Towards a Philosophy of Technology in Education: Mapping the Field

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Technology is the new star ship in the policy fleet for governments around the world. While often conceptually inchoate and ill-defined, it figures as a new subject in national curricula, often as part of the new core. It is promoted in higher education as part of a thrust to develop links with industry and business in a series of new venture partnerships. The emphasis on technology in education also accords with initiatives to promote greater entrepreneurial skills and activity within so-called national systems of innovation. In short, technology is seen to be a key driver towards the knowledge economy. Yet technology is not often theorised or well understood. Philosophy of technology is a newly emergent field although a poor cousin to philosophy of science. This paper outlines three major research programmes (after Lakatos) in philosophy of technology and discusses in turn their implications for a distinctively educational philosophy of technology. First, the Heideggerian programme, based upon Martin Heidegger's *The Question Concerning Technology* (1977, orig. 1949) developed in different ways by his student Herbert Marcuse in *One-Dimensional Man* (1964), by Michel Foucault in *Technologies of the Self* (1988), and by Hubert Dreyfus in *On the Internet* (2001a). Second, the socialist-feminist programme best exemplified in Donna Haraway's *Manifesto for Cyborgs* (1985/1991). Third, the social constructionist programme developed most recently by Andrew Feenberg in *Questioning Technology* (1999).

Introduction

Technology has become the new star ship in the policy fleet for governments around the world. While often conceptually inchoate and ill-defined, technology studies figures as a new subject in national curricula, often as part of the new core. Also technology as a subject is promoted in higher education, including teacher education programmes, as part of a thrust to develop links with industry and business in a series of new venture partnerships. The emphasis on technology in education also accords with initiatives to promote greater entrepreneurial skills and activity within so-called national systems of innovation. What is more, technology planning often is now part of national knowledge foresight programmes and science policy, designed to promote sunrise industries and knowledge and technology transfer. In short, technology is seen to be a key driver towards the knowledge economy.

The public policy focus on technology, in part, reflects a growing consensus in macroeconomics of 'new growth' or 'endogenous growth theory', based on the work of Solow, Lucas and Romer, that the driving force behind economic growth is technological change (i.e., improvements in knowledge about how we transform inputs into outputs in the production process). On this model technological change is *endogenous*, "being determined by the deliberate activities of economic agents acting largely in response to financial incentive" (Snowdon and Vane, 1999: 79). The neoclassical growth model developed by Solow assumed technology to be exogenous and therefore available without limitation across the globe. Romer's endogenous growth model, by contrast, demonstrates that technology is not a pure public good for while ideas are *non-rivalrous* they are also partially *excludable* through the legal system and patents. The policy implication is twofold: knowledge about technology and levels of information flow are critical for economic development and can account for differential growth patterns. Knowledge gaps and information deficiencies can retard growth prospects of poor countries, while technology transfer policies can greatly enhance long-term growth rates and living standards.

My purpose is not to explain the recent increase in the public profile of technology in economic and education policy, but rather to begin to develop a mapping of the field of philosophy of technology and its significance for education. At a general level, this is important because philosophy of technology addresses general questions concerning the nature of technology, its impact on society and, for the purposes of this paper, specifically on education. Philosophy of technology, therefore, promises the possibility of an understanding of technology that may be important not only to public policy but also in helping to conceptualise intellectual approaches to the study of technology and, indeed, to shaping new fields of knowledge and research. These approaches to the study of technology, clearly, have a significant role to play in curricularising technology at all levels. Philosophy of technology may also have a role to play in relation not only to structuring a largely disparate and inchoate field but also more directly in teaching and learning about technology. These are only promissory notes to be redeemed, if at all, at the end of the paper after our investigation.

We might make even grander claims for philosophy of technology. Just as economic growth theory now postulates an endogenous model where technology is considered as a factor intrinsic to development, in society and education the notion that technology is an autonomous system operating neutrally has come under increasing scrutiny. Rather than considering technology as something separate from daily life and from society at large, philosophers and sociologists now contemplate the way in which technology structures our institutions and impacts upon all aspects of our existence. Clearly, technology has permanently altered the labour process and our conception of labour in post-industrial service-oriented societies and it continues to transform our notions of intellectual labour. With the environmental movement, as Feenberg (1999) comments, technology entered the charmed circle of democracy. The very technical transformation of government and democracy is a subject in its infancy, with various thinkers beginning to explore the possibilities of joined-up-government and cyberdemocracy (e.g., Poster, 2001). The technological revolution demands new types of media and multimedia literacies, just as print technology transformed the public sphere, and makes possible the radical restructuring of education as a key to democracy and active citizenship within the global economy (Kellner, 2001). With the discoveries of biotechnology and the prospects of the human genome project, the very stuff of life and its reproduction is now a matter of urgent ethical and political concern. The possibilities for dealing with so-called learning disabilities genetically or as part of biological planning and regulatory regimes are as yet unrealised. Furthermore, advances in information and communications technologies and in related telecommunications technologies have already transformed our practices of reading and writing, of communicating, of viewing, and of the transmission, storage and retrieval of information, thereby, also changing the nature of our knowledge practices and institutions (Peters and Roberts, 1998). New information and communication technologies raise complex ontological, epistemological, ethical and identity issues; they at one and the same time present exciting educational possibilities but also grave dangers (Burbules, 2001). At the experimental psychological level, it is obvious that the computer has stimulated the development of models of the mind, providing not only a computational analogue for the brain but also research programmes for the so-called revolution in cognitive psychology now in its third generation (Bruner, 1996; Harré and Gillett, 1994). Philosophy of technology is a field that defines what it is to be human in terms of technology; in short, technologies shape and produce our subjectivities.

