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CHAPTER EIGHT

SUSTAINABLE TECHNOLOGY

Beyond Fix and Fixation

Aidan Davison

Today's world looks like no other that has gone before. Cars, televisions, air-conditioners, computers: objects unimaginable only a few generations ago, yet now so familiar as to make the idea of life without them almost as unimaginable. The simplest of activities depend on the unseen genius of hydro-electric turbines, cables overhead, underground and undersea, combine harvesters, satellites – all knit together by global flows of electronic information. This is a world populated by transgenic crops, cloned animals and humans conceived in test tubes. A world in which the already ill-fitting categories 'natural' and 'artificial' will be of ever less help, where replacements for worn-out body parts may soon be grown from our tissue, and where surgeons and soldiers alike benefit from ever more powerful tools.

Perhaps the most remarkable thing about this world, however, is not the objects that fill it so much as the fact that change itself seems to be its unifying constant. The surfaces around us are altered ceaselessly in the race to keep up to date. Time seems to accelerate and space to shrink, as the basis of social order becomes mobility itself (Urry 2000). The proliferation of mobile telephones in little more than a decade, combined with their continual innovation and capacity for making fashion statements, tells a story typical of this world's capacity for social change, not to mention economic growth.

A more disturbing story is to be found in news that the number of people who are overweight has grown to be more than 1.1 billion, matching the numbers of those who live in hunger (Gardner & Halweil 2000). In the United States alone, 61 per cent of the adult population is overweight, with around 40 per cent of this group classed as obese (Gardner 2001). To interpret this story we need to remember that although the second half of the 20th century saw the world economy

grow more than 700 per cent (Worldwatch Institute 2002: 59), the gap between the wealth of the richest 20 per cent and the poorest 20 per cent of the human population increased two and a half times during this period, reaching a ratio of 74 to 1 by 1997 (UNEP 2002: 35). More to the point, if the entire population of nearly 6.5 billion were to live as this wealthy 20 per cent does – in affluent nations such as Australia, Britain, France, Germany, Japan and the United States, and within elites in even the poorest nations – it would require the natural resources of somewhere between four and eight planets like our own (UNEP 2002: 36). It is not hard to imagine that in such a world conflicts over access to natural resources and distribution of environmental risks will increase in frequency and intensity.

In part, these facts remind us of the colonial history on which many modern technological triumphs are built, burdening the present with a legacy of ecological damage, social inequality and cultural imperialism. Aeroplanes and the Internet may bring the globe within reach to most of us with access to university education, but these technologies remain inaccessible to a majority of the human population (UNEP 2002: 36–7). While we all face ecological problems of global scale, the minority living in abundance do so in circumstances very different from those of the majority living in poverty. The facts of malnutrition are also disturbing, however, because they remind us that affluent modern life does not equate with social, physiological or psychological well-being in any straightforward way, for abundance, too, has its dangers.

The question of what sustainability can mean in a world where powerful currents of technological change are defining new patterns of excess and scarcity at bewildering speed is a commanding one. The literature addressing this question has grown vast since the early 1970s (Dobson 1999; Harris et al. 2001). Arising jointly out of concern about ecological damage done to a finite planet and about inequalities in modern forms of social development, this literature now takes as its common purpose the integration of environmental, economic, social and cultural objectives into a seamless and stable platform for public policy (Dale 2001; Kohn et al. 1999). There is, however, wide and passionate disagreement about the nature of these objectives. The resultant debate is complex, involving many different contesting positions, and no one topic has succeeded in producing conflict and misunderstanding as thoroughly as that of technological progress.

This chapter reviews controversy over the role of technology in the creation of more sustainable societies. The discussion begins by introducing the two explanations of technology, and the themes of

fix and fixation to which they give rise, that have dominated these debates. These explanations, *technologies as neutral servants* and *technologies as autonomous masters*, are shown to be the source of endless conflict. Apparently opposed, both explanations ignore the many ways in which technological means and human ends interact. In response, the final section introduces a third explanation, that of *technology as social practice*. In exploring the prospects for sustainable technological futures, this explanation invites inquiry into technology as both a product and a producer of social order and cultural meaning.

