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WHICH BELIEFS DRIVE TECHNOLOGICAL INNOVATION?

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The role of technologies in environmental crises

Attempts to understand environmental crises cannot avoid scrutinising the technologies that have had a large hand in creating the societies in which we live. The very word 'environment' betrays a technological approach: the implication being that the 'environment' is *our* surroundings which we have the freedom to manage, engineer and ultimately control. There is an urgency about the need to critique the technological perspectives, processes and products by which, at an accelerating pace, we manipulate the planet's resources and its life-sustaining eco-systems.

The mutual shaping of technologies and implicit beliefs

Critique of the technologies that powerfully extend our capabilities and radically alter living conditions, is often confined to discussion of their use. We assume that technologies are neutral tools in our hands and that ethical questions only arise over how they are to be used. This is to underestimate the social and moral dimensions of the value judgements that are ubiquitous in the conception and realisation of a technological product. Value judgements govern each move: the assessment of the problem to be pursued, the people consulted, the resources demanded, the production processes installed, the marketing tactics employed, and the criteria chosen to measure progress and evaluate success. The final product is marked by the commitments and beliefs that have all along guided its development:

> We create the things we value, the things we think beautiful or useful. We devise tools, machines and systems to accomplish the ends we value....Our beliefs, our values, our philosophies, our experiences, in short our culture, is made manifest, in part in the artefacts and systems we create. (Prime 1993, p. 30)

In the new circumstances created by the artefact or system, these in-built values will both determine its impact and influence subsequent developments. Equally, there may be far-reaching social and ecological consequences because relevant social, moral and spiritual concerns were not taken into account during the research and development processes: omissions are also value-judgements that mark the outcome.

The extent to which a technology can impose priorities and norms, that have been built into its ways of working, is illustrated by Pertti Pelto's account of the introduction of snowmobiles to the Skolt Lapps of Finland in the 1960s:

> As a result of replacing dogsleds and skis with machines, reindeer herding practices changed, female reindeer fertility declined, a cash economy dependent on outside fuel and machine parts was established, and a highly egalitarian society rapidly became divided into a society with a few successful entrepreneurs and many wage laborers who formerly had been independent and self-employed. Clearly the new technology was not a neutral factor. [It] reconstituted the entire society and the ecology of the region. (Cobb, C. 1992, p. 6)

Likewise, Jerry Mander reports on the consequence of introducing computers and computer training (through American and Canadian government "aid") to the Indian and Inuit peoples of the Arctic regions:

> Once an intimate knowledge based on close observation and centuries-old teachings, the relationship among human and animals is now based on computer print-outs, and has thus become a fast-paced, objective, abstract, quantitative kind of knowledge. This is destructive of Indian cultures and traditions. … Recent evidence (also) suggests that the computer management systems rarely improve upon the native conservation and management systems. In fact, the modern systems often prove disastrous. (Mander 1991, p. 257)

A recent study of the commercial and political forces driving the genetic engineering of trees has concluded:

> The processes through which genetically engineered trees are being developed are profoundly biased against social arrangements which promote and rely on biological diversity. These processes are also riven by dilemmas and destructive tendencies which chains of technical refinements, no matter how long, are likely to be powerless to overcome. Tackling the challenge GM trees pose means tackling the industrial and bureaucratic tradition which seeks the radical simplification of landscapes. (Corner House 2000, p. 12)

Such a task is made harder by the feedback created: uniform forests of genetically identical trees, modified to serve particular industrial functions, reinforce the commercial values that prompted investment in the technology in the first place. This is a typical example of the way value-laden technologies have a tendency to exercise a power which all too easily spirals out of human control:

> We are progressively being manoeuvred into ways of acting—both in the home and in employment—which are not of our deliberate choosing, but which are dictated by the technologies we have ourselves created. Far from our values shaping technology, technology is shaping our values'. (Layton 1992, p. 10)

Dominant beliefs

This suggests that it is crucially important to break in and examine the beliefs that are driving cycles of technological innovation: innovation shaped by particular passions, needs, goals, economic forces and political pressures, which then skew future development in favour of the same inbuilt aspirations.