Yet as a field, philosophy of technology is both a recent and a poor cousin to philosophy of science. Philosophy of science has had little time for either technology or the relation between science and technology. Technology was not seen as philosophically interesting. Traditionally, in standard accounts, technology often has been seen as synonymous with industrial technology that came into existence on the back of Enlightenment science and flourished in the nineteenth century to develop exponentially and in a myriad of different directions in the twentieth century. On this conception it was seen as the handmaiden of science, a kind of applied knowledge that put into practice the pure theory of science. This standard liberal 'engineering' account is now being questioned, modified, refined, and alternative theories are being developed. Some scholars who read the present situation critically want to talk of the conglomeration 'technoscience', indicating a dramatic historical shift in the nature of knowledge (e.g., Lyotard, 1984); others contemplate reversing the traditional relationship, suggesting that technology is the ground out of which science came to be and that modern technology rather than science is the all embracing and pervading ethos defining the modern *zeitgeist* (Heidegger, 1977).

Ways of mapping the field

Carl Mitcham (1994) makes a distinction in *Thinking Through Technology* between an engineering and humanities tradition. The former takes technology as a good or positive value and is oriented to technological development, whereas the latter interprets technology more broadly in relation to culture and history. Where the former tends towards a kind of technicity and materiality, the latter views technology as something more than material, embodying cultural practices and symbolic forms. The former tends to treat political and ethical aspects of technology, in so far as these questions arise, only retroactively as a way of responding to the worst excesses of technology, whereas the latter treat them as central. The engineering tradition is indebted to nineteenth century German philosophy (neo-Kantians and neo-Hegelians, and especially Marx, Kapp and Dessauer, although is not restricted to them; see also Pitt, 2000). The humanities tradition in the twentieth century owes its shape to Mumford, Ortega, Dewey, Jonas, Heidegger and Ellul who turn to cultural critique and tend to investigate the interface between technology and culture, emphasising the instrumental nature of technology and its essence in control and efficiency functions.

For the sake of this essay I shall be focusing on the humanities tradition and what has been called the classical philosophy of technology (Achterhuis, 2001) and, in particular, mainly I shall be considering what I call the Heideggerian research programme in philosophy of technology, construed in Lakatosian terms, even although without empirical testing it is difficult to know what might constitute a progressive as opposed to a degenerating problem-shift. I consider in terms of the Heideggerian programme not only Heidegger himself, beginning with his famous late essay "The Question Concerning Technology" (1977), but also Herbert Marcuse, Heidegger's student, with his major work *One-Dimensional Man* (1964), Michel Foucault and his *Technologies of the Self* (1988), and, finally Hubert Dreyfus, especially his work *On the Internet* (2001). When I use the term 'programme' I do not mean to suggest that subsequent thinkers slavishly imitate Heidegger or even subscribe to the same basic ontological commitments. Rather I mean to suggest that each of these thinkers in their own way have developed out of Heidegger's work their own distinctive orientations. Against these thinkers indebted to the Heideggerian programme, as I put it, I will offer two contrasts, the socialist feminist programme developed by Donna Haraway and the social constructivist programme offered by Andrew Feenberg. I offer the work of Haraway because, first, she is one of the few theorists working in philosophy of technology who takes questions of gender seriously, and, second, she focuses on the twin fields of communications and bio technologies. I refer to Feenberg because he takes the constructivist programme further than any other thinker.

Before embarking on this task, let me suggest, first, that it is possible to carry through a similar programme for Marx, Dewey, Mumford, Ortega, Jonas, and Ellul. A full mapping of the field would at least configure the main contours of each programme, sourcing main texts and noting major theorists. It would be an additional endeavour then to indicate where these programmes have been picked up and developed in relation to education. Second, I should make it clear that I do not believe that this is the only way to map the field. Indeed, there are other useful ways of proceeding, including what we might call the approach through national traditions. Here we might talk of the British empiricist tradition beginning with Francis Bacon's *Novum Organum*, or the German tradition, including many of the classical approaches from Marx to Heidegger, or the recent Dutch tradition, focusing on Hans Achterhuis and his colleagues, who published *De maat van de techniek* (*The Matter of Technology*) in 1993, followed by *Van stoommachine tot cyborg: denken over techniek in de nieuwe wereld* (*From the Steam Engine to Cyborg: Thinking Through Technology in the New World)* in 1997. Achterhuis' (2001) *American Philosophy of Technology: The Empirical Turn* clearly fits into this category, with pen nail sketches of the work of Albert Borgmann, Hubert Dreyfus, Andrew Feenberg, Donna Haraway, Don Ihde and Langdon Winner.

As an example of this approach, Achterhuis (2001: 3) distinguishes between the classical thinkers of technology and the American philosophers of technology, maintaining:

> The classical philosophers of technology occupied themselves more with the historical and transcendental conditions that made modern technology possible than with the real changes accompanying the development of technological culture.

