Cybernetics evoke visions of a distant future in which human beings have been relegated to a quaint reminder of the natural world. Christopher Rye looks ahead with Professor Kevin Warwick, leading light in the merging of man and machine.

The cyberman cometh

Welcome to the wired world of Kevin Warwick, Reading University's professor of cybernetics, occasional forecaster of the death of mankind — and the Man with the Chip in his Arm. "Cybernetics is all about humans and technology interacting," he explains.

The famous chip in question resembles a glass pill; much the same size and shape as a vitamin capsule, but not as good for you. "I'm an interface man," says Warwick. "The implant in my arm is an identifier. As I pass through different doorways, the building recognises me and lets me in. It's like a more permanent form of smartcard."

The professor's cyberpill contains three silicon chips and an electromagnetic coil to power them, which is activated by radiowaves from intelligent devices dotted about the cybernetics building. (An effect discovered by Michael Farraday many years ago.) The chip transmits a 64-bit signal. In some ways similar to the smartcard technology pioneered by the likes of Bull (now used by the French health service to allow patients to visit any doctor), Warwick's implant contains ID information, allowing him access to appropriate parts of the building. Hidden speakers greet him by name as he enters rooms, and the same technology can be used to activate facilities such as PCs, heaters and talking information points in accordance with his security clearance.

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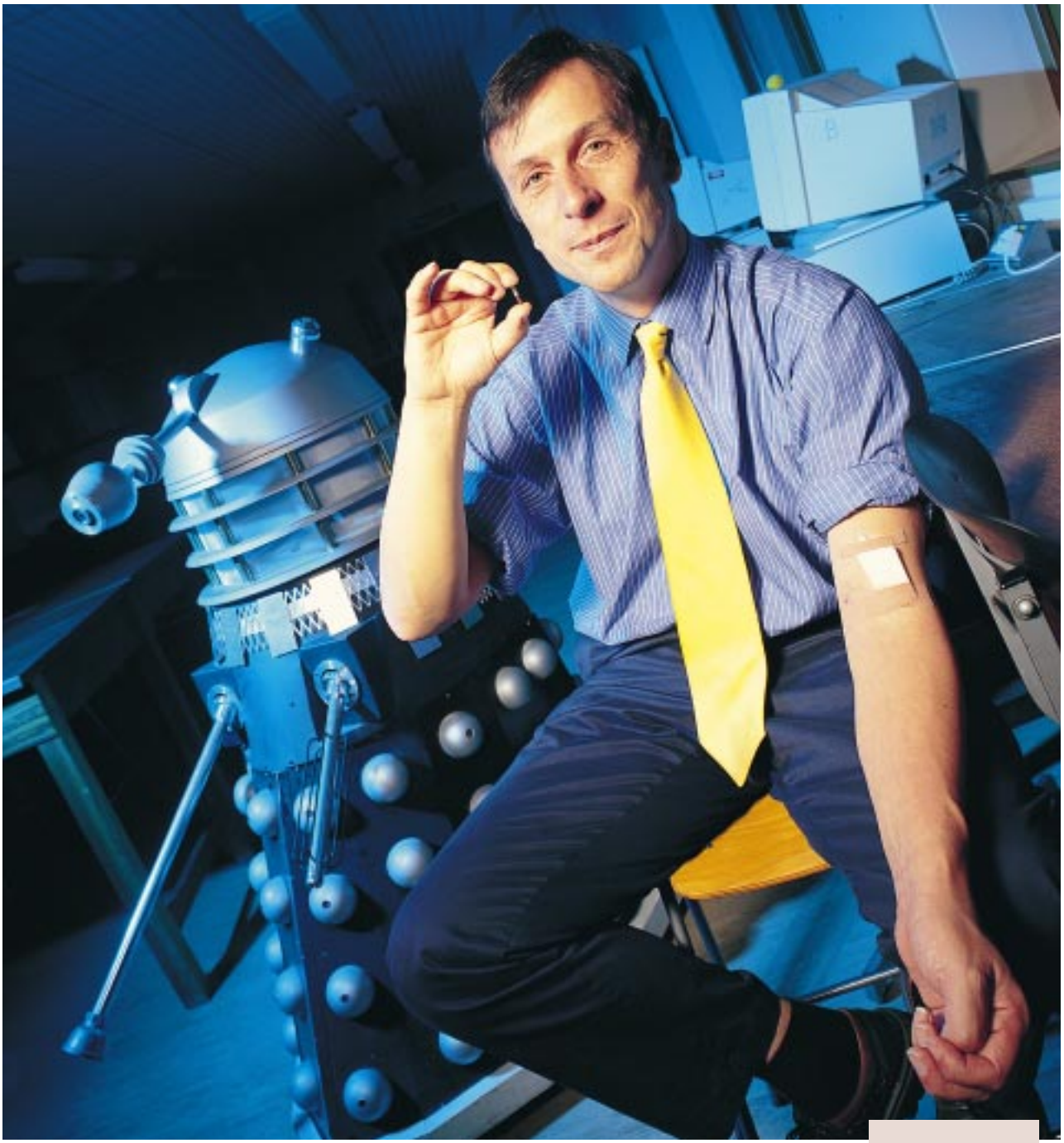
In the short term, it's a cost-saving device, a security tag and an ID card, all rolled into one innocuous-looking capsule. It holds information like, Kevin Warwick comes from Coventry, the place people are normally sent to. He was born there in 1954. Appropriately enough, he held positions at Warwick University, as well as Oxford and Newcastle, before joining Reading a decade ago. This followed a spell with BT as a school leaver, then quitting to take a first degree at Aston followed by a PhD and research post at Imperial College, London.