BACKGROUND TO THE ISSUES

Since 1980, news of environmental crisis has produced a great deal of discussion about the need for technological management of natural environments, much of it under the heading of policy for sustainable development. But it has also provoked widely held and acutely felt fears and hopes about technology (Davison 2001: 11–89; Prugh et al. 2001). This is not surprising. As we shall see, although modern scientific and economic institutions routinely assume technology to be a value-neutral tool, utopian dreams and dystopian nightmares about technology have long had powerful influence in the Western imagination (Winner 1977; Noble 1997). On one side gather prophets of 'simplicity' who see in modern technology a self-destructive addiction, a deadly fixation laying waste to people and planet with equal abandon (e.g. Mander 1991; Mills 1997; McKibben 2003). On the other side gather prophets of a 'Golden Age' who see in technological progress a way of fixing, permanently, the problems of society and ecology, thereby building a safe future with few if any limits (e.g. Kelly 1994; Easterbrook 1995; Lomborg 2001). Labels such as 'technocrat' and 'Luddite' have become barbed weapons with which to attack opponents in a debate whose heat invites combative metaphors. It seems we are impelled to declare our allegiance: are we for technology or against it? Is technology a force for good or a force for evil?

In these conditions the demonising and the canonising of technology is common. Caricatures of naked hippies returning to 'the cave' or films about 'brave new technocrats' doing the bidding of computers are familiar subjects of popular culture (Falzon 2002: 149–80). Careful visions of the future, those capable of reminding us of enduring possibilities in today's political choices, are shouldered aside by the easy fatalism of apocalyptic or complacent claims that the script of the future is already written (Prugh et al. 2001: 21–46).

Social scientists have contributed to the conflict such all-or-nothing positions create, positions demanding of almost religious faith, to the

extent that they have opted out of these value-laden debates. Seeking the safe ground of objectivity, many have joined natural scientists in treating technologies simply as physical facts. It has often been assumed, therefore, that rational conversation about sustainable technology is best led by engineers and economists, and in a language closer to mathematics than to politics or ethics (e.g. Weaver et al. 2000).

It is also true, however, that the presumption that social life is best understood through the lens of scientific objectivity has been challenged in recent decades. With this has come growing interest in the complexity and ambivalence of phenomena wrapped up in the phrase 'modern technology'. A multidisciplinary coalition of perspectives now recognises the dangers of trying to pull issues of fact and technology away from those of value and politics. Since the early 1970s this inquiry has spread rapidly under a range of titles, the most common of which is perhaps that of science, technology and society studies (STS). Within this field, philosophical analyses have largely inquired into the human essence of technology (Borgmann 1984; Winner 1986; Higgs et al. 2000). In contrast, political, sociological and historical analyses have explored the social construction of specific technologies in particular contexts, emphasising issues of gender, race, class, identity, culture and ecology (Cockburn & Dilic 1994; Jasanoff et al. 1995; Reynolds & Cutcliffe 1997). While 'essentialist' and 'constructivist' approaches have often developed independently of each other, they have begun to converge into a rich conversation that does not simply bring together different disciplines but challenges the validity of the boundaries that define them in the first place (Feenberg 1999; Cutcliffe & Mitcham 2001; Ihde & Selinger 2003).

Drawing from STS literature, the following section investigates two dominant and apparently antithetical sets of assumptions about technology, to be discussed here under the headings of *instrumentalism* and *determinism*. These assumptions have been applied to growing concern about environmental issues to produce proscriptions for quick tech-fixes and warnings about deadly fixations. Tracing the sources of this conflict, we consider how to move beyond it and towards approaches to sustainability that do not separate technology from social contests over political ideals, moral values and cultural worldviews.

KEY DEBATES

Instrumentalism

Instrumentalism names the claim that technology is simply the sum of all those tools, those artefacts, which humans use to advance their

interests in life. This view is most often presented as commonsensical – after all, guns don't prowl the streets by themselves – and is the explanation embedded in modern scientific and economic institutions. It draws on two distinct but convergent sources of justification that we can call *naturalist* and *rationalist*. Naturalist justifications see technology as a fact of nature, and thus socially neutral, changing according to laws akin to those of natural evolution. Rationalist justifications, in contrast, see technology as a human and not a natural phenomenon, albeit one still socially neutral, the product of objective rationality. While the former has been important in entrenching instrumentalism in modern life, the latter is explicit in the formal definition of technology as 'the scientific study of the practical or industrial arts' (Oxford English Dictionary 1989). This definition supports the perception that technologies are empty conduits for ideas. Technology is, in this view, applied science and, seeming to lack any meaning of its own, has 'come to mean everything and anything; it therefore threatens to mean nothing' (Winner 1977: 10).

