor. It also correctly predicts the notion of artificial intelligence; that robots can develop a 'soul'. Popular fiction replies to this 'warning' in the 1940s, when Isaac Asimov puts forward his Three Laws of Robotics in the story *Runaround*, which are intended to prevent robots, now increasingly likely to become reality, from turning on their creators.

By the 1960s and 1970s, robots had adopted a humanoid shape and were reaching outer space in Arthur C Clarke's *A Space Odyssey*, and in *Star Wars* in the form of android C3PO and the mobile robot R2D2. The timing coincides with the emergence of the first intelligent robot and NASA's Viking missions to Mars.

In this millennium, fictional images of robots have been turned on their heads, as cloning and genetic engineering become an actuality. The obvious example is Stephen Spielberg's *AI*, where a young boy discovers he is a robot. Whether this is another prophetic vision by the movie world remains to be seen.

Japanese giants

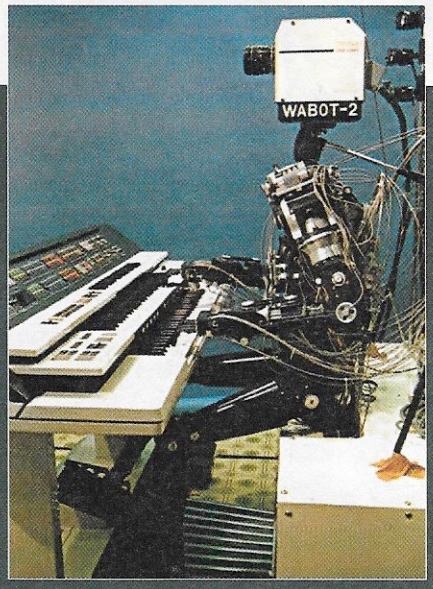
Japanese fiction, like the rest of the world, has a long history of flirtation with robots. There is, however, one key difference in that Japanese fiction has tended to portray robots fighting for the peace and justice of humankind, such as *Tetsuwan Atomu* (Mighty Atom). Created in 1951, Tetsuwan was a robot schoolboy with searchlight eyes and rocket propeller feet, who used his powers to fight everyday villains. In 1970, Doraemon was born, a robot cat, which was the faithful companion to an average schoolboy and produced sci-fi curiosities from his fourth dimensional pocket. In real life, there's also evidence of a long-standing fascination with mechanical dolls, which the Japanese have made since the 17th century.



■ WABOT-1 was one of the first walking robots and a pioneer of the Japanese robotics revolution.

Despite this, Japan was a relatively late starter in investing in robotics research. The spark that lit the flame was the licensing of Joseph Engelberger's Unimate robotic arm to Kawasaki Heavy Industries and a visit to the country by Engelberger. 'It was the first time I ever flew first class: they gave me a great tour of the country and I saw all the shrines, and finally I went to a meeting where they had 500 executives of Japanese industry,' he recalled. 'The Japanese people are very polite and they said 'what if no-one asks a question – that would be embarrassing?' So they made me make up some questions and put them on little slips of paper so they could bring them to me. As it happened, I started at 1:30 and the questions were so heavy they dragged me off at 5:30,' added Engelberger.

The Japanese were swift to act on this burst of enthusiasm, and formed a Japan Industrial Robot Association following Engelberger's visit. 'They got a top executive from Mitsubishi to be the titular head of their society, and I couldn't get anyone from General Motors or IBM or any of the big companies to give their name,' said Engelberger.



■ Waseda's second-generation WABOT-2 talked and played the piano.

The groundwork paid off and in 1974 the WABOT-1 appeared, closely followed by WABOT-2 and investments by electronics giants such as Honda and Sony. Today, Japan is the robotics capital of the world.