In his attempt to do this, Arnold Pacey analysed two different world views governing the use of natural resources:

> The values of people who worry about environmental problems include a concept of nature in which living things have an intrinsic worth and the goal of material development is regarded as, ideally, to find ways of living in harmony with nature. By contrast, the confidence of many economists and engineers in human ability to overcome every problem may often reflect a moral judgement that the proper role of man is mastery over nature. (Pacey 1983, p. 67)

Pacey then examines in detail three sets of values: one based on rational, materialistic and economic goals, one keen to exploit the frontiers of capability, and the other representing the attitudes and needs of users (seen as closely allied to the values embodied in work traditionally done by women):

> Nearly all women's (traditional) work falls within the usual definition of technology. What excludes it from recognition is the fact that it implies a different concept of what technology is about. Construction and the conquest of nature are not glorified, and there is little to notice in the way of technological virtuosity. Instead, technique is applied to the management of natural processes of both growth and decay....[which] partly depends on accepting and working with nature rather than trying to conquer it, and is a neglected concept in conventional technology. (Pacey 1983, p. 104)

This analysis is neatly summarised by Ursula Franklin: 'the technological order is geared to maximising gain; the strategies of the women's world are more often than not aimed at minimising disaster' (Franklin 1985, p. 8). It is given concrete form by Patricia Hynes:

> In December 1989 the National Academy of Engineering picked the top ten engineering accomplishments of the past twenty-five years: moon landing, application satellites, microprocessors, computer-aided design, CAT scan, advanced composite materials, the jumbo jet, lasers, fibre optics, genetic engineering. What could have been picked in the fields of energy, transportation, pollution control, agriculture and medical technology if the social usefulness and ecological impact of technology were of primary consideration? Photovoltaics, wind turbines, high-speed trains, biodegradation of solid and hazardous waste, alternatives to chlorofluorocarbons (CFCs), biodegradable plastic, widespread use of integrated pest management and organic agriculture and an effective male birth control device.
>
> The dramatic differences in these two sets of technologies lie not in their technical and intellectual challenge, but rather in their values, purpose and design relationship. The former prioritise human mastery over nature and devices for faster, more extensive manipulation of information. The latter tend to work in partnership with nature, to be extensions of natural resources, to manifest consciousness of social and environmental impact, to link the human and natural world (Bank Street College of Education, 1991). (Hynes 1994, p. 141)

In case this all sounds a bit distant from the kind of decisions we make in our daily lives (which have the effect of reinforcing the decisions of the designers, inventors and manufacturers of the consumer goods we buy), here is what Walter Schwartz reported in an article a few years ago:

> Twelve-year old Katy wrote in her essay on Life at the [unimaginable] Age of 25: 'I have many attitudes, one of my strongest is going to be Greenpeace and the environment.' Then she added: 'I would live in a house with 10 rooms and my car would have to be either a BMW or a small blue Metro. I'd rather have a Lamborghini'.

Walter Schwartz went on to comment:

> [Was Katy] more illogical than the rest of us? …we have all become a bit green …but we have not changed our values. We are thankful for our supermarkets, which kill the commercial life

> of our town, cover fields in concrete and add to road congestion. We need our car, although we know that traffic growth must one day be halted. We need to rest from the strain of modern living by taking foreign holidays, although we know that mass tourism kills the environment and distorts the economy of host countries, not to speak of what airplane engines do. (Schwarz 1994, pp. 12,13)

In other words, the values and beliefs that are actually prompting our decisions are those promoted by our technological environment. We are putting our hope and trust in that which can be delivered through technology. We crave its products. We become obsessed with its goals of efficacy and efficiency. The latest hi-tech is our measure of progress. The technical fix is the means of salvation.
Or as George Grant has expressed it:

> We have bought a package deal of far more fundamental novelness than simply a set of instruments under our control. [Technology] is a destiny which enfolds us in its own conceptions of instrumentality, neutrality and purposiveness. (Grant 1986 p32)

Alternative frameworks

But technology does not need to be driven by narrowly focussed instrumental criteria, or made to serve purely materialistic and commercial goals. The example given by Hynes, quoted above, indicates the potential for giving primary consideration to social usefulness and ecological impact. For her part, Franklin, while recognising the power of technological values, nevertheless argues strongly for the claims of justice:

> Today the values of technology have so permeated the public mind that all too frequently what is efficient is seen as the right thing to do. Conversely, when something is perceived to be wrong, it tends to be critiqued in practical terms as being inefficient or counterproductive (a significant term in its own right). The public discourse I am urging here needs to break away from the technological mindset to focus on justice, fairness, and equality in the global sense. Once technological practices are questioned on a principled basis....new practical ways of doing what needs to be done will evolve. (Franklin 1992, p. 123)

