Dreaming of Cyborgs, Sex, and Catastrophe:
Warwick's rush to the brink (and a note on Clayton's 'policy arena')

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> 'This is the extraordinary story of my adventure
> as the first human entering into a Cyber World; a
> world which will, most likely, become the next
> evolutionary step for humankind.'
> Kevin Warwick, *I, Cyborg*[1]

'Android Video' records a conversation between Hiroshi Ishiguro (a computer scientist from Osaka University), Repliee Q1 (a 'female' android) and Robert Epstein (an American psychologist).[2] With a face modelled after a Japanese TV host, Q1 has been described as 'the most human-looking robot yet' and as one of the most beautiful (**see fig. 1**).[3] In 'Android Video', Ishiguro presents himself as the android's creator, Q1 rehearses her behavioural routines, while Epstein is on a date. As he recalls in an article entitled 'My date with a Robot':

> I put on my Sunday best – and my thinking cap, of course – and entered Ishiguro's laboratory with butterflies in my stomach. And, no, I am not kidding about that. I really was nervous, in part because I was getting a glimpse of the future and in part because I would be visiting a lovely humanlike female.[4]

The video begins with the action well underway: the tour of the lab has been completed (during which Epstein stumbled across a discarded android, 'a perfect replica of [Ishiguro's] four-year-old daughter'), and with preliminary introductions over a more detailed examination of Q1 begins. The android takes centre stage: she flutters her eyelids, looks to the left and right, gestures with her arms, smiles on occasion and even appears to breathe. Her suitor is not interested in what Q1 is saying, perhaps because she can offer only what she has been programmed to say. He is much more interested in the mechanisms, triumphs and shortcomings of her body.

Epstein and Ishiguro stand between Q1 and the camera, and are for much of the video just beyond the camera's field of vision. Apart from one brief moment when the camera pans back, we catch glimpses only of their arms as they point towards one of the android's components, or their heads as they lean forward to look more closely at her body. Speaking in English while Q1 persists in Japanese, they

discuss her eyes, lips and motorised movements; the wear and tear on key parts; and a new creation, Ishiguro's robot-double, which he plans to seat at his desk at Osaka University so he need never again go to work.

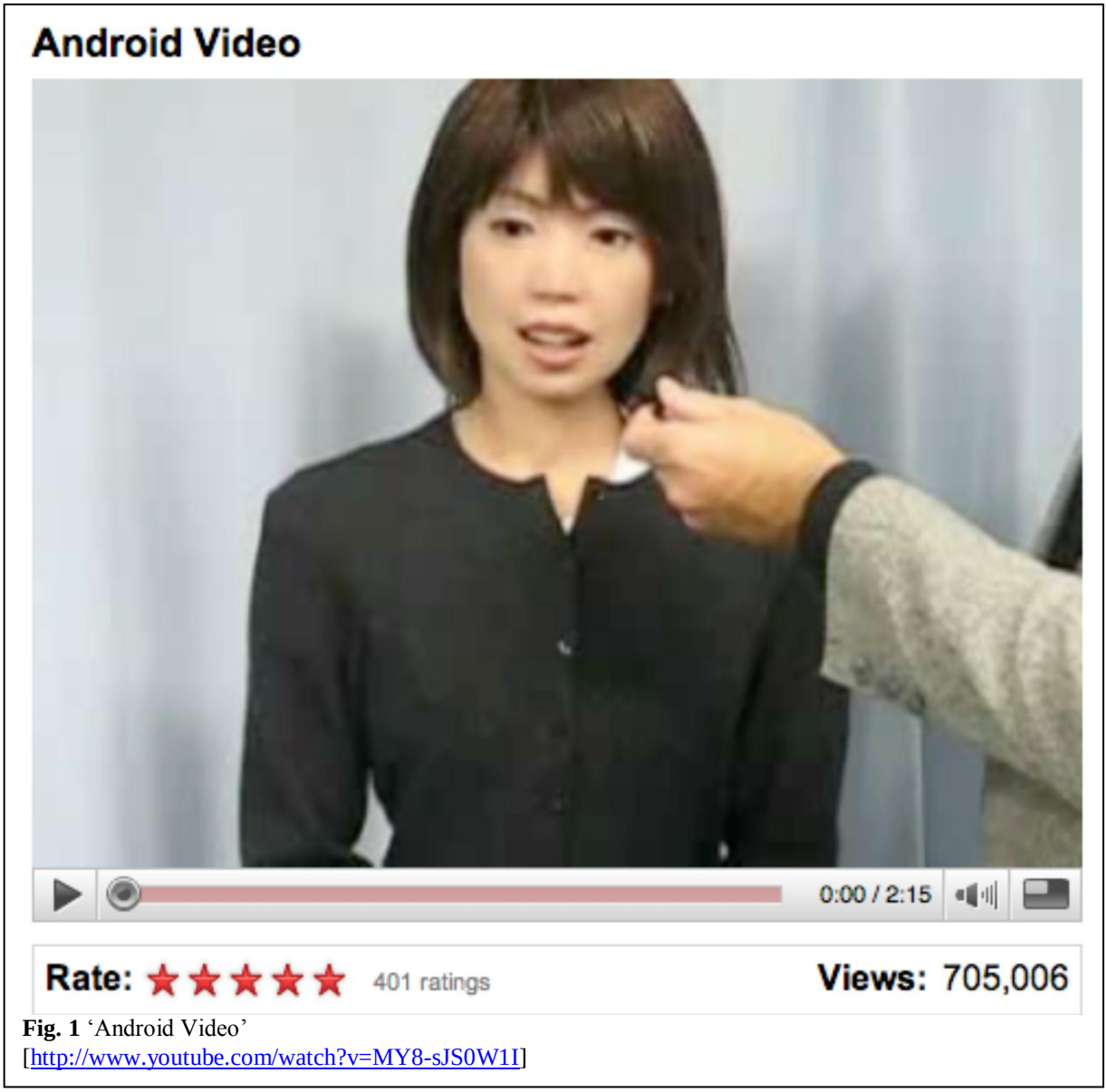

Fig. 1 'Android Video'
[http://www.youtube.com/watch?v=MY8-sJS0W1I]

As Epstein prepares to leave, he says to Ishiguro in a voice of quiet amazement (beginning with an echo of Frankenstein's cry, when he discovers that his monstrous creation is alive):[5]

> So maybe you'll see it ... but she'll be alive ... she'll be alive. ... But you see the problem is, what happens *after* the singularity ... and no-one seems to know that ... a lot of people think about this but they don't

> know, because if we do reach the point of the singularity everything changes, everything changes, everything changes the next day ... everything ...