Achterhuis (2001) suggests that American philosophy of technology can be broadly characterised by an empirical turn that took a constructivist direction that opened up the black box, analysing the formation of technological processes and describing the social forces acting upon them. Technology was no longer considered autonomous or monolithic but rather comprised of many distinct technologies that needed to be analysed separately. Rather like the empirical turn that philosophy of science took after Kuhn, so too American philosophers of technology began to investigate in actual contexts the ways in which technology and society influence one another. The terms 'technoculture' and 'technosociety' on the one hand speak to the way classical philosophers had disembedded processes of technology, while on the other, they recognise how technology itself is a social activity, which is given a particular cultural form. American philosophy of technology also distinguishes itself from classical philosophy in the approach to nature, no longer necessarily holding to the technological disenchantment of nature subscribed to by Jonas, Ellul and Heidegger but exhibiting a greater sensitivity to ideological constructions of nature.

Finally, I should mention a conceptual approach to distinguishing varieties of theory in technology developed by Andrew Feenberg. Figure 1 (see p. 20), as Feenberg (1999: 9) indicates, sets out the theoretical variety that has unfolded over time according to two axes:

> The theories differ with respect to the role of human action in the technical sphere, and the neutrality of technical means. Common sense assumes both the possibility of human control and the neutrality of technology. Deterministic theories, such as traditional Marxism, minimize our power to control technical development, but consider technical means to be neutral insofar as they merely fulfil natural needs. Substantivism shares determinist scepticism regarding human agency but denies the neutrality thesis. Ellul, for example, considers ends to be so implicated in the technical means employed to realize them that it makes no sense to distinguish means from ends. Critical theories, such as Marcuse and Foucault's left dystopianism, affirm human agency while rejecting the neutrality of technology. Means and ends are linked in systems subject to our ultimate control.

David Blacker's (1994) discussion of the ontologies underlying various ways in which technology is discussed in a representative sampling of the education literature indicates how these conceptual distinctions might work. Yet he only employs two implicit ontologies – the substantive and the instrumental, i.e., only two squares of Feenberg's grid. Yet within these categories he suggests we might talk of 'pro' and 'con' attitudes. For example, he labels the work of C. A. Bowers (1982, 1988) as an educational theorist that proposes a form of substantivism. For Bowers the "technological mindset" is so pervasive that every school reform and aspect of contemporary pedagogy is unwittingly contained within it. It is the Herculean task of a radical pedagogy to step outside this to recover what is truly human. As Blacker (1994) comments a subtler version of this view derives from the Frankfurt School's critique of instrumental reason and is evident in the educational theory of Broughton (1985). Educational substantivist or what Blacker calls "radical instructional design" (RID) theory – the computer romanticists – constitute the pro-technology lobby, holding that technology holds the key to effective learning and successful school reform (e.g., Heinich, 1984, 1985; McClintock, 1988; see also Winn, 1989).

There is also an educational pro-technology that takes the form of instrumentalism. The most celebrated example of this way of thinking, Blacker claims, is the work of Seymour Papert (1980) whose *Mindstorms* lay the pattern for a computer instrumentalism that argued that LOGO (and other computer programmes) offer children "powerful ideas" for problem-solving (see also Papert, 1987; Franz and Papert, 1985; Davy, 1985). Educational anti-technology instrumentalism often takes a Marxist form or a form of socio-political critique evident in critical theory of technology, stated most carefully by Feenberg. In education this position is ascribed to Bowles and Gintis' (1976) *Schooling in Capitalist America*, where the guiding idea for educational reform is the necessary transformation of social relations rather than a new technology.

Blacker (1994) argues that a proper theory of technology in education ought to take account of both positions and he begins to outline such a theory in terms of an appeal to the thought of Dewey and the early Heidegger. It might be called "double aspect" theory of technology for on this theory technology is both concealing and revealing (see Blacker, 1994).

The advantage of Feenberg's and Blacker's approach is that it provides a way of classifying theories of technology according to their underlying theoretical commitments, but as can be seen from my discussion (below) it is clearly the case that a programme may cut across these lines, so that the Heideggerian programme, for instance, can run across forms of substantivism (Heidegger) and critical theory (Marcuse and Foucault). Feenberg's position is that of critical theory, although he works it out somewhat differently.

Outlining the Heideggerian Programme: Heidegger, Marcuse, Foucault, Dreyfus

Heidegger

Heidegger delivered four lectures comprising "The Question Concerning Technology" in 1949 – over 50 years ago. It remains one of the most profound statements concerning technology that has been made and established a tradition of thought, remaining an important source of inspiration for a generation of philosophers writing of the nature of technology. Heidegger (1977: 4) poses the question quite forthrightly:

> According to ancient doctrine, the essence of a thing is considered to be what the thing is. We ask the question concerning technology when we ask what it is. Everyone knows the two statements that answer our question. One says: Technology is a means to an end. The other says: Technology is a human activity.

Two definitions: the instrumental and the anthropological. Heidegger goes on to question the instrumental and the will to mastery that such a conception entails. This is the source, in part, for the notion of instrumental rationality, a purely technical reason, that the Frankfurt School contrast strongly to practical reason.

For Heidegger, "technology's essence is nothing technological" (1977: 4). It is a system, *Gestell*, an all-encompassing view that describes a mode of human existence. Heidegger's account relates technology back to a critique of the Western metaphysical tradition and focuses upon the way *machinic* technology can alter our mode of being, distorting our actions and aspirations.

In terms of the received view technology is something that stands in a subsidiary, instrumental, and temporal relation with modern science. Modern physical science, beginning in the seventeenth century, is seen historically as achieving a kind of take-off by 1750, and its institutionalisation through royal societies and universities also dates from that period. *Machinic* technology, by contrast, chronologically speaking, begins in the eighteenth century and comes to fruition in the nineteenth century. It is pictured essentially as the "handmaiden" to science and it is regarded as an application of "pure" science or applied science.