Janet Burns, when examining the meaning of technological literacy, draws attention to the distinctive 'Discourse' of different social groups, each with its set of values, beliefs and practices (Gee 1996). Liberating literacy is demonstrated when one Discourse is critiqued in terms of the values and

beliefs associated with another. Her example echoes the accounts given by Pacey, Franklin and Hynes:

> Most people would agree that Western technological Discourses are traditionally underpinned by values of efficiency, profitability, competition and the control of nature. [By contrast] values of cooperation with nature underpin the philosophies of feminists and many indigenous peoples, [who] are thus well positioned to examine values of control and to suggest alternative directions. (Burns 1997)

The contribution of religious faith

Religious faith is a mainspring of just such alternative Discourses that question the 'values' i.e. the expectations (individual and cultural) and powers (ideological, economic and political), driving the development of technologies:

> The first step in dethroning technology, to chasing it back to its proper place in the order of things, is not to belittle it or detract from its intellectual fascination or its power to set men and women free from drudgery, but, rather, to erect around it and over it other values and wisdoms that oblige us to see technology in its correct perspective. The great themes of the meaning of life, the redemptive potential of death and suffering, the astonishing insights of artistic intuition, the recovery of a sense of the cosmic scale of human tragedy and the human comedy, all that earlier ages and different cultures have understood as wisdom, and all that is supposed to be reflected in and meditated upon through religious consciousness—these are the powers that reduce an upstart lust for technique to its proper place. (Elliott 1988, p. 179)

A seminar organised in Cambridge in March 2001 has affirmed that "the major religions have much to teach us about a correct attitude to the natural world and to all living creatures. They suggest a variety of ways in which we might enhance our appreciation of the natural world's beauty and mystery and live more responsibly and harmoniously within it." (The Islamic Academy 2001, p. 8) Such religious insights are a response to that which is transcendent; to an imperative from outside the world of our own making; in Christian terms, to a God who created the world in and for love. They embody a wisdom that calls in question the habits and expectations of any culture, not least one dominated by economics and technology. It is a wisdom that warns against the arrogant assumption that we can exploit the natural world without regard to its carrying capacity or that we are entitled to control and manage its delicately-balanced eco-systems for our own selfish purposes. It speaks a prophetic word concerning the wholeness of human life, in which the health of human communities is bound up with our stewardship of the rest of the living world. For example:

> We want to say as forcefully as we can that social justice for all people and eco-justice for all creation go together. Social justice cannot happen apart from a healthy environment, and a sustainable and sustaining environment will not come about without greater social justice.…The biblical concept of justice recognises the need for healthy relationships in creation as a whole. This way of viewing justice helps us to understand the linkage between poverty, powerlessness, social conflict and environmental degradation. (World Council of Churches 1991, p. 60)

Such wisdom understands human beings 'as persons-in-community rather than individuals-in-markets' (Cobb 1994, p. 8). It demands, at the heart of decisions about investment and technical advance, a sensitivity towards potentially affected communities and cultures, in whatever region of the world they are, not least towards their interdependence with the natural environment. It lays upon us a response-ability of care towards the whole 'Earth Community' (Rasmussen 1996).

Response-ability and long-lasting commitments characteristic of religious faith

It needs to be stressed that it is that primary response of faith, leading to serious, long-lasting commitments, that nurtures such wisdom. Following Kierkegaard, Hubert Dreyfus has described such commitments in this way:

> They are neither the ones that I arbitrarily choose nor the ones that I am obliged to keep because of my social role. Rather, these special commitments are experienced as grabbing my whole being. When I respond to such a summons by making an *unconditional* commitment, this commitment determines who I am and what will be the significant issue for me for the rest of my life. … They establish qualitative distinctions between what, for the individual, is important and trivial, relevant and irrelevant, serious and playful. (Dreyfus 1999, p. 19)

Religious faith calls us to be engaged with the life of those whose lives touch ours, committed to building relationships that respond to the purposes of God's good creation. It is the wisdom wrought out of that committed engagement that must be brought to bear, often polemically, into the debate about the purposes of technological activity and the means being used to achieve them.