The instrumentalist representation of technologies as unquestionably loyal servants dominates sustainable development policy. Consider the claim in the sustainable development manifesto – the Brundtland Commission's *Our Common Future* – that with 'careful management new and emerging technologies offer enormous opportunities for raising productivity and living standards, for improving health, and for conserving the natural resource base' (WCED 1987: 217). Assuming that sustainability hinges on objective management of technologies, rather than on any properties inherent in technologies themselves, the Commission placed its faith in the continued evolution of presently dominant technological systems: 'Information technology . . . can help improve the productivity, energy and resource efficiency, and organizational structure of industry . . . The products of genetic engineering could dramatically improve human and animal health . . . Advances in space technology . . . also hold promise for the Third World' (WCED 1987: 217–18).

The World Resources Institute stripped this faith back to its core in 1991, asserting that 'technological change has contributed most to the expansion of wealth and productivity. Properly channelled, it could hold the key to environmental sustainability as well' (Heaton et al. 1991: vii, ix). The following year, technological efficiency was the biggest hope shining through *Agenda 21*, the United Nations' action plan for sustainable development, despite the fact that the term 'technology' itself was notable mostly for its absence (Davison 2001: 25).

Indeed, *Agenda 21* is a powerful example of the paradox of instrumentalism: namely, that the more technology becomes an organising principle of social policy, the less there seems to be to say about it other than how to achieve it.

Confidence in the pursuit of the efficient maximisation of production as the shortest path to sustainable development was elaborated during the 1990s, chiefly through the idea of eco-efficiency advocated by the World Business Council for Sustainable Development (Schmidheiny 1992; de Simone & Popoff 1997), but also, in a more subtle way, under the heading of 'ecological modernisation theory' (Mol & Sonnenfeld 2000). The decade closed with Paul Hawken, Amory Lovins and Hunter Lovins' (1999) blueprint for 'Natural Capitalism', based on a 'Factor 10' increase in resource use efficiency, although only two years earlier the latter two authors, writing with another colleague (von Weizsäcker et al. 1997), had judged 'Factor 4' to be sufficient to realise sustainability.

Unlike the 1970s and 1980s, when environmental discussion focused on the earth's limits to growth, the entry into a new century has been marked by confidence that the only limits that matter are those imposed by the current state of technology and furthermore that sustainable development will ensure these continue to be pushed back (Davison 2001: 13–17). Earlier emphasis on strengthening and extending governmental regulation is giving way to an expanded role for responsible corporations. Armed with triple bottom line accounting, cradle-to-cradle management, closed-loop production and other eco-techniques (see Holliday et al. 2002), corporations champion the goal of profitable environmental stewardship. Unlike the three earlier UN conferences on the environment (in 1972, 1982 and 1992), the 2002 World Summit on Sustainable Development's *Plan of Implementation* assumes that sustainable consumption requires above all else increases in the efficiency of product management and that it requires little if any political and cultural negotiation about modern lifestyles, or about the global systems of production, information and finance on which they rest (UN 2002: 13–20).

Beyond instrumentalism

Instrumentalist explanations offer some insight into technology, and the agenda of eco-efficiency is capable of improving some measures of environmental quality. They are, however, unable to address many of the social causes of unsustainability for they arise out of the fallacy of taking a partial truth to be the whole truth about technology.

In maintaining the separateness of human ends and technological means, such explanations are unable to expose the values and assumptions that inform modern understandings of development, progress and sustainability.

Certainly technologies function, in part, as tools. Descriptions of these functions provide what Carl Mitcham (1994: 160) usefully calls *first-order* definitions of technology. Such definitions have clear merit. It is still the case, for instance, that television sets come with on/off switches, as well as with an increasing choice of content and modes of delivery, not to mention the fact that consumers are free not to buy these tools or to discard them. Eco-efficiency offers the promise that soon television sets – of earthier tones and textures, no doubt – will be made out of recycled materials, using fewer resources and producing less waste of lower toxicity, that they will be powered by 'cleaner' energy sources and that they will advertise an ever-growing range of 'green' products and provide interactive sustainability training via DVD.

