Design and Technology Education: Whose design, whose education and why?

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Abstract

This paper seeks to demonstrate the significant, if not essential, place of design in our lives and in the technological world. Further, it contends that such a significant presence warrants a role for design in the general education of all students in two principal ways. In one way, it presents design as necessary to the integrity of Technology Education. In another, as a result of this necessary integrity, it argues a case for the key role of Design and Technology (D&T) Education as a core component of any ethically defensible curriculum of a state education system. The case presented is not limited to any particular society or educational jurisdiction.

Key words

Design, design and technology, curriculum, ethics, democracy

Prefatory note

Nomenclature is something of an issue for a paper such as this. The majority of the readership is well acquainted with the name 'Design and Technology'. It is in the title of the journal, it is in the name of the associated (UK-based) professional association, and it is the name of a school subject familiar to that readership. 'Design and Technology' is known in these circles as a compound noun, a phrase that has its meaning because it is more than a simple addition of 'Design' to 'Technology' or vice versa. This name, and this meaning, is by no means universal. There are other names for the similar practices that happen in this professional educational field. Commonest and broadest of these is 'Technology Education' in which design may be present (depending on location) to varying implicit or explicit degrees. In some locations design may be considered to be marginal to the enterprise of Technology. Readers are asked to allow some flexibility in how the terms are used in this article. Nothing that is written here is in any way intended to marginalise any group or curriculum approach for whom the article may have some application.

Introduction

> Design directly expresses the cultural, social, political and economic complexion of a society, and it thus provides a snapshot of that society's condition. Design matters: it is too important just to celebrate, collect or historicize. The world situation demands that we develop a greater awareness of design's explicit and implicit values and their implications, and exercise a greater control of design in our societies.
>
> (Whiteley, 1993:158)

Whiteley's words serve to set the scene and perspective of this paper. All we might add is that, since they were written, economic globalisation has moved further.

I hope to show that the nature of the phenomenon 'design' – at once both ethereal yet tangible (like 'technology') – is such that its curriculum inclusion is eminently warranted. I will argue that its inclusion benefits society, education and individuals alike. I hope to show that (Design and) Technology Education is an ideal vehicle for the articulation of design in the curriculum.

Across the world, at an increasing rate, the amount of curriculum enquiry and development in something broadly known as Technology Education has been impressive (see e.g. Layton, 1994; Black and Atkin, 1996; Kimbell, 1997). The ongoing output of journal papers, texts and national and international conferences all attest to the development of this critically important aspect of education. Concurrently, there are intra – and inter-jurisdictional differences and debates around nomenclature, around purposes, and around philosophies. Within this educational phenomenon the degree to which design is an explicit aspect can vary. In time, there may be something of a global settlement about these matters.

For some, design is *de rigeur*. After all, 'Design and Technology' (as a compound noun) has been under way for well over three decades as a school subject in some jurisdictions. But we

also know that internationally, for a variety of good reasons, this is not the case. For a start, there is enough contention around the uses and meanings of the word within the English language without testing its ability to translate. The very cultural nature of such a term means that local meaning must be achieved against local context. To articulate whatever one means by 'design' (or whatever term in another language) is to grapple with matters of politics, culture and practice. The word can defy translation between cultures and some sensitivity and respect is needed here. Meanwhile, in some settings 'design' may seem either superfluous or its role is nascent.

While 'design' is the concern of this paper I do not offer some grand theory on design. Contributions to that discussion are many and are readily available elsewhere. Some would say that the word is over-theorised. However, what is offered here seeks to be an affirmation of design's place in Technology Education and, in turn, within Education for democratic life – which is seen as more than just 'democracy' the political noun.

Any quality education today is an education for global citizenry. If we can think environment globally, or economy globally, or peace, or communications, or health or whatever, then we can conceive of education globally. For this reason, I begin with a look at the world as it is – the world we live in, the world we have created. I then move to a discussion of the interplay of society, democracy and culture. From such beginnings I present what I believe to be *the* core construct around which all the design-in-technology-in-education issues revolve – or should revolve – that of ethics. When the ethical view has been presented it is possible to explore design and, in turn, the educational issues.