Heidegger reverses the chronological order of the received view. He distinguishes technology in its various manifestations from its essence that is not technological and describes this essence by returning to the Greek concept of *technë*, which relates not only to the activities and skills of the artisan but also to the arts of the mind and fine arts. *Technë* is a word linked to episteme. It is a form of knowing in the widest sense. The essence of technology, Heidegger maintains, is a *poiësis* or "bringing forth" which is grounded in revealing (*alethëia*). He writes: "Technology is a mode of revealing. Technology comes to presence in the realm where revealing and unconcealment take place, where *alethëia*, truth, happens" (Heidegger, 1977: 13).

Heidegger distinguishes modern technology from its ancient form: "The essence of modern technology shows itself in what we call Enframing … It is the way in which the real reveals itself as standing-reserve" (Heidegger, 1977: 23). He observes: "The revealing that rules in modern technology is a *challenging*, which puts to nature the unreasonable demand that it supply energy that can be extracted and stored as such" (Heidegger, 1977: 14). Heidegger describes this *challenging* as a demand and a *setting upon*. As he indicates: "modern technology sets upon nature challenging forth the energies of nature, unlocking and exposing them but always directed toward furthering something else (maximum yield at the minimum expense)" (Heidegger, 1977: 15). Heidegger uses the term *setting-in-order* and suggests: "Everywhere everything is ordered to stand by, to be immediately at hand, indeed to stand there just so that it may be on call for a further ordering. Whatever is ordered about in this way has its own

standing. We call it the standing-reserve [*Bestand*]" (Heidegger, 1977: 17). Enframing endangers 'man' in his relationship to himself and to everything that exists. Its destiny is to banish humankind into a kind of revealing which is an ordering and where this ordering holds sway, it drives out every other possibility of revealing. Thus, *Enframing* conceals that form of "revealing which, in the sense of *poiësis*, lets what presences come forth into appearance" (Heidegger, 1977: 27).

Modern technology thus is seen in terms of "productionist metaphysics" where the concept of "standing reserve" refers to resources, which are stored in anticipation of consumption. Ingrid Scheibler (1993: 116) explains that modern technology, for Heidegger, "is linked to a particular mode of conceiving our relation to the world – of bringing forth – through a process that objectifies the world". For Heidegger the essence of technology is part of the broader project of understanding the relation of this mode of objectifying experience to the tradition of Western metaphysics, which means that the question concerning modern technology cannot be thought apart from the critique of Western metaphysics or, indeed, the critique of modernity.

Heidegger's account of technology has been criticised on a number of grounds. First, it is 'essentialist' in that it ascribes an *essence* to technology and thus cannot differentiate among different types or levels of technology. It can only describe technology as part of an evolving cultural system that becomes ever more efficient in ordering the world. While Heidegger acknowledges, quoting Hölderlin, that where the danger is, so too lies the "saving power" it is not clear in what the "saving power" consists. It may consists in a kind of poetic reflection which characterised an ethos and aesthetic sensibility in early Greece that was *technë* – "a single, manifold revealing" that revealed the true nature of things that exist and was responsible for "the safekeeping of truth" (Heidegger, 1977: 34). As he writes: "The poetical thoroughly pervades every art, every revealing of coming to presence into the beautiful" (Heidegger, 1977: 34). Second, therefore, Heidegger's essentialism is aimed at a kind of primordiality only recoverable, it seems, by returning to early Greek aesthetic sensibility. This sensibility that is the possible basis of a spiritual renewal is, for some, too abstract and too theological to inform a new technological practice. In short, it offers us no guidelines for reform of technology in the present era. Third, by ontologising technology in the way that he does and by linking it to the critique of Western metaphysics and especially the critique of modernity (via Nietzsche) he leaves no room for a future-oriented practice of reform or human agency reforming or changing or democratising the apparently autonomous cultural system of ordering that modern technology has become.

Marcuse

Heidegger's commitments stand in marked contrast on these points to Marcuse, Foucault and Dreyfus. Herbert Marcuse, who was Heidegger's student, in *One-Dimensional Man* (1964) runs together a humanist Marxism – the young 'rediscovered' Marx of the *Economic and Philosophic Manuscripts of 1844* (1964) – with a Heideggerian thesis. He clearly continues the Heideggerian programme in insisting that technology is the source of most of the difficulties that advanced industrial societies face. Indeed, technology and technological rationality (which has become a form of political rationality) has contained social change, especially progress that comes from the struggle of classes, and extends a system of domination that co-opts all possibility of protest. He also carries through Heidegger's argument that technology can no longer be regarded as neutral:

> In the face of the totalitarian features of this society, the traditional notion of the 'neutrality' of technology can no longer be maintained. Technology as such cannot be isolated from the use to which it is put; the technological society is a system of domination which operates already in the concept and construction of techniques (Marcuse, 1964: xvi).