The word 'singularity' here refers to three closely related ideas, popularised recently by Ray Kurzweil in *The Singularity is Near: When Humans Transcend Biology* (2005).[6] First, in the very near future we will have the means to design 'super-intelligent' machines. Second, once created these machines will quickly become many times more intelligent than their creators. And third, this development will bring humanity to a crossroads: either we become a subordinate species dominated by the machines or we must merge with them. As Kurzweil breathlessly explains, if we choose the latter course humanity will regain its rightful place at the centre of things: technological evolution, Kurzweil proclaims, will 'continue until the entire universe is at our fingertips'.[7] Our short video has unexpectedly assumed an apocalyptic tone. What began as a straightforward flirtation with an android is now carrying a lot of baggage.

From the moment Epstein announces that he has to leave, a close-up of Q1's face fills the screen. We first see a 45-degree shot of the left-hand side of her face, next a left profile, and then her face turned towards the camera. She now looks directly into the eyes of the viewer and then beyond us. As if proleptically rehearsing the assumption of the biological by the machinic body, during this closing section of the video we can hear Epstein but not see his (or Ishiguro's) body. Q1 smiles knowingly; her eyelids slowly open and close a number of times; she looks to the left and right, and leans slightly forward.

If she were alive and conscious would she welcome Epstein's disregard for her present and love for her future (more accomplished) self? In this strange reworking of the Pygmalion myth Q1's body is shaped, brought to life and instructed by the computer scientist (a modern incarnation of the artist); however it is the suitor rather than her creator who falls in love with her, and he wants an unusual kind of sex. When two people marry they symbolically become 'one', and sexual intercourse is sometimes described as an experience in which two become one, but this suitor hopes one day permanently to inhabit his lover's body, to

become a homunculus within an infinite machine. Love is here driven by the suitor's hope that he can 'augment [his] own intelligence through intimate connection' with machines.[8]

Kurzweil is confident that the singularity is near, no more than 20 or 30 years away, but where does the pre-history of this evolutionary leap begin? When the sacred books of the Cyborgs are written, their authors will no doubt nominate Charles Babbage's invention in 1834 of the 'Analytical Engine', an automatic calculating machine that is arguably the world's first computer, as marking the genesis of their world.[9] The role of John the Baptist crying in the wilderness might be played by Ray Kurzweil or Hans Moravec, as both predicted in 1989 that, in the twenty-first century, human intelligence would be surpassed by machines.[10] But who will be thought to have taken the first step from the human into a Cyber World?

If you are a devoted reader of *Wired* magazine the answer to this question should be obvious. The first tentative steps into a Cyber World were announced in the February 2000 edition of that magazine, just one month into the new century and the new millennium. In April of the previous year *Wired* was selling a different story. The stark black-and-white front cover carried the title 'LIGHTS OUT: Learning to love Y2K' and one of the lead articles contemplated the possibility that in the first moments of the new millennium the world would grind to a halt.[11] 'Powerless', by Jacques Leslie, begins by asking 'What happens at 00:00:01 on January 1?' The answer, provided in the next sentence is: 'Try deadly, black, and very very cold'.[12]

To the surprise of many, on 1 January 2000, '00:00:01' was followed by '00:00:02'. The first edition of *Wired* to appear in the new millennium was therefore able to announce on its cover that 'THE FUTURE GETS FUN AGAIN'.[13] Now at last its readers could turn their attention to 'The Exploding Science of Superlongevity' and 'Android Playmates!' With this fanfare, Warwick appears on the front cover of the next edition as poster-boy, prophet, case-study, first child, and valiant explorer of the New World (**see fig. 2**).[14]

Fig. 2 'I, ROBOT'. Front cover of *Wired* [http://www.wired.com/wired/archive/8.02/full.html]

Warwick looks out at the reader from the centre of the page. Superimposed on his bare left-arm is an x-ray photograph revealing what would otherwise have been invisible, namely a small Radio Frequency Identification Device (RFID) implanted beneath the surface of his flesh. As the parallel between the blue of Warwick's shirt and the magazine's banner title suggests, he is now *wired*. The light shining from the right-hand side of the page, at an angle that illuminates only one side of Warwick's face and body, leaving the other side in darkness, makes much the same point. The former, echoing the 'white' of the x-ray, evokes the radiance of the machinic body; the latter suggests the chthonic drives of the biological body. Confronted with this apparition, readers could be excused for feeling, like Keats's speaker,

> like some watcher of the skies

> When a new planet swims into his ken;
> Or like stout Cortez when with eagle eyes
> He star'd at the Pacific – and all his men
> Looked at each other with a wild surmise –
> Silent, upon a peak in Darien.[15]

Warwick's plans to enter the Cyber World are described in the lead article, entitled 'Cyborg 1.0: Kevin Warwick outlines his plan to become one with his computer'.[16] As the front cover proclaims, the first step had already been taken. The RFID inserted in his left arm 'communicated via radio waves with a network of antennas', installed throughout the Department of Cybernetics at Reading University, 'that in turn transmitted the signals to a computer programmed to respond to [Warwick's] actions'. It was fun:

> At the main entrance, a voice box operated by the computer said 'Hello' when I entered; the computer detected my progress through the building, opening the door to my lab for me as I approached it and switching on the lights. For the nine days the implant was in place, I performed seemingly magic acts simply by walking in a particular direction.[17]