The (technological) world we live in / the state we're in

The world we live in is for a large part of our making. We the species have created it. Yet we would deny having personally created it – as would most people I know. This created world is the work of others. I had no part in its design, its making. I wasn't consulted. All the human-made aspects of this world really must be the work of someone else. In the words of Sam Goldwyn the film producer "Include me out". With such reasoning we manage to eschew both self-involvement in, and collective responsibility for, our designed technological world. It is ironic that we can say that the material world in which we live seemingly simultaneously fulfils so many desires yet leaves so much to be desired.

What I allude to here is so massive, so pervasive, an issue that it remains largely obscured from interrogation (Sclove, 1995). The human-created technological world is so fraught with concerns that facing the associated issues seems a daunting prospect. I have elsewhere (Keirl, 2006 in press) offered and discussed a selection of technologies to illustrate the complexities of the technological phenomenon. For example:

- Three 'must-have' technologies – the phone, the car, and the computer – can all be shown to be highly contentious. Despite their 'ordinariness' they are readily problematised by thorough critique.
- Through artificial intelligence, xenotransplantation, robotics and nanotechnologies the concept of what it means to be human is looking unsustainable.
- Jeans are made from multiple materials and processes in multiple countries. Genes (of any species) are patentable and for sale. Geans – wild cherries – just aren't so available now. 130 years ago, an authority on the fruits of Great Britain reported 474 varieties of apple, 578 of pear and 116 of cherry, 28 of which were geans!
- Surveillance is ever-increasing and takes many forms in many aspects of our lives. Privacy, and our identity, is taken from us without our consent.
- We design and re-design (and de-design?) our being in many ways. Many people accept new identities without offering

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active resistance or critical questioning of how they will be 'changed'. Branding (Quart, 2003), image, virtual realities and fetishism are marketed to mould us to the point where we are simultaneously producer, product and consumer. We can now contemplate designed beginnings (with the concept of the designer baby) and we can contemplate designed endings – our deathdays.

- We design wars. Military spending drains research budgets and far exceeds human needs budgets. Product dependency is generated whether software licensing or genetically modified product licensing. Not only is almost all technological research and development profit-driven but it is also prone to secrecy, patent control and suppression. Altruism is marginalised and alternative technologies are regularly repressed.
- 'Wants' are purveyed through powerful and pervasive advertising and marketing strategies. Waste is good and is to be generated – viz. obsolescence, low quality, and superfluity of product design. My collection of washing up brushes and mops now exceeds 500. One Australian dairy company offers a range of 800 dairy product variations.
- There is a resultant mental health dimension too. As Packard cautioned nearly half a century ago:

> …the environment for a satisfying style of life is being undermined by all the emphasis on ever-greater productivity and consumption. As a result, the nation faces the hazard of developing a healthy economy within the confines of a psychologically sick and psychologically impoverished society.
>
> (Packard, 1960:293)

Since then, two generations have been born to such conditions. A more recent analysis from a clinical psychologist argues that:

> …high degrees of materialism have a toxic effect on psychological and social wellbeing. A strong materialist orientation has been associated with diminished life satisfaction, impaired self-esteem, dissatisfaction with friendships and leisure activities, and a pre-disposition to depression… (a) worrying rash of 'consumption disorders' such as compulsive shopping, consumer vertigo and kleptomania…
>
> Hyper-materialism also features predominantly in the emerging plague of 'existential disorders' such as chronic boredom, ennui, jadedness, purposelessness, meaninglessness and alienation…'
>
> (Schumaker, 2001:35)

Such is our world, our existence. These are the results, whichever way one looks at things, of our *designs*. And they are also the foundations of the future that we are laying for the generations ahead. Covertly, or with complicity, we are designing one kind of future or another.