Yet as he argues in *One-Dimensional Man* (1964) while advanced industrial society is capable of containing qualitative change, "forces and tendencies exist which may break this containment and explode the society" (xv). Here, Marcuse, under the influence of a humanist Marxism, departs from Heidegger to emphasise historical theory and practice, the possibilities of transformation, and historical alternatives based on subversive tendencies and forces. Marcuse borrows a Marxist utopianism based on a concept of human collective agency, although he is quick to point out that the kind of struggles will no longer be necessarily class based because technical progress has "abolished labour" and transcended the realm of necessity. There it serves as an instrument of domination, to become

"subject to the free play of faculties in the struggle for the pacification of nature and society" (16). He still holds on to the thesis that the processes of production transform labouring classes but in advanced industrial society mechanisation and occupation stratification has led to a change in attitude and consciousness of labourers, thus weakening the negative position of the working class and rendering them docile. As he argues in Marxian theory "the social mode of production, not technics is the basic historical factor. However, when technics becomes the universal form of material production, it circumscribes an entire culture; it projects a historical totality – a 'world'" (Marcuse, 1964: 154). It is not surprising that Marcuse became the hero of the New Left and student movement in the 1960s and 1970s. In a highly prophetic way he had anticipated the political significance of new social movements and their railing against technological enframing.

Foucault

Michel Foucault learns from both Heidegger and Marcuse. Like Marcuse, he departs from Heidegger's essentialism to focus on historical ontologies established through Nietzschean genealogical investigations. For him there are no universal necessities in human nature but only different *technologies* through which the subject is created or by which s/he creates him or herself. Following both Nietzsche and the later Heidegger, Foucault rails against the phenomenological and humanist subject to emphasise modes of subjectivation and the way that human beings become subjects. Thus, he transforms Heidegger's essentialism into an historical inquiry and he distances himself from Heidegger's universalism. From Heidegger he accepts the relationship between subjectivity and technology, although he gives it an historical cast. With Marcuse, he wants to locate questions of power at the centre of his inquiry, but this is not a Marxist notion of power, construed either individually or collectively. Rather it is a kind of power that springs directly from the will to knowledge and truth – a conception of power as positive, productive and capillary, very different from either Marxist or liberal accounts.

Foucault had spoken of a new book on "Technologies of the Self", shortly before his death, based on a seminar presented at University of Vermont in 1982. Throughout his work Foucault had been concerned with technologies of power and domination, whereby the self had been objectified through scientific inquiry. By 1981, he became interested in how a human being turns him- or herself into a subject. In particular, he became interested in those practices whereby individuals, by their means or with the help of others, acted on their own bodies, souls, thoughts, conduct and way of being in order to transform themselves and attain a certain state of perfection or happiness. At this late period of his life he became interested in the Kantian question "what are we today" and, he indicates that his project on the self was suggested by Christopher Lasch's the *Culture of Narcissism* (1978). In particular, he became interested in techniques of self-formation and how the roots of the modern concept of the self could be located in first and second century Greco-Roman philosophy and in fourth and fifth century Christian spirituality. As he says in the interview "Truth, Power, Self": "All my analyses are directed against the idea of universal necessities in human existence. They show the arbitrariness of institutions and show which space of freedom we still can enjoy and how changes can still be made" (Foucault, 1988a: 11).

Foucault may be disappointing for philosophers of technology who are looking for an account of technology *per se*, for his project is really to emphasise the relation between technique and subjectivity or self-development rather than to investigate anything about the nature of technology. And yet what Foucault does is to draw our attention to the ways in which technologies have always been part of culture and society and instrumental in questions of self-formation. In his essay "Technologies of the Self" he aims:

> to sketch a history of the different ways in our culture that humans develop knowledge about themselves… [and] to analyze these so-called sciences as very specific 'truth games' related to specific techniques that human beings use to understand themselves (1988b: 17).

He then outlines four major types of technologies, "each a matrix of practical reason" (18):

> (1) technologies of production, which permit us to produce, transform, or manipulate things;
>
> (2) technologies of signs systems, which permit us to use signs, meanings, symbols, or signification;

(3) technologies of power, which determine the conduct of individuals and submit them to certain ends or domination, an objectivizing of the subject;

(4) technologies of the self, which permit individuals to effect by their own means or with the help of others a certain number of operations on their own bodies and souls, thoughts, conduct and way of being, so as to transform themselves in order to attain a certain state of happiness, purity, wisdom, perfection, or immortality.

Foucault explains that in antiquity there were two major ethical principles – "know yourself" and "take care of yourself". The former came to displace and obscure the latter because the tradition of Christian morality made self-renunciation the condition for salvation. By contrast, taking care of oneself became presented as an immorality. Also, knowledge of the self, as Foucault explains "takes on an ever-increasing importance as the first step in the theory of knowledge" (22). Foucault then proceeds to investigate the theme of "taking care of oneself" in Antiquity, focusing first on Plato's *Alcibides 1* and second, on the Hellenistic period and the Stoics, four to five centuries later, including Seneca and Plutarch. He investigates techniques employed by the Stoics – the disclosure of the self through letters to friends and the examination of self and conscience – and the truth games of early Christianity, that led finally to the whole apparatus of confession.

Dreyfus

Hubert Dreyfus is influenced strongly by Heidegger's work (Dreyfus, 1991, 2001a, 2001b) and, in addition, he has written and drawn on the work of Merleau-Ponty (Dreyfus, 1964) and Foucault (1982). Beginning with *What Computers Can't Do* (Dreyfus, 1972) first published over twenty years ago, Dreyfus develops a non-reductionist account of the relation between minds and brains at a point historically when the computer-mind analogy has dominated for decades. He has been an early and consistent critic of artificial intelligence (AI). As Phillip Brey (2001: 39) notes:

> A remarkable aspect of Dreyfus's critiques is that they are motivated by a philosophical tradition – phenomenology – which at the same time was not often associated with science and technology and seemingly far removed in its concerns. Phenomenology, as it appears in the work of Martin Heidegger and Maurice Merleau-Ponty, applies itself to describing the interrelationships between human beings and the world, and uses the first-person experiences of human beings as a point of departure. And while Heidegger, Merleau-Pony, and other phenomenologists have quite specific things to say about the nature of human perception, thinking and behaviour, their pronouncements about science and technology tend to be rather general and abstract. Dreyfus, however, was able to apply their ideas skilfully in his critique of AI to reach quite specific and concrete conclusions.