According to Warwick, this experiment was designed to determine 'whether information could be transmitted to and from an implant'. Its success opened the door to more ambitious ones: first 'a follow-up experiment with a new implant that will send signals back and forth between my nervous system and a computer'. Next 'the placement of a similar implant in my wife, Irena', that will allow 'movement and emotion signals from one person' to be sent directly 'to the other, possibly via the internet. [...] How far could we go in transmitting feelings and desires? I want to find out', he confesses. 'What if the other person became sexually aroused? Could we record signals at the height of our arousal, then play these back and relive the experience?' Warwick is longing for something like the 'flipflop switch' described by William Gibson in *Neuromancer* (1984), which allows you to 'access live or recorded simstim [simulated stimulation] without having to jack out of the matrix'.[18]

Where Epstein flirted with Q1 under the watchful eye of her creator, Warwick here contemplates a *ménage à trois* – with himself, Irena, and the computer as the players – although perhaps wisely on this occasion he leaves the machinic element in the background. Irena is willing to take part in this experiment

because, as Warwick tells us, 'if anyone is going to jack into my limbic system – to know definitively when I'm feeling happy, depressed, angry, or even sexually aroused – she wants it to be her'. Yet Irena can jack into Kevin's body only through the body of the machine, which will transmit (and to that extent mediate) their feelings and desires. How could Irena be certain that the impulses transmitted by the computer accurately convey Warwick's feelings and desires or even that they originate from him? Kurzweil writes that after the singularity 'we can be a different person both physically and emotionally. In fact, other people (such as your romantic partner) will be able to select a different body for you than you might select for yourself (and vice versa)'.[19] And as Gibson imagined in *Neuromancer*, the same technology would allow others to step into this already crowded scene, jacking in from another terminal. If this were to occur, Warwick's *ménage à trois* would become a millenarian love-in.

In the years immediately following the publication of 'Cyborg 1.0', Warwick implemented the plan it sets out, although with results that are a long way from the hype. Warwick received an RFID implant on 24 August 1998. 'On 14 March 2002 [...] an MEA [Micro-Electrode Array] was surgically implanted into the median nerve fibres' of his left arm.[20] The implant included a radio transmitter/receiver that could *send* signals from Warwick's 'nervous system by radio to the computer' and *receive* 'signals sent [...] from the computer and' then 'feed' them into his 'nervous system' via his arm.[21] The signals sent to the computer were used to control 'a robot, an articulated hand and the local environment'.[22] The ability to receive signals potentially opened Warwick's nervous system to stimulation by any 'perceptual device' (human or non-human) attached to the computer. In the experiment described in *I, Cyborg*, the perceptual device was an ultra sonic sensor, 'much like the ones currently fitted to the rear bumper bars of cars', which were placed on either side of a baseball cap. 'As the sensors approached an object they sent a buzzing signal into [Warwick's] nerve, sending the signal from the left side sonar to one set of pins, and right side sonar to a second set'.[23] With this rudimentary input he was able, after six weeks practice, to navigate around the lab. As the information

that guided him had not been delivered by any of Warwick's five human senses, it could be said that for the duration of the experiment he had gained a sixth sense.

The most ambitious experiment, the climax of the sequence I have been describing, occurred on 10 June 2002, after Irena had an array implanted in her arm. 'I am he as you are he as you are me and we are all together' is the first line of *I Am the Walrus*, a song by the Beatles. Although it initially seems promising, this isn't quite the theme song for what went on at Reading. The actual connection between Kevin, Irena and the PCs to which they were attached (you, me and the computer, rather than you, me and the Walrus) was much more mundane. It involved an exchange of signals (a kind of rudimentary Morse code) rather than an interpenetration of identities. Warwick's connection with Irena was separated by several minutes from her connection with him. And for both participants the achievement of this 'link' was indicated by a single word, 'yes'. For Warwick at least, the imagined experience was orgasmic:

> I waited. It seemed to take an age. But then I felt it, a shot of current, a charge, running down the inside of my left index finger. A beautiful, sweet, deliciously sexy charge. I felt like I had never felt before. I jumped with surprise more than anything else and shouted, 'Yes!' After a few seconds it went again, another charge, just as sweet, just as clear. I shouted out again. Then again and once more. Each time I felt a pulse I shouted, 'Yes!' Even though I couldn't be sure whether Irena was moving her hand or not, I shouted to her to slow down, the pulses were coming thick and fast and I guessed she was having fun.[24]

Yet as Warwick admits in *I, Cyborg* during this experience Irena was in pain.[25]

I don't mean to trivialise Warwick's research which, amongst other things, makes a contribution to the development of brain/computer interfaces that may one day help stroke victims engage with the world, give people without limbs a measure of control over their environment (by using neural signals), and perhaps even give sight back to blind people. It is nevertheless important not to ignore the mismatch between the rather mundane results of his experiments and the utopian dreams they appear to support. The most prominent of these dreams concerns human *enhancement*, which is the subject of a paper entitled 'Upgrading Humans via Implants – Why Not?' published in this edition of *19*.

'Upgrading Humans' presents a series of four 'examples' arranged to compose a narrative that takes the reader to the brink of a Cyber World. The narrative unfolds in three stages: it is possible to use implants to influence the world around us (example 1); machines are potentially capable of independent action and can already exert an influence on us (examples 2 and 3); the cyborgs are coming (example 4). The four examples, the state-of-affairs concerning human enhancement they report, and the narrative that links them are used by Warwick to generate a host of questions, culminating in the following triumvirate:

> If many humans upgrade and become part machine (cyborgs) themselves, what would be wrong with that? If humans are left behind as some kind of subspecies, what is the problem? If you could be enhanced, would you have a problem witnessing the funeral of humankind?[26]

But let's turn back from the conclusion of Warwick's article in order to see how he brings us to that point. I can be brief because part of Warwick's essay traverses some of the ground we have already covered.

'Example Number 1' reports again the implantation of an RFID in Warwick's upper left arm, giving him the power to exert almost magical influence on his immediate environment. He notes in passing that 'implants are [often] located in a roughly similar place [...] even though they do not have to be'. And he gives as an example, 'the recent James Bond film *Casino Royale* (2006)', in which Bond also 'has an implant – in his left arm!'[27] But the same line of thought raises the question of why does an RFID need to be implanted anywhere in the body? Surely the same effects could be generated if it was simply held in the hand?