What can be said about the nature of technologies collectively? 'Technology' is a highly problematic term but technology's complexity does not, I believe, make the phenomenon of technology impenetrable. I have ventured (Keirl, 2006 in press) to summarise some common attributes of technology and those I wish to consider here are:

- technologies are *integral* to our lives and cultures. We can hardly define our existence without reference to them yet they remain *outside* of common critical discourse;
- all technologies have contested values. No technology is neutral or universally good;
- the post-human era is emerging, where the balance between our human identity as we have known it and the engineered human is shifting;
- technologies almost always emerge faster than the necessary associated ethical and legal considerations;
- personal and collective identities are shaped by the technologies with which we interact;

- as the raison d'etre of technology, power and empowerment are subject to attribution, distribution and ownership – in equitable or inequitable ways; and, importantly…
- all technologies are created by a manufacturing or enabling process resulting from human intention and design.

From such lists of technologies and their common attributes emerge design-technology-democracy concerns. The fact is that all may not be well with our technological world. In reflecting on this world, I would like to highlight two phenomena – ideology and invisibility – both of which are comprehensively addressed by Sclove (1995). He argues that technologies act as purveyors and protectors of ideology as well as being sources of ideology. As a consequence, technologies' interplay with ideology must be recognised and critiqued. Sclove is far from alone here. There is a growing heritage of philosophers of technology who bear out the issue (Heidegger, 1977; Winner, 1977, 1986; Ihde, 1993; Feenberg, 1999. See also Scharff & Dusek, 2003; Kaplan, 2004 for edited collections).

What has motivated such authors to pursue this issue is the curiosity that many share (and which is one of education's great challenges, I contend) about the total pervasiveness of technologies in our lives – their very intimacy with our existence as a species – *in parallel with* a deafening silence about that very presence. On the one hand technologies are consciously designed. On the other, we unconsciously and uncritically accept their life – and world-changing potency.

Design, society and ways we organise

There are many ways that we organise ourselves, our lives, and the cultural and social institutions with which we interact. Politics, the economy, law, health, education, clubs, sports, work and so on can all be seen as technologies that bring us together or form our social networks and our cultural cohesion. All these entities are designed entities and, thus, much of the background against which we conduct our lives can be looked at in terms of design. When we see these human-designed entities for what they are we can also understand the potential for their redesign.

Initially, this may seem unnecessary. After all, if it ain't (too) badly broke, why fix it? But what is clear is that when it comes to the technologies listed above, and their common attributes, it seems rather necessary to critique and question not only the products but also the culture and practices which brought them to be. This indicates the very *embeddedness* of particular technologies – whether material, virtual or genetic – within other technologies, that promotes the invisible and endorses the ideological. Matters of morality, responsibility, and complex values are all at play here and design, latently or actively, is ever present.

We are able to acknowledge that this embeddedness is what the design-society relationship is about. As Whiteley (1993) points out: 'We have to remind ourselves that a cultural condition is not *natural* but socially, politically and economically constructed.' (Whiteley, 1993:159). In turn, so far as the economic and material cultures of the rich and powerful minority-world societies are concerned, we might apply Borgmann's (1995) words: 'There is one heading… under which we can discuss and judge the quality of our material culture, viz., design.' (Borgmann, 1995:13).

But there is an ethos against which we would probably claim that all these designed cultural phenomena are played out. To a greater or lesser extent we would say that the designing and creation of the technologies of our institutions, systems, products and processes happens in democratic ways and that is because we live in a democracy. The claim is that we do things, or they should be done, democratically.

For the purposes of this paper, I take and accept democracy as ideal-to-striven-for. That is to say, it is neither static nor an end-state.

Its many imperfections are matters for constant identification and attempted resolution. The ideal is sought as circumstances change. What is necessary for its realisation is the *practice* of certain principles which are underpinned by ethics. Democracy is, thus, lived ethical practice. Such a statement is no cheap resolution to a thousands of years old debate but is made to introduce the matter of ethics as a central concern for each of design, democracy, society and technology. So far as the technology of politics is concerned, democracy is seen as the most ethically defensible form of social and political organization.

Ethics, democracy and design practice

If the technological examples outlined were not enough to raise debate and concern about the world we are creating, then we might look for other causes and/or tensions.