These outcomes are to be welcomed in a world in which television is a major preoccupation. Nonetheless, this is not the whole picture! Television has also produced profound changes in human experience, giving rise to a wide set of social, or *second-order*, meanings. By becoming central to the flows of information, money, images, stories and desires in social life, television has also become central to the contest for political power and cultural legitimacy (Kubey & Csikszentmihalyi 1990). It has enabled the acceleration and expansion of the cultural practices of consumption, in the process changing the character of these practices. To take an example mentioned earlier, television is implicated in the problem of over-nutrition through the combination of physical inactivity and advertising of processed and fast foods – to which could perhaps be added, passive intellectual and emotional habits – associated with it. The social world of Australian children born in the 1980s is not comparable with that of the 1930s, in no small part because of the changes television has made possible to everyday practices. And, of course, changes arising from this innovation are inextricably enmeshed with the countless effects rippling outwards from other areas of innovation through networks of social practice. These worlds are not just physically different. They are different in the kinds of human experiences, needs and capacities they make more or less familiar.

Modern scientific and economic institutions are largely concerned with first-order or instrumental meanings of technological sustainability, imagining an impermeable wall between the objectivity of science and the messy complexity of wider society. In contrast, environmental

social movements have had much to say about second-order implications of technological change, and in so doing have relied heavily on the second dominant mode of modern explanation of technology, that of technological determinism.

Determinism

Technological determinism refers to two groups of perspectives sharing two assumptions: first, that technological development is at least partly autonomous, unfolding according to its own internal forces outside the sphere of social control; second, that technological autonomy sets limits on human autonomy, thus exercising social control in its own right. Unlike instrumentalists who explain technology as a 'law' of natural evolution, determinists represent technology not as value-neutral but as political power independent of human action, entrenching some social interests and values while undermining others, thus altering the balance and direction of social development.

Put in such bald terms, determinist explanations seem unconvincing. It appears illogical to claim that the things that humans make can become masters over their makers. Why, then, have such explanations been a significant theme in modern political thought and popular culture (Winner 1977)? The simplest answer to this complex question is that technological determinism has more to do with everyday experience than it does with rational argument. It arises out of the confusing and conflicting feelings that have been provoked by technological change since the first axe made both kindling and revenge more readily available. It is instructive to read, for instance, even if it is hard to comprehend in our era, Plautus' reaction to the high-tech of his day, some twenty-three centuries ago: 'Who in this place set up a sun-dial,/To cut and hack my days so wretchedly/Into small portions' (cited in Boorstin 1983: 28).

Often discussed under the labels of *technophobia* – fear of technology – and *technophilia* – adoration of technology – strong emotional responses are integral to our embodied interaction with the technologies around us (Thayer 1995). Cars may appear as collections of objects on a factory line, but once they have become a paraplegic's means of mobility or a setting for horrific injury or a code of social status or an adolescent's rite of passage or a threat to the atmosphere they are inseparable from the conflicting interests at the centre of social life. Wrapped up as they are in this drama, it is not so difficult to believe that technologies have at least some life of their own and many inhabit our experience as friends and enemies rather than as tools.

Technological determinism ranges along a spectrum from pessimistic to optimistic versions of technological destiny. In optimistic accounts our technological dictators are benevolent. Technology becomes, in effect, the principle of evolution embodied in our species. In this vein, the environmentalist Buckminster-Fuller claimed that 'the universe is a comprehensive system of technology' (1970: 178). More recently Kelly has taken up this theme: 'As we improve our machines they will become more organic, more biological, more like life, because life is the best technology for living' (1994: 212). Easterbrook emphasises the flip side of this argument, announcing that nature 'needs us – perhaps, needs us desperately' to overcome its limitations and errors (1995: 668). This is the way, utopian determinists argue, that humanity will design out 'the age-old failures of war, poverty, hunger, debt, nationalism, and unnecessary human suffering' (Fresco & Meadows 2002: 35). Such views are not new. They can be, in part, traced back to reinterpretations of Christian belief in the European Middle Ages that were later cemented into the foundations of modern science, most notably through the writings of Francis Bacon (Noble 1999).