It is precisely this orientation and his non-reductive account of the relation between minds and brains that makes his work of the first order of importance to education thought and to educational philosophy. It should come as no surprise that the intersection of his interests in psychology, cognitive science, ethics, entrepreneurship, and expert systems, should profile Dreyfus as one of the most important and yet unrecognized philosophers who speaks to educational questions. *Mind over Machine* (1986), written with Stuart Dreyfus, provided a detailed account of the phenomenology of skill acquisition; an approach utilised and developed in a series of papers, including most recently, "Intelligence without Representation. Merleau-Ponty's Critique of Mental Representation: The Relevance of Phenomenology to Scientific Explanation" (1998), where Dreyfus outlines in summary the stages of an adult acquiring skill by instruction from the novice, through advanced beginner, competence, and proficiency, to expertise.

On the Internet (2001a), in a sense, represents the culmination and synthesis of much of his work with direct application to education, bringing together, as it does his interests in Nietzsche, Merleau-Ponty, Heidegger and Kierkegaard as their work impacts on contemporary questions concerning the body, self and skill acquisition. He begins: "The Internet is not just a new technological innovation; it is a new type of technological innovation; one that brings out the very essence of technology" (2001a: 1), and ends (106):

> as long as we continue to affirm our bodies, the Net can be useful to us in spite of its tendency to offer the worst of a series of asymmetrical trade-offs: economy over efficiency in education, the virtual over the real in our relation to things and people, and anonymity over commitment in our lives. But, in using it, we have to remember that our culture has already fallen twice for the Platonic/Christian temptation to try to get rid of our vulnerable bodies, and has ended in nihilism (see Peters, 2002).

Haraway's *Manifesto for Cyborgs* and Feenberg's Constructivism

Haraway

Donna Haraway's project is distinctive of the socialist tradition and marked by its concern for feminism issues in relation to technology. I include Haraway here partly because the question of the gendered nature of technology is not a topic that has been taken up by male theorists. The feminist emphasis alone warrants her inclusion. Yet Haraway is also a highly original thinker who brings her analysis to bear on information and reproductive technologies. Like all the theorists we have so far discussed Haraway wants to question the alleged neutrality of technology, especially its alleged neutrality in the face of gender. Haraway sees not only technology and technological rationality as gendered but also what Foucault calls technologies of the self. Indeed, the very concept of "biopower" is gendered.

Haraway is Professor in the History of Consciousness department at the University of Santa Cruz where she teaches feminist theory and science studies. She is the author of *Crystals, Fabrics and Fields: Metaphors of organicism in twentieth-century developmental biology* (1976c), her PhD thesis, *Primate Visions: Gender, Race, and Nature in the World of Modern Science* (1989c), *Simians, Cyborgs, and Women: The Reinvention of Nature* (1991c) and *Modest_Witness@Second_Millenium.FemaleMan-Meets-OncoMouse: Feminism and technoscience* (1997). For the purposes of this essay I shall focus briefly on her most famous essay "Manifesto for Cyborgs" that originally appeared in *Socialist Review* in 1985. An early version (1991a), from which I shall work is entitled "The Ironic Dream of a Common Language for Women in the Integrated Circuit: Science, Technology, and Socialist feminism in the 1980s or a Socialist Feminist Manifesto for Cyborgs". The complete version appears in Haraway (1991b: 149-181). In the paper Haraway looks at electronics and biotechnology "to suggest the scope of social reformations which socialist feminists and other progressive groups must face." She goes on to write (1991a: 2):

> I want to be able to show how we can generate new political imaginations and practices that might empower us in the permanently fractured, reconstituted world in which we are placed and place ourselves. My traditional and starting point of the partial but rich ground of socialist, especially Marxist, feminism… Without arguing for a theoretical or practical hierarchy among class, race, or sex… how might a politics proceed which aims for our material and imaginative empowerment in the social relations produced by and producing science and technology?

Haraway characterises the emerging world system "as a movement from an organic, industrial society to a polymorphous, information system" (*pace* Heidegger) and she examines "women in the integrated circuit" in relation to two universes of science and technology: communications technologies and bio-technologies. These technologies are "tools for recrafting our bodies"; they "embody social relations" and are "instruments for enforcing meanings". Haraway maintains that boundaries are very fluid between tool and myth, instrument and concept, social relations and anatomies of possible bodies (2). She argues (3):

> Communications sciences and modern biologies are constructed by a common move – the translation of the world into a problem of coding, a search for a common language in terms of the common coin through which all resistance to instrumental control disappears and all heterogeneity can be submitted to disassembly, reassembly, investment and exchange. I like to term the logic of this kind of knowledge and practice an informatics of domination. The world becomes a game plan; everything is only a move; to win is to stay in the game; to persist is to communicate successfully, to reproduce favourably, to replicate faithfully enough.