Undoubtedly our preferred (designed) economic system has much to reconcile in terms of its pursuit of profit and growth. The 'market system', as euphemism 'benign but without meaning' (Galbraith, 2004:5) for capitalism, has so influenced institutions, governments, social relations and product research and development at local, national and global levels that to question it seems heretical. Yet when we step aside and pose ethical questions such as 'How should we live?', 'What is right or wrong in terms of the environment, health or wellbeing?' or 'What is the difference between a *need* and a *want*?', we create discomfort and receive scorn rather than ethically informed answers. As Campbell (in Whiteley, 1993) has argued, just because a society's material values are seen as 'normal' or 'rational', this is no guarantee that they are ethically sound.

The whole 'market' enterprise is fraught with problems and dissatisfactions. (For an introduction to the issues for design-democracy-education interplay see Baynes, 2005). The rhetoric of progress, growth, choice and change is remarkably problematic when an ethically driven design critique is applied.

These associated problematics reach well into education and must, I have argued, be considered by the (Design and) Technology Education profession as our curriculum debate unfolds (Keirl, 2002a; 2002b; 2003).

Lurking behind the market rhetoric are two long-recognised phenomena. First, there is what Mesthene (1970), commenting on Macpherson, notes as the 'two internally inconsistent assumptions' on which Western democratic theory is based. One assumption (associated with capitalism and the market) sees man (sic) as the infinite desirer and consumer of utilities. The other, (as justification of liberal democracy) sees 'man (sic) as exerter of his uniquely human capacities and asserts the equal right of every individual to make the most of himself' (Mesthene, 1970:110). This inconsistency is sometimes teasingly articulated as the tension between *homo sapiens* and *homo rapiens*.

The second phenomenon behind much market rhetoric is that of determinism (in hand with technological determinism). This is a significant philosophical field and must be acknowledged when design-ethics-society relations are under examination. A determinist position is usually to be found behind the advocacy of change, choice, and/or progress in the name of the market system. But when change is defended in the name of growth, choice (in the market) as democratic right, and progress as 'natural' or 'inevitable', then questions are begged about human will, intention and efficacy.

If we believe that, as humans, we actually have and are capable of expressing our individual and collective will, then we claim some efficacy to bring about and implement our intentions. To claim to act ethically – whether in our daily lives, in our design choices, or through our system of political organisation – is not only to assert our will to act but is to do so in ways that are considerate of ourselves, our species, other species, the environment and the future. The bringing of technologies into the world involves four phases – *intention* (why do it);

design (how to develop the intention into a possibility); *manifestation* (its bringing-into-being); and *application* (its effects or the uses to which it is put). Whilst the first of these might happen in the mind of just one person, the fourth potentially affects not only the whole species but more. Ethics matters at every stage. Precisely because ethics is of central importance to democracy, design, and society, it is argued that it should at once be both foremost as a *practice* in our lives as well as a *precursor* to our technological intentions.

So far as the ethical-political practice of democracy is concerned, we might apply three of its basic constructs – participation, representation and opposition – to our technologies as well as to our political lives. In considering what ethical design (and technology) might be, we can reflect on how we participate in the designing, how we are represented in the designing and how we can oppose the designing. At present, I argue, our roles are minimised on all three counts and, thus, a greater understanding of design is needed.

Design for all?

Dr Johnson's Dictionary has design as 'a scheme formed to the detriment of others' (Onions, 1983:528). In some senses, for this paper, Johnson's words are apposite, but Mayall (1979) draws out other important issues when, alluding to Snow's (1959) 'two cultures' thesis, he says:

> For far too long we have been afflicted by the design of so-called form and the design of so-called function, the design of the arts-based world and the design of the science-based world; a subject which might appear to confirm all too clearly that we have a bi-cultural society. Yet as far as the real subject of design is concerned, nothing could be further from the truth. …(D)esign is the great integrator; a subject in its own right and certainly not, now or ever, a derivative of art and science in whatever terms these themselves may be defined.
>
> (Mayall, 1979:5)

Design is all too simplistically seen as 'does it work' or 'how does it look' and this issue is returned to time and again by theorists of the field. Mayall (1979) here alerts us to the educational case for design as a subject but the problem is one of educational history too. Not only can we trace the roots of such thinking to the Ancient Greeks but we also seem to maintain a blind acceptance of the division to this day (the invisibility thesis again).