'The Japanese interest blossomed so much faster than European and US interest. They had a lot of things going for them, because there was no unemployment and they didn't like to admit foreigners, early retirement and a culture that had already seen a lot of robots in their movies. All of this set the scene for them, and today the Japanese still control 65 or 70 per cent of the industry,' said Engelberger.

paths are converging. The Honda robot is the child of two parents: one is the industrial robot and the other is the entertainment robot. I see it going in both paths – eventually it could evolve into a factory robot that's very humanoid, or it could take its place in the home,' agreed Rosheim.

Does this mean we're on the brink of Capek's vision being realised? Will robots replace workers on the factory floor, or care workers in the home? Could they even, eventually, revolt and rule the world? There's no simple answer. Robots have already replaced workers for some of the more dangerous jobs in factories, such as spray painting and die-casting. Robots are also, in some respects, already procreating, as they take over in the clean rooms of electronic factories where impurities such as human hair and skin would ruin the manufacturing process.

Putting a robot in the home is a harder task still. 'A factory is a very structured environment, unlike the home, which would require a very smart and dexterous robot,' said Rosheim.

Engelberger is more optimistic. 'Today, voice recognition is pretty advanced, and with two arms and pretty good artificial vision I could sit in the living room and tell my robot 'please get me a beer', and be fairly confident it would come back with beer rather than milk. In the US, 90 per cent of everything is barcoded and robots can read barcodes easily, so we could have the robot take deliveries, order things from the stores, put them away in cabinets, cook recipes and be generally useful,' he said.

We may well see robots at work and at home, but as for taking over the world artificial intelligence is still literally in its infancy; Waseda's piano-playing robot, the WABOT-2, still only equates to a mental age of around two. Similarly, Cog wouldn't pass the Turing test, still considered the benchmark for machine intelligence. A newer, experimental field of research is looking to give machines emotions, but as yet has had few real results. For the time being, machines have little desire for world domination, and even if they did it's unlikely they would be successful. It will be some time before we're threatened by Capek's vision of robots, or need to deploy Asimov's Law of Robotics for the preservation of mankind. ○

NEXT PC PRO ISSUE
Next month: *build your own robot*

War of the Web

International terrorists are turning to the Web to wage guerrilla warfare. Is this the future of war? Sarah Kidner investigates

Techno-terrorists are attacking. In 1995, 54 Serbian sympathisers attacked the ATM (Asynchronous Transfer Mode) network under installation in Croatia. Around a year later, the Provisional IRA planted a bomb to knock out the electrical substations supplying central London. At the end of last year, Palestinian and Israeli cyber-terrorists engaged in a vicious Internet battle that resulted in the theft and public posting of a database containing the personal information of 700 members of the American Israeli Public Affairs Commission.

More recently, the Cold War was reborn on the Net as Chinese and US supporters vented their anger over the crash landing of the US' P-3 spy plane in China and the holding of the crew. Pro-Chinese supporters broke through the defences of at least six US government sites, including www.whitehouse.gov and the official site of the US Navy, and posted a worm that automatically defaced over 8,500 servers and could still be in the wild.

Governments are scared. These high-tech international conflicts are beyond their control: the cyber-terrorists answer to no-one. 'Anyone can start a war if they've got the skills, [and] that democratisation of the right to wage war is something that's frightening for governments,' said Alistair Kelman, visiting fellow for the London School of Economics' computer security research centre.

What's more, the groups are capable of highly organised attacks. 'Chinese hacking is still quite young, [but] the attack was extremely well co-ordinated by the Chinese. If they'd been more organised and more malicious it could have been a very bad experience. There was also a great deal of opportunity for someone more malicious to sneak under the radar while we weren't looking and cause some serious damage,' said Michael Cheek, director of intelligence production for security consultant iDefense.

Cracks in the Whitehouse defences reveal the vulnerability of governments to attack. 'Whitehouse.gov is essentially a promotional site, but there were a number of other sites that could have had better security. Organisations should be vigilant in all walls and all links. The fact that some sites were hacked into shows that they were the weakest link,' said Cheek.