At the other end of the determinist spectrum the prospect of technological malevolence has been recorded famously in Mary Shelley's *Frankenstein*, Aldous Huxley's *Brave New World* and George Orwell's *Nineteen-Eighty Four*. The following observation is typical:

> The machine has got to be accepted, but it is probably better to accept it rather as one accepts a drug – that is, grudgingly and suspiciously. Like a drug, the machine is useful, dangerous and habit-forming . . . You only have to look about you at this moment to realise with what sinister speed the machine is getting us into its power. (Orwell 1936: 189)

Orwell fails to come close, however, to the antipathy D.H. Lawrence had packed, a few years earlier, into his poem 'Death is Not Evil, Evil is Mechanical', with its shattering conclusion that those seeking immortality through technology 'begin to spin round on the hub of the obscene ego/a grey void thing that goes without wandering/a machine that in itself is nothing/a centre of the evil world-soul' (1986: 248).

Such visions of technological excess owed much to earlier Romantic traditions in art and literature (Postman 1999). They were to be deepened by the technologised horror of the Second World War and the acceleration of industrial innovation it catalysed. From the late 1940s through to the 1960s, intellectuals as diverse as philosopher Martin Heidegger, theologian Jacques Ellul, historian Lewis Mumford, and critical theorist Herbert Marcuse converged on Lawrence's theme that

humanity was itself in danger of becoming a machine (Davison 2001: 96–100). Inevitably, the recognition of global ecological damage that began to spread rapidly during the 1970s became a further and powerful motive in casting technology as an inhuman and unnatural force bent on destruction of life itself. At least, it did so until the goal of eco-efficiency emerged in the late 1980s as a new centre of gravity in another phase of instrumentalist optimism in technological progress.

Beyond determinism

Despite their very different conclusions about technology, instrumentalist and determinist explanations rest on a shared foundation. They both accept the binary or dualistic logic of modern rationality, given famous expression by René Descartes four centuries ago, that represents body and mind as entirely separate categories of existence, with 'the body' belonging to the inferior realm of nature and 'the mind' to the supreme realm of culture (Plumwood 1993). Viewed through the lens of dualism, technology and human, means and ends appear discontinuous. Technology is located outside the human essence, becoming either servants of ideas and morals, in the case of instrumentalism, or, in the case of determinism, inhuman forces acting on ideas and morals.

The section below explores debates over the sustainability of technological futures. Yet rather than understand technology as tools for fixing complex social problems with engineering solutions or as an addictive fixation that has humanity in the grip of a suicidal dependency, it draws on recent theoretical interest in technology as social practice. It presents technology as a key ingredient of the social conditions of identity and relationship into which ideas about sustainability must be translated.

FUTURE DIRECTIONS

An absolute, rigid distinction between culture and nature has been a central feature of modern Western traditions (Latour 1993), and one that has shaped much thinking about sustainability. Embedded within this distinction is an assumption that both culture and nature can be reduced to a single and very different universal essence. During the history of industrialisation, the technological digestion of the earth's 'resources' – the universal essence of Nature – and their reconstitution in the forms of 'civilisation' – the universal essence of Culture – defined human progress. The pendulum has now well and truly swung on this history. Expressions of nature's essential value and meaning are everywhere visible in everything from environmental philosophies to real

estate spiel (Cronon 1996). Whether thought of as machinery doing a poor job and needing technological updating, or as virginal wilderness needing protection from technology, however, nature remains often understood as opposed to culture.

The conceptual separation of nature and culture is most often translated in practical terms into the view that technology is opposed to ecology as if it were a separate category of reality, the boundary between them policed by notions of 'naturalness' and 'artificiality'. As will be appreciated from the foregoing discussion, this translation is not straightforward because modern traditions have also imagined an impermeable wall between the facts of technology and the values of society. Thus while ecology and technology are thought to be fundamentally different, both have been excluded from understandings of what makes us human. Many environmentalists have sought to reclaim ecology as a source of human meaning. Yet in celebrating nature's inherent values, much environmentalism has only strengthened the perception of technology as inhuman and unnatural (Davison 2001: 63–89). Radical ecology movements, in particular, often promote a form of direct human reunion with nature seen as avoiding altogether the alienating mediation of technology (e.g. Sessions 1995). What is often lost in this yearning for an enchanted nature is recognition that all human practices, those that cherish and nurture life as much as those that seek to control and destroy it, are inherently technological.