In Warwick's second example 'a neural culture', described as a 'biological brain', is combined with a robot device. Input to this biological brain derives from the robot's ultrasonic sensors; output from the brain is used to steer the robot past obstacles:

> What this means is that the brain of the robot will shortly be a biological brain, not a computer. All the brain will know is what it perceives from the robot body, and its only action will be to drive the robot body around. The biological brain will, to all intents and purposes, be the brain of the robot.[28]

This example echoes the previous one: in both cases a biological device (human being/neural culture) uses a machine (implant/robot) to mediate its relations with a circumscribed portion of the external world.

It seems a long jump from here to the third example, but the distance is traversed thanks to the intimacy between biological and non-biological devices, demonstrated by the first and second examples (human/implant; biological-brain/robot). With this homology established, one can then ask: if a biological brain can control a machine, is it possible for a machine to control a brain? In his third example, Warwick answers in the affirmative by turning to 'intelligent deep-brain stimulators', currently used for the treatment of Parkinson's disease, epilepsy and Tourette's syndrome.[29] In treating the first of these diseases, for example, an 'artificial brain' is used to monitor the biological brain, in order to detect signals that presage an unwanted shaking of the body. When these signals appear, it delivers an electrical charge to the brain which, by overriding the brain's own signals, ensures that the aberrant behaviour does not occur. In Warwick's short summary: 'It is the job of the artificial brain to out-think the human brain and to stop it doing what it normally wants to do.'[30]

Is this really an artificial brain and is it 'thinking'? Or is it more closely akin to a sophisticated prophylactic device? Rather than allowing himself to be detained by such questions, Warwick rushes on to 'Example Number 4', which repeats in abbreviated form an event described in *I, Cyborg*, namely the surgical implantation of a Micro-Electrode Array (MEA) 'into the median nerve fibres' of his left arm. Such devices, we are told, open the possibility of radically 'enhancing an individual's abilities':

> Extra-sensory input is one possibility, but there are many more as well, such as improving memory, thinking in many dimensions, and communication by thought alone. These are just some of the potential, yet realistic, benefits. To be clear: all these things appear to be possible for humans in general.[31]

As a first step towards these possibilities Warwick describes the use of signals, transmitted to the MEA by sensors placed on either side of a baseball cap placed on his head, to navigate around his laboratory. As noted earlier, this apparatus and the

ultrasonic sensors make '[e]xtra-sensory input' a (extremely rudimentary) reality; nevertheless it remains difficult to see how one might leap from this kind of input to an improved memory or 'thinking in many dimensions'. How does this, or even Warwick's account in *I, Cyborg* of his Morse code encounter with Irena, presage 'communication by thought alone'? His ecstasy, coupled with his lack of awareness of her pain, suggests just how heavily mediated this purportedly direct communication will always be.

The disjunction between Warwick's rather mundane results and the dreams they support is not necessarily a terminal problem: no doubt all research is overtly or covertly, partly or wholly, driven by dreams. However, in this case Warwick's dreams are used not only to interpret results but in part to generate them (in the Morse-code encounter with Irena, for example). They inflect the research questions, help condition the research environment, inform the research design, and in large part determine the measures of success and failure. Once againagain, perhaps the same could be detected, at least to some degree, in all scientific enquiry, but to an outsider what is most striking about Warwick's research is the apparent lack of reflection on the drives and fantasies that inform it.[32] There is a feedback loop missing here, a lack that seems all the more surprising because of the ambition of Warwick's research, its engagement with fundamental questions, and its elaboration as public spectacle. Listing the dreams (and attendant cultural assumptions) that inform Warwick's research would be a lengthy task. In this context, I will therefore turn only to those conditioning Warwick's desire to become a cyborg.

Warwick appears seriously to believe that, for the three months or so that he carried an MEA implanted in his left arm, he was the world's first cyborg. And it is to this state that he wants to return. In the closing sentences of the penultimate chapter of *I, Cyborg*, written three days before the MEA was removed, he admits that 'already I'm looking forward to that time. As someone once said, "I'll be back"'.[33] The allusion is, of course, to the Terminator, played by Arnold Schwarzenegger in the movies of the same name, but this filmic cyborg is itself a descendent of comic-book superheroes, such as Green Lantern, who in 1959, when Warwick was 5 years old, was about to re-emerge as Hal Jordan, during the Silver

Age of Comic Books (it is no doubt purely coincidental that Warwick's facial features resemble those of Hal Jordan).

Like most of these comic book heroes, Warwick's cyborg is male, has super-human powers at his disposal, exerts these powers on a world imagined as standing apart from him, and is engaged in a fight against the evil empire of the machines. The foundations of this empire have been laid; its edifice is even now being constructed; after we reach the singularity, machines will control the earth.[34] Warwick appears to believe that this nightmare scenario can be averted only if we merge with the machines. And this belief in turn generates the oppositions that structure his thought: on the one hand, the cyborg; on the other hand, inhuman machines and unenhanced human beings. It is hardly surprising therefore that his dream that we will one day have the world at our fingertips always brings in its wake the nightmare that one day we will be destroyed.