Similarly, organised attacks on commercial Web sites represent a serious threat to the economy. 'Economic attacks sap the lifeblood of the economy and have the potential for significant impact, not only on tax revenues but also on economic confidence in the UK as a safe, secure trading location,' said a spokesperson for DERA (Defence Evaluation and Research Centre).

More organised attacks are inevitable. 'The attacks by Chinese sympathisers following the P-3 aircraft incident were at the nuisance level because of poor targeting based on limited intelligence. However, as open-source intelligence capabilities grow, attacks of this nature will become more effective. This is probably about five years away,' said the DERA spokesperson.

Electronic warfare on a larger scale will also come from the military as it embraces technology as a weapon. 'China has bought into the idea of using information technology in the battle zone [and it] has a highly developed cyber-warfare ability. It's developed DDoS [Distributed Denial of Service] attacks that can gain access to enemy systems,' said Ian Synge, managing editor of Jane's Information Group. 'Penetration aids, systems that can deny service and give malicious access to the power network and shut down power stations – these are things the military is very interested in now. More and more the traditional military is relying on information flow in the battlefield,' he added.

It's a threat that the UK is taking seriously. The government-founded NISCC (National Infrastructure Security Co-ordination Centre), the IAAC (Information Assurance Advisory Council) and DERA are all developing electronic defences. DERA, for example, has developed an early warning system to alert users to email viruses and prevent them from spreading. Called ::Mail, the email plug-in presents users with a pop-up menu every time they're about to send an email, asking them if they really want to send the email.

The next war *will* be fought with high technology, and cyber-warfare will be just one component. 'DERA sees information warfare as being one component of an overall information campaign that may be waged against us, for example, to convince our leaders to change their policies. The IW component would focus on CND (Computer Network Defence), which is directed at the protection of those IT systems supporting business processes that are critical to the functioning of the nation,' said the DERA spokesperson. 'There are portable devices that can emit electromagnetic pulses and blow up all the computers in the area,' said Kelman.

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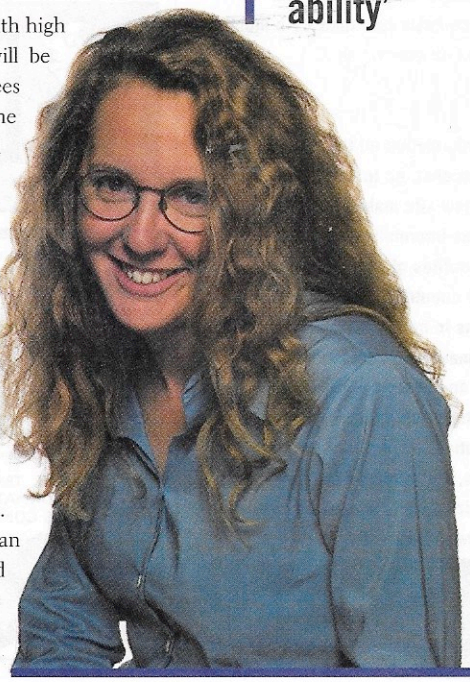
'China has bought into the idea of using information technology in the battle zone [and it] has a highly developed cyber-warfare ability'



NEWS ANALYSIS

The cooling in the Microsoft/Intel alliance is good news for the industry and end users, argues Sarah Kidner

The Wintel of discontent

It is official – the temperature is plummeting, the Christmas displays are already in the shops and soon the only daylight I am likely to see will be in my lunch hour. I am facing another winter of discontent and I am not alone. All the signs are that the famed special relationship between Microsoft and Intel is also facing the big chill. Could this be the beginning of the Wintel of discontent?

Recent scrutiny of Microsoft and Intel by the US Department of Justice has led to a ridge of high-pressure building between the two. A leaked Intel memo reportedly accuses Microsoft of putting pressure on Intel to drop its work on a key Java development that Sun believed would pose opposition to Microsoft. The memo is now expected to form a key part of the DoJ's case against Microsoft.