And Professor Warwick is nothing if not a publicist, both for his own research and, to be fair, the work of the university and its students.

In the cybernetics laboratory are a Dalek (a roving fire extinguisher), a crouching robot cat and a cybernetic yo-yo machine. Quaint or not, the machines' young creators are researching the world around them as they play, and their attempts to create anthropomorphic devices may lead them to question whether machines should "ape" mankind at all. Nevertheless, these primeval-looking robots (and primeval is the right word) could be the forerunners of a new master race, if some of Warwick's more apocalyptic pronouncements are correct. None other than Gillian Anderson, of X-Files fame, has named Professor Warwick the leading prophet of the robot age, much to the delight of conspiracy theorists. What is certain is, he has become established as Britain's foremost proponent of artificial lifeforms and computer intelligence, predicting a grim future for mankind in books such as *March of the Machines* and his new title *In the Mind of the Machine*. Both deal with preparing us for a T2-style future in which super-intelligent devices have relegated Man to number two on the evolutionary scale, thanks to his own efforts. Man's, that is. Or perhaps Professor Warwick's?

"People have been talking about computers becoming more intelligent than Man for years. That's all sci-fi authors have been writing about. But no-one had blasted ahead and actually done it. Pushing back the frontiers of machine intelligence: that's what I'm doing today."



Photograph by Phil Curtin

▲**The Man with the Chip in his Arm: Professor Warwick believes that the implant 'is a step in the right direction of merging humans and technology'**

Part of Warwick's work is aimed at researching the implications of a future where intelligent devices, via networks, educate themselves and share information as a collective, but which respond to humans on an individual basis, thanks to what they've learned about us already, and ID devices such as the intelligent implant.

In fact, most of the elements Warwick has been "warning" us about for years are now in place: the internet, intranets and extranets; mobile devices, and technologies such as neural networks (which learn from their mistakes), intelligent agents and chatterbots (web-based software robots you can converse with) already roam the network. All that is missing is for the machines to begin teaching each other, and take over the burden of designing their replacements.

"We've already built an autonomous, roaming robot which updated an identical robot in New York via the internet with what it had learned about its environment. The beginnings of machine conversing independently with machine are here today. The implant is a step in the right direction of merging humans and technology," he says.

The "right direction" Warwick refers to is his research into a more seamless interface between man and machine, such as his experiments with intelligent buildings. These buildings could include your home and/or office , and are part of a Europe-wide programme the University is leading. Intelligent buildings know your name and your location, and share data from one device to the next via an internal network or intranet, allowing them to interact more closely with us (on a first-name basis) by understanding our needs or preferences.