Technological literacy: the exercise of critic competence

The case for examining implicit Discourses as an integral part of technology education in schools was made forcibly by John Tomlinson in a *TES* article a decade ago:

> Technology based on the simplistic change-equals-growth-equals-progress paradigm constituted "a reckless incursion into the future". … To continue to place mankind's narrow understandings and vested interests in manipulating the world at the top of the value scale is to ensure the end of our species. … [This daunting insight] must be a spur to a different way of using knowledge as wisdom and to seeing our sojourn here as a trusteeship—a cooperative and constructive endeavour rather than a competitive struggle. It goes to the heart of how we see ourselves and, therefore, of how we should educate our children. (Tomlinson 1990, p. 16)

The same challenge was put by Brian Chapman in the *School Science Review* a year later:

> Science and technology servicing a global economy rooted in free-market competition and consumption would seem to have very different priorities to those that would exist in a global economy based on cooperation and conservation. Do we really want to educate young people so that they can deploy their … technological skills on the trivia of affluence? … Or do we want to educate them for a world in which, if they do become … technologists, their science and technology will be directed to … attempting to ensure the survival of Planet Earth? (Chapman 1991, p. 58)

In other words, a crucial educational goal is the kind of technological literacy referred to by Janet Burns: a literacy that critiques value judgements in the course of technological development on the basis of other Discourses—not least those originating in religious faith—which emphasise the meaning and purpose in our lives and relationships, the trusteeship we have been given and the moral responsibilities we carry. It requires what David Layton calls *critic competence*:

> The ability to judge the worth of a technological development in the light of personal values and to step outside the 'mental set' to evaluate what it is doing to us (e.g. it might be encouraging a view of social problems in terms of a succession of 'technical fixes' rather than more fundamental considerations). (Layton 1993, p 61)

To develop critic competence, young people must be given opportunities to reflect on what—or who—'grabs' their trust and commitment, to consider the beliefs held by different social and cultural groups, and to discuss the basis for understanding what is 'good' for human welfare and by implication for all the interlocking relationships in the created order:

> We have to understand what human welfare is. This is the moral horizon for technology which cannot be set aside, neither in the world, nor in education, We have to think about what is good for us as people living in this or that society and how technological capability serves that, and how technology education can re-create that capability: both to make good things and to know what the good things are that technology can enhance. (Olson 1997, p. 389)

Incorporating reflection on beliefs into design and technology education

It is understandable if design and technology teachers feel daunted by the challenge to open up implicit beliefs and values for discussion and debate. Yet this could be the aspect that helps pupils to see the social relevance of what they are doing, that gives them the chance to do something they feel is worthwhile. The reflection on fitness *of* purpose as well as fitness *for* purpose (Barnett 1994, p. 57) can actually come quite naturally at many different points in the process of designing and making and evaluating products. I pointed to some of the opportunities in an article in the *International Journal of Technology and Design Education*, in part using as an alternative Discourse the concepts elaborated by the Panel for Education for Sustainable Development:

> When pupils work together on projects for other people, it can encourage 'compassion … and concern for social justice; willingness to act as a responsible citizen, learning from and working with others to improve situations; respect for both human diversity and biodiversity' (Panel for Education for Sustainable Development 1998 pp. 5,6). In investigating ecological impacts pupils can grow in their 'concern for and appreciation of all living things, their needs and their interrelationships' (ibid., p. 5). In assessing impact they may realise that more is at stake than can be solved by a simple 'technical fix'. As they design a product and struggle to take conflicting values into account, they may find themselves having to justify their choices. As they investigate and evaluate a product and its packaging, they can consider the motivation behind its design and production, speculating on whose interests were taken into account and whose were ignored. They can give thought to the 'winners' and the 'losers'. (Nuffield Design & Technology Project 1995, p. 74) They can reflect on the image, life-style or status associated with the product and which of their own values it invokes and which values it disparages. (Allison 1999) They can debate these values, and the expectations and beliefs that they represent, not least in order to test out their own sense of priorities. If pressed a little

> further – and here technology teachers could draw on the expertise of their Humanities colleagues – pupils can learn to 'distinguish between technical issues (what is possible) and ethical issues (what ought to be done)' (Millar 1998, p. 2022) and to debate the basis for their ethical judgements. (Conway 2000, p. 252)

The National Curriculum claims that 'design and technology prepares pupils to participate in tomorrow's rapidly changing technologies. They learn to think and intervene creatively to improve quality of life' (DfEE/QCA 1999, p. 15). To achieve this aim, the OFSTED guidance on inspecting design and technology gives weight to the need for critic competence: it suggests that inspectors look out for characteristics in pupils' attitudes to learning such as 'appreciation of users' needs, other people's values, environmental issues and moral questions, when designing, and readiness to reflect these in their work' (OFSTED 1999, p. 6). Religious insights about God-given responsibilities to sustain life on earth have a direct bearing on value judgements being made in the pupils' activities. Opportunity to open this up for consideration and thoughtful debate is essential to their learning. It is also a crucial aspect of effective environmental education.

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