If design can be recognised as cultural integrator then it can also be seen in much richer and socially more beneficial ways. It is not simply about representing a body of knowledge or as being concerned with objects. Its process and practice for potential common good must also be understood too.

To describe Whiteley's (1993) approach to design as critical is not to say it is negative. He is not *anti*-design but *pro*-design as, '…to be anything else naively denies the power of design in people's lives, and also its overwhelmingly positive potential to effect change.' (Whiteley, 1993:158). His three broad critiques – of 'green' design, socially responsible design and feminist design – are presented as socio-political rather than spiritual. The last, he says, brings the politicisation of design into the sharpest focus (Whiteley, 1993:5). He also poses Booth and Stockley's 1990 question as to whether, if design were a person, it would be a 'mature adult taking responsibility for its actions or a whining adolescent, insecure and struggling to come to terms with the outside world.' (Whiteley, 1993:1). (In educational terms we might ask if it is, at present, something of an underachiever.)

Ihde (1993) reminds us that *all* cultures, no matter how technologically minimalist, are complex cultures – this is a core aspect of our existences. Meanwhile, Borgmann (1995) sees design as being a matter for everyone's concern in the same way as health, justice and education are matters of the common good. Part of his perspective addresses what he calls '(e)ngagement… the symmetry that links

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humanity and reality. Human beings have certain capacities that prefigure the things of the world; and conversely what is out there in the world has called forth human sense and sensibility.' (Borgmann, 1995:15). This echoing of Heidegger and the existential nature of our humanity-reality relations also offers a clue to the invisibility issue. Because of the intimacy of these relations, we cannot either 'be' without them, or distance ourselves enough to recognise, let alone explain, the phenomenon. Borgmann (1995) argues that engagement has actually declined because of a shift from aesthetic design towards one of engineering design. As users, we are less engaged and increasingly disburdened – we feel less responsibility in relation to, or for, design.

Existential appreciations of design-in-this-world such as Borgmann's are readily richer than utilitarian-economic approaches. The latter have their history well established. Just as Penfold (1988) documented the late 19th Century claims that an upgraded technical education system would improve Britain's economic competitiveness with France and Germany, so it was the case for design competition in the early 20th Century when ' …a number of British designers were becoming increasingly aware that European design developments were taking the lead.' (McDermott, 1993:79). At about the same time, design was proffered as the anti-recession fix in Germany (McDermott, 1993:90). Design's ascribed potential as economic saviour has a steady history. In 1947, Lippincott saw the role of the designer as 'to imbue the consumer with the desire of ownership' (cited in Whiteley, 1993:45). By the 1980s, in the UK, the government of the day had produced a 'Profit by Design' brochure and saw design as serving the national interest, that is, creating wealth, winning markets, and giving 'the international competition a sound drubbing' (Whiteley, 1993:162). These may be the facts of life of the market system but evidence is still sought that the same practices and criteria are universally applicable to, and benefit, other realms of human endeavour.

To this situation come calls for designers to examine their value systems and the ways they operate. Design may be a relatively new area of study or of professionalism but our 'engagement' is potentially a human commonality awaiting a shared critique. Pye (1964) and Mayall (1979) both acknowledged design's nascence, its lack of theoretical discourse and its struggle for recognition either in tertiary education or as anything other than being for an elite in society. This last concern would have been echoed by Walter Gropius who resisted design-as-idealism as well as design-as-materialism seeing it as:

> …neither an intellectual nor a material affair, but simply an integral part of the stuff of life, necessary for everyone in a civilised society… Our conception of the basic unity of all design in relation to life was in diametric opposition to that of "art for art's sake" and the much more dangerous philosophy it sprang from, business as an end in itself.
>
> (cited in Buchanan 1995:36)

If such a position is to be realised then design must be seen as accessible for all people. Such access must be about redistribution of power so far as design elitism is concerned; it must be about increased collective understanding of design-as-human-enterprise; and, it must be about the capacity to express will and effect change so far as 'engagement' is concerned. Such access can only be granted within a democratic civics supported by a democratic education system that, in turn, articulates a rich, not a narrow, engagement with design. A step in this direction is noted by McDermott (1993) who comments that design theory in the UK in the 1990s was no longer focused on a single idea about aesthetics or process but was pluralist with '…the only shared aim (being) to place design in its widest social context' (McDermott, 1993:88).