Immediately one can pick up the resonances to the work of Heidegger and Foucault, especially the ways in which they point us toward the complex relations between technology and subjectivity, between technologies and identities. Yet at the same time there are clear echoes of Marx and Marcuse. Yet the tools for analysis that we might use – Marxist, psychoanalytic and feminist – are all problematic. Humanist Marxism asserts an essentialism that suggests we can only come to know the subject through labour. It thus relies on a Western sense of self and erases the polyvocal and inassimilable difference made visible in anti-colonial discourse. Psychoanalysis, at least the Freudian and Lacanian discourses, relies on the category of women as other, that is unable to escape the familial narrative or the birth of the "self" drama. Feminism imposes a false unity whereas there is nothing about being female that naturally unites women.

It is for these reasons that Haraway chooses the figure of the cyborg. As she writes (1991c: 140-150):

> A cyborg is a cybernetic organism, a hybrid of machine and organism, a creature of social reality as well as a creature of fiction. Social reality is lived social relations, our most important political construction, a world-changing fiction. The international women's movements have constructed 'women's experience', as well as uncovered or discovered this crucial collective object. This experience is a fiction and fact of the most crucial, political kind. Liberation rests on the construction of the consciousness, the imaginative apprehension, of oppression, and so of possibility. The cyborg is a matter of fiction and lived experience that changes what counts as women's experience in the late twentieth century. This is a struggle over life and death, but the boundary between science fiction and social reality is an optical illusion…
>
> By the late twentieth century, our time, a mythic time, we are all chimeras, theorized and fabricated hybrids of machine and organism; in short, we are cyborgs. This cyborg is our ontology; it gives us our politics. The cyborg is a condensed image of both imagination and material reality, the two joined centres structuring any possibility of historical transformation. In the traditions of 'Western' science and politics – the tradition of racist, male-dominant capitalism; the tradition of progress; the tradition of the appropriation of nature as resource for the productions of culture; the tradition of reproduction of the self from the reflections of the other – the relation between organism and machine has been a border war. The stakes in the border war have been the territories of production, reproduction, and imagination.

She continues: "Cyborg replication is uncoupled from organic reproduction" (150); "The cyborg does not dream of community on the model of the organic family" (151). It does not aspire to "organic wholeness" and "is not afraid of joint kinship with animals and machines… of permanently partial identities and contradictory standpoints" (154). As Carolyn Keen (2002: 1-2) observes:

> The cyborg thus evades traditional humanist concepts of women as childbearer and raiser, of individuality and individual wholeness, the heterosexual marriage-nuclear family, transcendentalism and Biblical narrative, the great chain of being (god/man/animal etc.), fear of death, fear of automatism, insistency of consistency and completeness. It evades the Freudian family drama, the Lacanian m/other, and 'natural' affiliation and unity. It attempts to complicate binary oppositions, which have been 'systematic to the logics and practices of domination of women, people of color, nature, workers, animals' (Haraway, 177).

The cyborg, then, becomes the figure by which Haraway investigates the creation myth of genetic engineering and the relations among genetic engineering, sex and reproduction.

Feenberg

Feenberg's (1999) *Questioning Technology* is, perhaps, the most comprehensive introductory texts in philosophy of technology. It is the third book in a trilogy dealing with technology, including *Critical Theory of Technology* (1991) and *Alternative Modernity* (1995). In *Questioning Technology* Feenberg takes the constructivist turn against all forms of essentialism. As he writes (1999: x):

The 'essence' of actual technology, as we encounter it in all its complexity, is not simply an orientation toward efficiency. Its many roles in our lives cannot be captured so simply. This is the burden of constructivist sociology of technology, which affirms the social and historical specificity of technological systems, the relativity of technical design and use to the culture and strategies of a variety of technological actors. Constructivism, in short, has introduced difference into the question of technology.

Feenberg argues against both essentialism and its cousin – determinism – to put forward a political theory of technology, which embraces the social dimensions of technological systems, including their impact on the environment and workers' skills and their role on the distribution of power. Feenberg wants to encompass the technical dimension of our lives and to provide a social account of the essence of technology, which enlarges our democratic concerns. Feenberg suggests that his philosophy of technology comprises four major elements, which I have abridged for the purposes of this essay.

1. *Hermeneutic Constructivism*. Technology is not the product of a unique technical rationality but of a combination of technical and social factors. The study of these factors must include not only the empirical methods of social science but also the interpretive methods of the humanities in order to get at the underlying meaning of technical objects and activities for participants. Meaning is critically important insofar as technical objects are socially defined.
2. *Historicism*. In recent years technology studies has benefited greatly from the adoption of a historicist approach derived from the work of Thomas Kuhn in the history of science. Instead of regarding technological progress as a deterministic sequence of developments, we have learned to see it as a contingent process that could lead in many different directions.
3. *Technical Democracy*. A technological society requires a democratic public sphere sensitive to technical affairs. But it is difficult to conceive the enlargement of democracy to technology through procedures such as voting … Nevertheless, local publics do become involved in protests over technical developments that concern them. Hence the widespread recourse to protests and public hearings in domains such as environmentalism … we are witnessing the slow emergence of a technical public sphere but that it has been largely overlooked because of its unfamiliar concerns and fragmented form.
4. *Meta-Theory of Technology*. There have been many attempts in philosophy to define the essence of technology and to distinguish the specific difference of modern and premodern technologies … these various theories are unilateral and fail to grasp the full complexity of their object. I distinguish two levels of technical 'instrumentalization' … At the primary level technology reifies its objects, i.e. decontextualizes them and manipulates them. At the secondary level various compensations are introduced to recontextualize technical objects once again, for example, by providing them with ethical and aesthetic dimensions (http://www-rohan.sdsu.edu/faculty/feenberg/Method1.htm).