But is Warwick really the first cyborg? It depends on whether or not one believes that to count as a cyborg one's machinic parts must be brought inside rather than left outside one's biological body. If outside is as good as inside, Warwick is late by many thousands of years. As Clark observes in *Natural-Born Cyborgs*, to see human minds as standing apart from technology is

> to misconceive our own brains, which were designed by nature to be unusually open to profound reconfiguration by the specific and technologically evolving environments in which they grow and learn. It is also to ignore, or deliberately downplay, the crucial fact that any built-in neural adaptations are simply one contribution to the developmental unfolding of a complex distributed cognitive device. That complex device is the human mind, and it is a device whose problem-solving routines are defined over an unruly mass of biological and nonbiological circuits and pathways.[35]

As Clark goes on to argue:

> The word 'cyborg' once conjured visions of wires and implants, but [...] the use of such penetrative technologies is inessential. [...] What matters most is our obsessive, endless weaving of biotechnological webs: the constant two-way traffic between biological wetware and tools, media, props, and technologies. The very best of these resources are not so much used as incorporated into the user herself. They fall into place as aspects of the thinking process. They have the power to transform our

> sense of self, of location, of embodiment, and of our own mental capacities. They impact who, what and where we are.[36]

Seen in this light, the oppositions and discriminations that structure Warwick's argument, drawn ultimately from Descartes' *Discourse on Method* (1637),[37] should be replaced by ones drawn from the study of complex ecologies (or self-reflexive systems) that include biological and non-biological components.[38] As one makes this shift, the apparent object of Warwick's experiments changes. For example, the first of the cases discussed in 'Upgrading Humans via Implants' now provides an example of a simple, self-enclosed system that – because its non-biological elements (implant, computer) operates within carefully defined limits and the system as a whole operates within a carefully circumscribed environment – fosters the illusion that its human component has been enhanced.

In Warwick's second example we are introduced to a still more rudimentary system. While the robot remains within the experiment's carefully defined environment, it fosters the illusion that it has an embryonic 'brain' capable of 'sensing' the environment and so learning from its activities. And Warwick's third and fourth examples provide particular but nevertheless striking examples of the body's ability to reconfigure itself in response to new non-biological elements in its environment. Indeed it is this remarkable openness to 'profound reconfiguration', possible in a 'complex distributed cognitive device', that opens the possibility of restoring sight to blind people, moving a prosthetic limb by neural impulses, or enabling a paralysed patient 'to move a cursor on a computer screen'.[39]

When one turns to the broader 'systems' that enable while also shaping Warwick's experiment, the 'ecology' becomes much more complex. In 'Upgrading Humans via Implants' Warwick's references to 'commercial potential', 'military and medical issues', the Cybernetics Department at Reading University, and so on, suggest some of the most important of these systems. *I, Cyborg* and 'Cyborg 1.0' foreground another system – the mass media – which plays an unusually prominent role in the conception and day-to-day unfolding of Warwick's experiments.

In this context the front cover of *Wired* for February 2000, notwithstanding my earlier remarks, provides a vivid portrait of Warwick as an element within the

machine of the popular media. Arguably this machine (with its biological and non-biological components) is itself a cyborg and, articulated by its global body, Warwick magically produces effects much more dramatic than his Morse-code interaction with Irena, but also much less predictable. To cite only an obvious example, in *I, Cyborg* Warwick relates a story he was told by Elena Kokurina, scientific correspondent for the Russian newspaper *Obschaya Gazeta*. '[S]he had been at a party in Moscow, talking to a doctor from a mental hospital in the centre of the city', when she mentioned Warwick's implant and 'the two-inch scar' it had left in his arm. The doctor at first doubted whether this was true, but when Kokurina confirmed that on 14 March 2002 Warwick had received an implant:

> the doctor replied that she had just solved a complex mystery that had been baffling him and his colleagues. He had not been aware that my operation had taken place, yet since the middle of March he had been faced with eleven cases in which he had been confronted by a patient with a two-inch scar, just below the wrist, claiming that they had received an implant which was doing all sorts of strange things to the body.[40]

As we have seen, for Warwick the implanted MEA provided a foretaste of the much-greater ability of future cyborgs to exert influence at a distance and to receive input from external sources. No doubt because they live in the centre of a still-authoritarian culture, a society that until recently was centrally planned, the doctor's patients immediately recognise the vulnerability of Warwick's cyborgs to external programming. Echoing aspects of the nightmare retailed by Warwick in *March of the Machines*, they therefore take his implant as a metaphor for their lack of control over their own lives, particularly within the circumscribed world of the mental hospital. Given that the symptoms reported to Kokurina suggest astute, although dystopian readings of Warwick's experiments, his response to Kokurina's story is surprisingly lacking in affect:

> I had hoped, perhaps rather big-headedly, that our experiment might affect how people thought all around the world. But this wasn't quite what I had expected. I did feel some warmth though in that we had had such an effect as far a field as Moscow.[41]

The most obvious of the 'systems' that enable/shape Warwick's research are related to gender. Do all male creators (or would-be creators) of cyborgs and

androids dream of an orgasmic union either with their creations or mediated by them? Amongst those discussed in this essay, admittedly a small sample, the only creator that seems not to belong to this class is the earliest, Charles Babbage. As one stands in the Science Museum in London looking at the resplendent, labyrinthine, metallic body of the Difference Engine No. 2, completed in November 1991 according to Babbage's specifications, it seems a world away from Repliee Q1.[42] Yet in *Passages from the Life of a Philosopher* (1864) Babbage implies that his adult interest in automated reason was sparked by a visit when he was eight to the remarkable Mechanical Museum run by John Merlin in Prince's Street, London, where he was shown 'two uncovered female figures of silver, about twelve inches high',[43] one 'in the attitude of dancing, and the other walking'.[44] In Kirby's *The Wonderful and Scientific Museum* (1803) the same small automata are described as being able

> to perform almost every motion and inclination of the human body; viz. of the head, the breasts, the neck, the arms, the fingers, the legs, &c. even to the motion of the eye-lids, and the lifting up of the hands and fingers to the face.[45]

Babbage was particularly impressed by the dancer who, he recalls, 'attitudinized in a most fascinating manner'. As he also admits, 'Her eyes were full of imagination, and irresistible'.[46]

I should add in parenthesis that it's not just computer engineers and pioneers that share this fascination. WowWee Toys has recently advertised a female robot called Femisapien who, her creators claim, is 'smart, funny, can dance up a storm, and perform skits with you or with other WowWee robots'.[47] But that's not all. This 15-inch tall robot speaks 'Emotish', walks, talks, sings, can detect obstacles, and will respond to you. Indeed, she is a potential 'girlfriend', an automated Barbie doll, who conveniently 'kisses on command':[48]