Just imagine for a moment that your office or home is more intelligent than you are.

You stumble in after a night on the town and try to locate the light switch, only to find a message saying, "Your dimmer's in the dog".

"The short-term question is, why have separate networks?" says Warwick. "We have a phone system, TV and radio, the internet offering pseudo real-time pictures... it's no longer feasible. Meanwhile, your PC sits there, inanimate: you have to sit at it and type into it. But if you have an in-built interface with it, like this implant, you could simply write letters in the air, which your PC could interpret and type for you. It's intuitive computing, not typing."

But Warwick's motivation, he says, is to knock down the physical barriers between Man and machine, so when the day comes that computers finally overtake Man in intelligence (some estimates put it at 10 years, others say it's already happened), we will have far greater control over them by having a direct link at biological level – part of us will be machine.

"I believe the human brain is just a physical thing," says the professor. "I'm not someone who believes there's a magic bit of 'oofle dust' that makes us conscious, so there is no reason why machines should not be more intelligent than us very quickly. It's a matter of processing power.

"And ultimately, our thought processes may control our computers. Our DNA, our genes, that's just our initial programming. Our earliest childhood experiences add a little more. There's nothing else to it."

But even if you accept this reductive view of human life (which has the advantage, for scientists, of permitting every type of research), surely implanting technology into the brain is the ultimate intrusion into people's sense of privacy and identity? Could a computer, for example, understand the difference between our everyday thoughts and our fantasies?

"Obviously," says Warwick, "there's the Big Brother problem of the whole process going the other way – of the network reading people's minds. But the mistake people make is in assuming computers have to be implanted into the brain. You could implant them anywhere."

BT's "futurologist", Ian Pearson, has talked about complementing our "limited" human intelligence with microchips. But, do we know enough about the way the human mind works to contemplate this level of interaction?

"We need to know enough medically to make the implant. My chip, for example, had to be put in by a doctor during a surgical operation. People don't necessarily want that. It's also made of glass, and there's a risk it might start moving around in my body, so it has to be taken out.

"But a lot of this research is happening outside cybernetics, such as experiments into 'rewiring' the nervous system for people who have been incapacitated by a serious accident. We can teach these people to use their bodies in new ways, such as how to operate an artificial arm with muscle movements."

Disability is a favourite theme. Here is a market for more creative uses of Warwick's intelligent-implant technology. Intelligent implants, smartcards or even tags could quite literally open doors for people, and at least part of the intelligent-buildings research proposes interactive signs that light up and speak as you pass.

It's encouraging he accepts that using an implant as both ID and tracking device is a far more attractive proposition to the type of corporation (or military concern) that often stumps up the cash for research.

A speaker at the recent TUC conference complained about helpdesk operators being enslaved to the technology, forcing them to take call after call. Companies can already monitor their employees' PC keystrokes. But many advances in computing today are democratic ones – the PC, the internet, even the mobile phone. The Prime Minister has talked about an "online democracy". So isn't the professor concerned his research could lead to less democracy and less equality, by putting greater instruments of social control in the hands of business?

"You're right there could be big positives for business in the beginning. They would be the first adopters and they may use it to control their staff. But I, as an individual, only saw the positive for other individuals. That there had to be some benefit for the rest of us." So is big business or the military funding his experiments? He looks sheepish. "We have our fair share of, er, little windfalls," he laughs. "I have to be careful what I say about these things. But I can put my hand on my heart and say, no, the military hasn't funded this project." Back in the laboratory, he demonstrates Roverr [sic], a robot on wheels that resembles a collision between a bicycle and a dustbin. It was designed by one of his undergraduates to run the Bracknell half-marathon by following in the professor's footsteps as he ran ahead wearing an ultraviolet-emitting belt. Unfortunately, the student hadn't banked on sunshine confusing the robot's UV sensors. "It followed the sun, rather than me, and crashed into the pavement," says Warwick.

Maybe the future is in safe hands after all.

The human brain is just a physical thing ... so there is no reason why machines SHOULD NOT BE MORE INTELLIGENT THAN US very quickly

● Kevin Warwick's *In the Mind of the Machine* is out now in paperback, published by Arrow.