Concluding note

In this paper I have been concerned to map approaches in philosophy of technology, focusing on how we might address this question, and also the importance of the field for education. I mapped the humanities versus the engineering traditions and within the former, indicated what the Heideggerian programme might look like through the work of Heidegger, Marcuse, Foucault and Dreyfus. There is a question of how we determine a research programme in philosophy, left unresolved, and whether, in fact, it is correct to construe Marcuse, Foucault and Dreyfus as Heideggerian, especially when they all jettison Heidegger's essentialism and his post-humanism. I then contrasted the Heideggerian programme with Haraway's socialist-feminism project and Feenberg's sociological constructivism. Philosophy of technology is an exciting emerging field of interest. It has crucial significance for education, for education is not only a discipline often conceived as the study of education with an accent on its improvement, it is also a giant enterprise, increasing the centre of the knowledge economy, where such improvements are now driven by both economic theories concerning the importance of technology and technical innovations touted to transform its development. In relation to the economic and technical transformation of education I believe that the humanities tradition and, in particular, the Heideggerian programme of philosophy of technology offers a necessary corrective and critique to theories of educational modernity.

Figure 1: The Varieties of Theory

Technology is:	*Autonomous*	*Humanly Controlled*
Neutral (complete separation of means and ends)	Determinism (e.g. traditional Marxism)	Instrumentalism (liberal faith in progress)
Value-laden **(means form a way of life that includes ends)**	***Substantivism*** **(means and ends linked in systems)**	***Critical Theory*** **(choice of alternative means-ends system)**

Source: Andrew Feenberg, (1999). *Questioning Technology*. London & New York: Routledge, p. 9.

Notes

1 See, for instance, the US National Academies 1997 report in the series *Preparing for the 21st Century*, "Technology and the Nation's Future" at http://www.nas.edu/21st/technology/; see also the report in the same series "The Educational Imperative" at http://www.nas.edu/21st/technology/. For a European perspective see the OECD's science and technology policy at http://www1.oecd.org/dsti/sti/s_t/index.htm. See also *Research and Knowledge Transfer in Scotland*, Report of the Scottish Higher Education Funding Council and Scottish Enterprise Joint Task Group (2002) available at http://www.shefc.ac.uk.

2 Neoclassical economics does not specify how knowledge accumulation occurs. As a result there is no mention of human capital and there is no direct role for education. Further, in the neoclassical model there is no income 'left over' (all output is paid to either capital or labour) to act as a reward or incentive for knowledge accumulation. Accordingly, there are no externalities to knowledge accumulation. By contrast, new growth theory has highlighted the role of education in the creation of human capital and in the production of new knowledge. On this basis it has explored the possibilities of education-related externalities. In short, while the evidence is far from conclusive at this stage there is a consensus emerging that education is important for successful research activities (e.g., by producing scientists and engineers) which are, in turn, important for productivity growth; and, education creates human capital, which directly affects knowledge accumulation and therefore productivity growth. (See Report 8 "Externalities in Higher Education", *The Dearing Report*, 1997).

3 My interest was initially stimulated by reading Heidegger's work (see Peters, 2002). In 2002 I organised and taught a graduate level course entitled "Technology, Culture and Value" across two institutions in New Zealand: the University of Auckland (AU) and Auckland University of Technology (AUT). I held the course for explicit reasons as I wanted to institutionalise a philosophy of technology as a pedagogical intervention at AUT. Any university of technology needs to reflect on the nature of technology as part of its fundamental mission. The course of 12 three hour lectures, with 4 of the 12 taught by staff from AUT (Dr Elizabeth Grierson, Dr Mark Jackson, Dr Wayne Hope, Sharon Harvey), focused on Heidegger, Marcuse, Foucault and Haraway, before focusing on issues (including the political technology of freedom, virtual learning, and technologised cultures) and disciplinary approaches (architecture, visual arts, higher education, media studies). See the website at: (http://www.aut.ac.nz/faculties/arts/summer_school/about.shtml), especially the links to theorists, web resources, essays, and journals.

4 Burbules (2001) mentions as exciting possibilities new opportunities for learning involving constructivist, problem-oriented, social learning as well as the benefits of visualisation and virtualisation, simulations and distance education. He mentions five dangers: the creation of an information caste society; commercialisation of education as a for-profit enterprise; the rise of edutainment and other hybrid products; the deregulation and decentralisation of public education and the greater interpenetration of public/private spheres; and finally, deinstitutionalisation of education leading to the demise of a public schooling system.

5 One might also attempt an institutional analysis of philosophy of technology, an approach implicitly suggested by Don Ihde (1996) in providing a retrospective of the Society for Phenomenology and Existential Philosophy (SPEP), founded in 1962, the Society for Women in Philosophy (SWIP) and the Society for Philosophy and Technology (SPT), whose origins date from the same time.

6 See Dreyfus *Heidegger and Foucault on the Ordering of Things*, 2001, University of California Press

7 See: http://www.cc.rochester.edu/College?FS?Publications?HarawayCyborg.html

8 For symposia on Feenberg's latest book see his homepage at http://www-rohan.sdsu.edu/faculty/feenberg/symposia.html including the article by Iain Thomson "From the Question Concerning Technology to the Quest for a Democratic Technology: Heidegger, Marcuse, Feenberg" that also appears in Peters (2002). See also his list of publications and comments on distance education and online community.

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