> Feeling lonely? Need someone to talk to who is non-judgmental, a great listener, and low maintenance? (Just a few fresh batteries and she's all yours). In Conversation mode Femisapien will respond to your voice, any loud sound really, and act as if she's talking to you. Her wrist LEDs will pulse with each phrase you say. If you don't talk to her she'll try to get your attention with a questioning Emotish sound every 20 seconds.[49]

In ‘Barbie Girl’, a hit song by the bubblegum-band Aqua, ‘Barbie’ tells us that:

> I'm a barbie girl, in the barbie world
> Life in plastic, it's fantastic!
> you can brush my hair, undress me everywhere
> Imagination, life is your creation [...].[50]

In ‘Robot Girl,’ WowWee Toy’s parody of this song, Femisapien tells her actual and potential consumers:

> I’m a robot girl in a robot world
> Made of plastic, I’m not spastic.
> If you touch me there
> I’ll kick you, you know where
> I get frisky
> Better not touch my boobies.[51]

The same toy is marketed in Japan by Sega Toys as E. M. A. (Eternal Maiden Actualization). According to Minako Sakanoue, a spokesperson for Sega, ‘She’s very loveable and although she’s not a human she can act like a real girlfriend’.[52]

Again and again Warwick’s rhetoric pits the stability of human nature against cyborg artifice, enhancement and fluidity. Many of the questions posed by Warwick, such as those quoted earlier in this essay, rely on this opposition to create the horns of a dilemma; yet it is hardly ‘breaking news’ to observe that, since at least the late-eighteenth century, the stable ‘nature’ assumed by more traditional cultures has been undermined. God, history, society, nature and the self have all come to seem contingent creations rather than necessary features of the world. As Marx observed 160 years ago, in modernity, ‘Constant revolutionizing of production, uninterrupted disturbance of all social conditions, everlasting uncertainty and agitation’ create a world in which ‘All that is solid melts into air’.[53] Biogenetic engineering represents the latest step in this sequence, one that reveals ‘our “natural” dispositions as mediated, not as given – as things which can in principle be manipulated and therefore as merely contingent’.[54] At each of its various stages, this undermining of traditional grounds of certainty therefore generates, in various proportions, excitement at the freedom this implies, nostalgia at what appears to have been lost, and a sense of crisis caused by the recognition that human nature is

contingent and that, rather than taking its orientation from the models supplied by another epoch, modernity must '*create its normativity out of itself*.'[55]

The emergence in recent years of 'an influential, semi-autonomous zone of activity known as the policy arena', described by Jay Clayton in this edition of *19*,[56] is therefore a welcome development, as one of the semi-public arenas within which this 'normativity' might be generated. Amongst the roles that 'literary studies' might play in policy discussions, Clayton proposes that 'we offer literary study to the policy community as a critical, historical and comparative instrument for assessing the changing place of scientific concepts in society.'[57] This is an important suggestion, and the work done by Clayton and Priscilla Wald with a grant from the National Human Genome Research Institute suggests some of the ways it might be realised. Yet at the same time it seems a rather circumscribed role for literary studies in policy discussions and (because literary studies overlaps with history, philosophy, sociology, and so on) for the humanities in general.

Fig. 3 'Femisapien,' aka 'E.M.A.' (Eternal Maiden Actualisation) [http://www.reuters.com/article/lifestyleMolt/idUST8462420080617

One of the assumptions driving Clayton's paper is 'The split between what C. P. Snow called the "two cultures"'.[58] Yet this division is often misunderstood. The divide between science and the humanities is the product of the shift in modernity from hierarchically stratified to functionally differentiated societies. The division between science and the humanities is mirrored by divisions between, say, religion

and science, or politics and religion, and so on. In modernity each of these spheres constitutes a relatively autonomous, some would say autopoietic, system. Yet this doesn't mean that they proceed entirely without reference to each other. Every system contains other systems in its environment and, just as significantly, systems interpenetrate, using material generated by other systems within their own. On the one hand, Warwick introduces the results of his scientific endeavours into culture (*I, Cyborg* is an autobiography; 'Cyborg 1.0' is science fiction; 'Enhancing Humans' is a case study). On the other hand, as I have argued, images, concepts and dreams drawn from literature, mythology and popular culture play prominent roles in his science.

Is this degree of interaction between different spheres a feature only of Warwick's work? The history of Artificial Intelligence (AI) research, to take an example germane to our discussion, suggests that it is not. At the risk of too drastically simplifying a fascinating history, one can say that whereas AI research began with a model of the mind based on Descartes, in the 1990s it moved to one strongly influenced by Heidegger. Engineering problems associated with 'attempts to use computers as physical symbol systems to simulate intelligence'[59] were consequently displaced by, for example, attempts to create 'a device sufficiently like us to act and learn in our world'.[60] In 1972, when the first phase of AI research seemed to be progressing rapidly, Hubert L. Dreyfus published the first edition of *What Computers Can't Do: A Critique of Artificial Reason*, which identified the philosophical assumptions underpinning this first phase of AI research and predicted its failure.[61] Dreyfus's book was initially greeted with hostility by many AI researchers, yet when the third edition of the book appeared in 1992, he was able to report that

> After fifty years of effort [...] it is now clear to all but a few diehards that this attempt to produce general intelligence has failed. This failure does not mean that this sort of AI is impossible; no one has been able to come up with a negative proof. Rather, it has turned out that, for the time being at least, the research program based on the assumption that human beings produce intelligence using facts and rules has reached a dead end, and there is no reason to think it could ever succeed. Indeed, what John Haugeland has called Good Old-Fashioned AI [...] is a paradigm case of what philosophers of science call a degenerating research program.[62]

In the preface to the third edition, Dreyfus reports the emergence of new paradigms for AI research, influenced according to Terry Winograd by Dreyfus's Heideggerian critique of AI, but he also predicts their eventual failure.[63] Dreyfus's 'Why Heideggerian AI Failed and How Fixing it Would Require Making It More Heideggerian', first published in 2007, suggests that the problems he predicted in 1992 would be encountered by these new paradigms have still not been satisfactorily resolved.[64]