The revelation has led to speculation that Bill Gates holds the upper hand in the famed Intel-Microsoft relationship. Others, however, see it as the start of a concerted pull away from the partnership by Intel. 'In recent months Intel has shown a greater deal of independence from Microsoft. Intel is thinking to itself there is no reason why we should let Microsoft push us around,' says Tony Clifford-Winters, senior research analyst for Bloor Research.

Intel is certainly showing signs of discontent with the Wintel alliance. Speaking behind closed doors at the annual Intel Developers Forum, the company's senior VP Albert Yu confided in delegates that, 'NT still has a long way to go.' Another tongue-in-cheek comment from Intel's Pat Gelsinger also speaks volumes: 'Let's pretend for a minute we are not all Microsoft cynics,' he says.

Intel is asserting its independence. Nowhere is that more apparent than in the server arena where the company is backing a series of initiatives that could lead to a renewed fervour for operating systems such as Unix. One such initiative is a project dubbed UDI (uniform device driver interface).

The project backed by Intel along with other members of the Unix community will effectively enable the industry to write a single device driver for any Unix operating system and could increase the popularity of Unix as an OS. 'This will significantly improve the availability of devices supported by the Unix operating systems, provide for a more standard, more robust device interface and device environment,' says John Miner, corporate VP and general manager for Intel's enterprise server group.

More telling perhaps is Intel's recent investment (notably alongside a similar investment by Netscape) in Linux vendor Red Hat Software (see *p51*). It is the first time that the chip giant has ever invested in any operating system company – a move that is likely to boost the acceptance of Linux in large enterprises. Added to that, the source code for the UDI environment will be available to the Linux community allowing developers to support customers 'who would like to have a choice of operating systems in enterprise computing,' says Miner.

> ***All the signs are that the famed special relationship between Microsoft and Intel is facing the big chill***

And there is no guarantee of a Wintel platform in the burgeoning handheld arena either. Intel has signalled its interest in the PDA arena with its recent acquisition of the StrongARM chip architecture, and there is no guarantee that when it does move into this market it will be backing CE.

Intel chief executive Craig Barrett is reportedly hedging his bets between CE and Psion spin-off Symbian. In the meantime, Microsoft has been running CE on non-Intel chips such as MIPs and Hitachi's SH series.

The simple truth is that Microsoft and Intel are no longer dependent on each other for their future success. With Merced still waiting in the wings, and following Compaq's acquisition of Digital, Microsoft is looking to Alpha as a possible platform for NT 5. Microsoft has already included support for Alpha within the NT 5 OS.

'By the time Intel ships Merced, Alpha will be running at two and a half times the performance and we are expecting it [Alpha] to be 50 per cent cheaper as it is a mature architecture,' says Richard George in charge of Compaq's Alpha processor in the UK.

Likewise, with the growth of low-end, application-specific devices, Microsoft's Windows platform is increasingly running on non-Intel processors. Acer's Stan Shih, for example, has been extolling the virtues of his concept for an application-specific XC that will run on x86 platforms and won't necessarily need the super-fast processing power of an Intel chip. In fact, it is a concept that is very similar to National Semiconductor's vision of a 'PC on a chip'.

Will there be a split in the Wintel alliance? In reality, it is unlikely but we are probably going to see the term Wintel bandied around less in the future. Sun Microsystems already bans the use of the term Wintel within its own organisation on the basis that the two are not a single company but are separate organisations with their own futures to think about. In the words of Andy Grove, 'we did not go to the altar, never swore allegiance or anything like that.'

And that can only be good news for PC manufacturers and end users. With more choice in the market there is less chance that they will be tied into Intel's ever decreasing technology cycles and Microsoft's constant upgrade cycles and hefty licensing fees.

As for my own winter of discontent, I'm planning on unpacking my winter duvet, breaking open the Baileys and making the most of my lunch hour daylight.