Representations of humanity, ecology and technology as separate forms of reality lie beneath the surface of current debates about sustainability and destabilise many policy attempts to pursue integrated forms of social development. Sustainable development has become a mechanism for fitting together technological, ecological, and socio-cultural objectives, rather than questioning how these objectives became disintegrated in the first place and how this disintegration might be avoided.

This state of affairs is profoundly ironic, for at the level of everyday practice the boundaries between humanity, ecology and technology are ever more permeable. Recent developments in gene technology, for instance, provide a vivid example of the ability of contemporary technology to make 'thoroughly ambiguous the difference between natural and artificial, mind and body, self-developing and externally designed, and many other distinctions that used to apply to organisms and machines' (Haraway 1991: 152). Controversy over gene technologies now threatens to burn out of control as these practices move out of laboratories into farms, factories and hospitals, touted as the solution to everything from human disease, starvation and depression to

biodiversity, pollution and waste management (Tokar 2001). Instrumentalist assurances that gene technologies are just another set of tools needing rational management hold little weight in the face of powerful resistance focused on at least six key issues:

1. the immorality and arrogance of seeking to redesign and commodify life;
2. the global risks to human and ecological health from a reductionist technology seeking control over complex living systems by manipulating what is thought to be their basic building blocks;
3. the inadequacy of capitalist motives of profit, competition and consumer preference in providing equitable human benefit and in tackling basic rather than trivial human needs;
4. the legal control of gene technology, including 'genetic information', by a relatively small number of large transnational corporations;
5. the capacity of gene technology to further widen the gap between wealthy and poor;
6. the use of gene technology for violent social purposes, and in the service of political authoritarianism in general.

These concerns are vitally important and demanding of serious political debate and action (Hindmarsh & Lawrence 2001; Bridge et al. 2003). Such debate and action are confused, however, by determinist representations of technology which suggest that the core threat posed by gene technology is that to an essential human (e.g. Fukuyama 2002) or natural (e.g. McKibben 2003) purity, to their sanctity, and which seek to redraw a line in the sand between the organic and the technological.

Alternatives such as 'organic' forms of agriculture or 'holistic' medicine may well be more sustainable than many emerging forms of gene technology. But they are not less technological, or more natural, in any essential sense. They represent crucially different forms of biotechnological social practice that need to be articulated as alternative and positive visions of technology – visions affirming that empathy and interconnection are as much technological possibilities as are control and alienation. Many forms of modern technology have done great damage to ecological and social systems by assuming they can be controlled as if humans stood outside them. The environmentalist celebration of the human location deep within these systems does not, however, mean that technology ought to be demonised and rejected. Rather, it demands inquiry into the ways technologies make possible

human embeddedness within these systems. Understanding technology as the means of belonging within networks of sustaining relationships ensures that technical issues of efficiency and control are unavoidably joined to social issues of sufficiency and moral purpose.

Insight into technology as social practice reveals more than just the ways in which technologies are developed and used in the context of social beliefs, values and goals. It asks how technologies are also constitutive of such beliefs, values and goals in the first place. Put simply, it asks: how are we being built as we build our world? Most importantly, such insight does not just provide greater powers of description. Inquiry into technology as social practice empowers groups and individuals to take political and moral responsibility for the building of human possibilities.

Objectifications of technology give rise to the strange result that the habitats humans build are not understood to be inherently part of their humanity (Davison 2004). Human agents inhabit technological space almost as strangers, asking of the objects around them: are you tool or tyrant? This question is of only limited use in taking practical responsibility for the challenge of sustainability. Technologies of genetics, biology, energy, matter and information cannot be neatly sorted into good and bad, or sustainable and unsustainable, piles. Produced within militaristic – or unjust or colonising or wasteful or racist or patriarchal, etc. – social practices, renewable energy technologies, sustainable forms of agriculture and other 'green' techniques may reduce some forms of ecological risk, but they may also help to prop up, to sustain, an unsustaining social whole. Then again, given that some powerful voices champion nuclear power as a renewable energy source and genetic engineering as a cornerstone of sustainable agriculture (Holliday et al. 2002), such approaches are by no means certain to reduce ecological risks either.