Carnegie Mellon opened their 'Robot Hall of Fame' on 30 April 2003. Curiously, of the first four inductees, two were imagined and two real robots: R2-D2 and HAL 9000 stood alongside the Mars Pathfinder Sojourner Rover and Unimate (the first industrial robot). In 2004, ASIMO ('the first humanoid robot to walk dynamically') and Shakey ('the first mobile robot that could claim to reason about its actions') joined Astro Boy, Robby the Robot and C-3PO. In 2006, two real and three fictional robots were inducted. And in 2008, Lieutenant Colonel Data took his place with three 'real' robots.[65] Is this collocation of actual and imagined robots an admission that the public are interested in the latter rather than the former? Do the museum directors hope the fictional robots will introduce visitors to their hard-working, not-particularly-attractive cousins? Are the imagined robots what real robots hope they will one day become? Whatever the answers we might give to these questions, this curious mingling of reality and fantasy, robotics and popular culture, evokes once more the remarkable interpenetration of science and culture that we have been tracing. In a world where the supposed impartiality and objectivity of science continues to be disturbed by utopian and dystopian dreams, the humanities have important roles to play both in and beyond the policy arena.

Endnotes:

[1] Kevin Warwick, *I, Cyborg* (London: Century, 2002), p. 1.

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[3] David Whitehouse, 'Japanese Develop "Female" Android', *BBC News*, 27 July 2005, <http://news.bbc.co.uk/go/pr/fr/-/1/hi/sci/tech/4714135.stm> [accessed 20 August 2008].

[4] Robert Epstein, 'My Date with a Robot', *Scientific American Mind*, 17:3 (June/July 2006), 68-73 (p. 71). The article is available online at <http://drrobertepstein.com/pdf/Epstein%20-%20My%20Date%20With%20a%20Robot%20-%20Scientific%20American%20Mnd%202006.pdf>

[5] *Frankenstein*, dir. James Whale (Universal Films, 1931).

[6] Ray Kurzweil, *The Singularity is Near: When Humans Transcend Biology* (London: Gerard Duckworth and New York: Viking Penguin, 2005).

[7] Kurzweil, *The Singularity*, p. 487.

[8] Kurzweil, *The Singularity*, p. 30.

[9] Charles Babbage, *Charles Babbage and His Calculating Engines: Selected Writings by Charles Babbage and Others*, ed. by Philip Morrison and Emily Morrison (New York: Dover, 1961).

[10] Ray Kurzweil, 'Human 2.0', *New Scientist*, 187, no. 2518 (24 September 2005), pp. 32-7 (p. 35).

[11] *Wired*, 7:4 (April 1999), front cover. Available at: <http://www.wired.com/wired/coverbrowser/1999> [accessed 25 August 2008].

[12] Jacques Leslie, 'Powerless', *Wired*, 7:4 (April 1999), pp. 1-9 (p. 1). Available at <http://www.wired.com/wired/archive/7.04/blackout.html> [accessed 25 August 2008]. See also Ellen Ullman, 'The Myth of Order', *Wired*, 7:4 (April 1999), pp. 1-6, <http://www.wired.com/wired/archive/7.04/y2k.html> [accessed 25 August 2008].

[13] *Wired*, 7:4 (April 1999), front cover. Available at: <http://www.wired.com/wired/archive/8.01/full.html> [accessed 25 August 2008].

[14] *Wired*, 8:2 (February 2000), front cover. Available at: <http://www.wired.com/wired/archive/8.02/full.html> [accessed 25 August 2008].

[15] John Keats, 'On First Looking into Chapman's Homer', repr. in *John Keats: The Complete Poems*, ed. by John Barnard (Harmondsworth: Penguin, 1977), p. 72, lines 9-14.

[16] Kevin Warwick, 'Cyborg 1.0', *Wired*, 8:2 (February 2000), pp. 1-4. Available at <http://www.wired.com/wired/archive/8.02/warwick.html> [accessed 25 August 2008].

[17] Warwick, 'Cyborg 1.0,' p. 3.

[18] William Gibson, *Neuromancer* (1984; rpt. London: Grafton Books, 1986), p. 70.

[19] Kurzweil, *The Singularity*, pp. 29 and 324.

[20] Warwick, 'Upgrading Humans via Implants – Why Not?', *19: Interdisciplinary Studies in the Long Nineteenth Century*, 7 (2008) <www.19.bbk.ac.uk>, p. 6.

[21] Warwick, *I, Cyborg*, p. 131.

[22] Warwick, *I, Cyborg*, p. 265.

[23] Peter Moore, *Enhancing Me: The Hope and the Hype of Human Enhancement* (Chichester: John Wiley, 2008), pp. 150-51.

[24] Warwick, *I, Cyborg*, p. 282.

[25] Warwick, *I, Cyborg*, p. 284.

[26] Warwick, 'Upgrading Humans', p. 10.

[27] Warwick, 'Upgrading Humans', p. 2.

[28] Warwick, 'Upgrading Humans', p. 4.

[29] Warwick, 'Upgrading Humans', p. 5.

[30] Warwick, 'Upgrading Humans', p. 5.

[31] Warwick, 'Upgrading Humans', p. 6.

[32] See, for example, Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts* (Princeton: Princeton University Press, 1986).

[33] Warwick, *I, Cyborg*, p. 297.

[34] See, for example, Kevin Warwick, *March of the Machines: Why the New Race of Robots will Rule the World* (London: Century, 1997). A revised edition was published with the title *March of the Machines: The Breakthrough in Artificial Intelligence* (Urbana and Chicago: University of Illinois Press, 2004).

[35] Andy Clark, *Natural-Born Cyborgs: Minds, Technologies, and the Future of Human Intelligence* (Oxford: Oxford University Press, 2003), p. 141.

[36] Clark, p. 198.

[37] René Descartes, *The Discourse on Method* (1637), repr. in *The Philosophical Works of Descartes*, trans. by Elizabeth S. Haldane and G. R. T. Ross (1911; rpt. Cambridge: Cambridge University Press, 1972), I, p. 166.

[38] See, for example, Niklas Luhmann, *Social Systems*, trans. by John Bednarz, Jr. with Dirk Baecker (Stanford: Stanford University Press, 1995).

[39] Clark, p. 121.

[40] Warwick, *I, Cyborg*, pp. 250-51.

[41] Warwick, *I, Cyborg*, p. 251.

[42] See 'Doron Swade operating Babbage's Difference Engine No 2', Science Museum, London, Image 10303322 <http://www.sciencemuseum.org.uk/images/I033/10303322.aspx>

[43] Charles Babbage, *Passages from the Life of a Philosopher* (London: Longman, Green, Longman, Roberts, & Green, 1864), p. 17.

[44] R. S. Kirby, *The Wonderful and Scientific Museum: or, Magazine of Remarkable Characters; including all the Curiosities of Nature and Art, from the Remotest Period to the Present Time, Drawn from Every Authentic Source*, 2 vols. (London: R. S. Kirby and J. Scott, 1803), I, p. 275.

[45] Kirby, p. 275.

[46] Babbage, *Passages*, p. 17. For a fascinating account of human – robot interactions and their future see David Levy, *Love + Sex with Robots: The Evolution of Human – Robot Relationships* (London: Duckworth Overlook, 2008).

[47] WowWee Toys, *Femisapien Review* <http://www.robotsrule.com/html/femisapien-review.php> [accessed 25 August 2008].

[48] Rodney Joyce and Chika Osaka, 'Japan makes robot girlfriend for lonely men,' *Reuters*, 17 June 2008 <http://www.reuters.com/article/rbssLeisureProducts/idUST8462420080617> [accessed 25 August 2008]. See also the video at: <http://www.reuters.com/news/video?videoId=84713&newsChannel=rbssLeisureProducts>, which describes the robot doll as a 'Humanoid Hottie', a 'thirty-eight centimeter curvaceous cyborg [that] blows kisses, sings, and shakes its [...] "groove things"'. Videos about Femisapien, produced by WowWee Toys, are available at <http://www.robotsrule.com/html/femisapien.php#pictures>

[49] WowWee Toys, *Femisapien Review*.

[50] Aqua, 'Barbie Girl', Aqua Lyrics <http://www.azlyrics.com/lyrics/aqua/barbiegirl.html> [accessed 25 August 2008].

[51] A video of 'Robot Girl' is at <http://www.robotsrule.com/html/robot-girl.php> [accessed 25 August 2008].

[52] Joyce and Osaka, 'Japan makes robot girlfriend'.

[53] 'Manifesto of the Communist Party' (1848). I am quoting from the 1888 English edition reprinted in *Karl Marx and Frederick Engels: Selected Works* (Moscow: Progress Publishers, 1970), pp. 31-63.

[54] Slavoj Zizek, 'Bring me my Philips Metal Jacket: Slavoj Zizek welcomes the prospect of biogenetic intervention', *London Review of Book*, 25:10 (22 May 2003), pp. 3-5 (p. 3). See also Peter Sloterdijk, 'Anthropo-Technology', *New Perspectives Quarterly* 21:4 (2004), 40-44. Sloterdijk argues that:

> If there is man, then that is because a technology has made him evolve out of the prehuman. It is that which authentically brings about humans. Therefore humans encounter nothing strange when they expose themselves to further creation and manipulation, and they do nothing perverse when they change themselves autotechnologically, given that such interventions and assistance happen on such a high level of insight into the biological and social nature of man that they become effective as authentic, intelligent and successful coproductions with evolutionary potential' (p. 4).

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[55] Jürgen Habermas, *The Philosophical Discourse of Modernity: Twelve Lectures*, trans. by Frederick Lawrence (Cambridge: Polity Press, 1987), p. 7.

[56] Jay Clayton, 'Inherited Behaviour in Collins's *The Legacy of Cain*: Victorian Studies and Twenty-First-Century Science Policy', *19: Interdisciplinary Studies in the Long Nineteenth Century*, 7 (2008) www.19.bbk.ac.uk, p. 3.

[57] Clayton, p. 14.

[58] Clayton, p. 3. See C. P. Snow, *The Two Cultures and the Scientific Revolution* (Cambridge, Cambridge University Press, 1959) and *The Two Cultures: A Second Look* (Cambridge: Cambridge University Press, 1964).

[59] Hubert L. Dreyfus, *What Computers Still Can't Do: A Critique of Artificial Reason* (Cambridge, MA: Massachusetts Institute of Technology Press, 1992), p. xiv.

[60] Dreyfus, *What Computers Still Can't Do*, p. xlvi.

[61] Hubert L. Dreyfus, *What Computers Can't Do: A Critique of Artificial Reason* (New York: Harper & Row, 1972). The second edition of this book was entitled *What Computers Can't Do: A Critique of Artificial Intelligence* (New York: Harper and Row, 1979).

[62] Dreyfus, *What Computers Still Can't Do*, p. ix.

[63] Terry Winograd, 'Heidegger and the Design of Computer Systems', speech delivered at the Applied Heidegger Conference, Berkeley, California, December 1989. Quoted in Dreyfus, *What Computers Still Can't Do*, p. xxxi. For an account of the importance of philosophy for AI research see Philip Agre, 'the soul gained and lost,' 'Constructions of the Mind', *SEHR*, 4:2 (1995), <http://www.stanford.edu/group/SHR/4-2/text/agre.html> [accessed 25 August 2008].

[64] Hubert L. Dreyfus, 'Why Heideggerian AI Failed and How Fixing it Would Require Making It More Heideggerian', in *The Mechanical Mind in History*, ed. by Philip Husbands, Owen Holland and Michael Wheeler (Cambridge, MA: Massachusetts Institute of Technology Press, 2008). See also Dreyfus's 'Telepistemology: Descartes's Last Stand', in *The Robot in the Garden: Telerobotics and Telepistemology in the Age of the Internet*, ed. Ken Goldberg (Cambridge, MA: Maccachusetts Institute of Technology Press, 2001) pp. 48-63.

[65] For details, see <http://www.robothalloffame.org/inductees.html> [accessed 25 August 2008].