Technologies are integral to the political and moral processes that shape social life. Furthermore, they now play a more central role in the creation of human possibilities, and in the creation of ecological and other risks, than ever before. Bruno Latour, a leading sociologist of technology, encourages us to observe how the modern project of dominating nature has created a paradoxical social reality in which mastery and predictability of any kind are ever less likely:

> Behind the tired repetition of the theme of the neutrality of 'technologies-that-are-neither-good-nor-bad-but-will-be-what-man-makes-of-them', or the theme, identical in its foundation, of

> 'technology-that-becomes-crazy-because-it-has-become-autonomous-and-no-longer-has-any-other-end-except-its-goalless-development', hides the fear of discovering this reality so new to modern man who has acquired the habit to dominate: there are *no masters anymore* – not even crazed technologies. (Latour 2002: 255)

This realisation offers very different understandings of sustainability from those produced by instrumentalist and determinist representations of the future as either controllable through rational planning or prefabricated through the trajectories of the present. It emphasises that technologies build the habitats through which societies continuously remake human experiences, capacities and needs in ways inherently experimental and unpredictable; in ways never fully knowable. 'If you want to keep your intentions straight, your plans inflexible, your programme of action rigid, then do not pass through any form of technological life' is Latour's wry advice (2002: 252), for technologies are the means of achieving predetermined ends, as well as the means of creating new ends.

There are many ways in which understandings of technology as experimentation in human possibilities can inform ideas of sustainability. Recent interest in social theory of risk, mobility, hybridity, networks and contested natures (e.g. Adam et al. 2000; Urry 2000; Castree & Braun 2001; Macnaghten & Urry 2001; Ihde & Selinger 2003), in particular, has much to offer discussion of technology and sustainability. Such approaches reveal questions of sustainable technology to encompass much more than the imperative of efficiency, for they reach back to the most basic concerns of human meaning. They enable us to see technological futures afresh by exposing the limits of representations of technology as tools or tyrants and by reclaiming technological choices as political and moral negotiations about the human character of social practice.

Discussion Questions

1. Give three examples of technology you would like to see in the everyday life of the 22nd century. How does each example embody your vision of 'social progress'?
2. Discuss the claim that 'genetically modified foods represent the best hope for overcoming global food insecurity'.
3. Outline one argument in favour and one against the cloning of extinct and endangered species as a means of biodiversity protection.
4. Are the phrases 'sustainable technology' and 'sustaining technology' interchangeable? Why?

5. Assess the recyclable, renewably powered, non-polluting private automobile as an example of sustainable technology.
6. Describe three representations of technology in recent popular culture in relation to the themes of instrumentalism and determinism.
7. What ought sociological study of the idea of 'eco-efficiency' encompass?
8. What effect is implementation of renewable energy technologies likely to have on the gap between the richest 20 per cent and the poorest 20 per cent of the global population during the next twenty years?
9. Explain your understanding of wilderness. How is this understanding related to your everyday experience of 'built' environments?
10. Evaluate the following proposition: 'the traditional technologies of indigenous cultures were just as advanced as those of today and can help provide solutions to global environmental problems.'

Glossary of Terms

Determinism (technological) represents technological change as autonomous, outside human control, and either socially good (utopian) or evil (dystopian).

Eco-efficiency: measure of ecological impacts and economic prosperity per unit of production.

Instrumentalism represents technology as a collection of neutral tools, or physical facts, lacking any inherent meanings, purposes, politics or values.

Luddite: deriving from the resistance of 19th-century English craft workers to industrialism, now often used pejoratively about people seen to be anti-technology.

STS: interdisciplinary field of science, technology and society studies.

Sustainability: a wide arena of debate, rather than a specific concept, asking basic questions about the relationship of: humanity to nature; present to future generations; wealthy to poor; technology to social progress; and global to local politics.

Sustainable development: narrow interpretations of sustainability focused on increased production and resource use efficiency.

Technocrat: those in positions of social authority who reduce social problems to matters of instrumental calculation and technological efficiency.

Technology: inherent dimension of human experience having both first-order (invention, production and tool use) and second-order (worldviews, politics, morals) meanings.

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