Whilst the positioning of design within its broader social context is necessary, it is also necessary that the professional practice of design (and the education thereof) maintains its

own critique. One-liners about the definition of design are unhelpful. For example, to pluck sentences such as 'Design is the conscious effort to impose meaningful order.' (Papanek, 1974:17) may be relevant to the case being presented but is of little help to the holism of design that must be understood by society and for society. This holism is articulated in texts such as Buchanan and Margolin (1995) and is particularly represented when the complexity of issues is based on sound theoretical analysis (see, eg, 'Six requirements for design' in Pye, 1964; 'Ten Principles in Design' in Mayall, 1979; McDonough's 'Hannover Principles for sustainable design' in Ellyard, 1998).

In turn, the question is begged of designers: 'What is good design?'. To try to answer this question using criteria of form, or function, or profit, is to fall well short of the ethical question 'What is good design?' which is a matter for the 'engaged' (and educated) community too. In Manzini's (1995) view, professional designers lack '…an ethics of design adequate to the new problematic framework and to new sensibilities' and he calls for '…new values and deeper conceptions of quality.' (Manzini, 1995:220). The responsibility is significant. Borgmann sees it in the sense of trusteeship: 'Designers… have been entrusted by society with a valued good and are hence accountable not only to the immediate desires of society but also for the well-being of the good that is in their care.' (Borgmann, 1995:18)

Education(al) design(s)

As can be seen from what has been presented, design matters. It is integral to the bringing-into-being of *any* technology. It can also be understood in many ways. This means that it is both a powerful concept, valuable to any society claiming to be democratic, but it is an educationally challenging one too.

Here I re-affirm the role of education within democracy. If democracy (even as ideal) is the most ethically defensible form of political organization, then a requisite of democracy is an education system that promotes and defends that democracy (White, 1973). I also re-iterate the enormity of the technological presence in our world and that it is human-created and warrants ethical interrogation. The technological examples and their common attributes (cited earlier) signal a particular educational role too.

The combined issues of education for democracy and education about technologies are major ones and are ultimately matters for the profession as a whole. However, D&T education has a particular role to play as it is a meeting point for so many of the issues addressed here. This begs the question of the profile of an appropriate D&T curriculum – one that is holistic, dynamic and critical – and I contend that there are some impediments to that curriculum being enabled. Taking up these challenges is part and parcel of healthy democratic curriculum design and development.

First, and foremost, is the recognition of the invisible and the ideological and the acknowledgement of the need to act on them. D&T education, by adopting critical approaches, can readily expose technologies and their designs for the totality of what they are and for whose agendas they serve. Challenge this may be, but it is arguably the predominant democratic goal for a rich design education to address. Technologies can no longer remain ignored or be taken simplistically as 'things' or applied science or hi-tech. They must be foregrounded from the background they represent. In bringing them into the foreground, the associated ideological interests (and their underpinning values) will also become public and available for interrogation.

Second, as has been said, there is also a huge spectrum of technologies to address. This pervasiveness and multiplicity need not be a reason to deem the challenge impossible to meet. In fact, a key is to recognise the common attributes of *all* technologies and to build an appropriate education around these. The one such attribute under examination here is design.

Thus, third, design must be understood for its richness. Design may (could) be a subject. But it might also be understood as subjectivity and objectivity, as knowledge-creating or as a way of knowing. (The epistemological baggage of 'fields' such as 'the arts' or 'the sciences' should not be replicated for D&T which serves education well as both integrator and meaning-maker. Also, the pursuit of technology's own 'body of knowledge' should be seen for what it is – either illusory or serving perhaps one or two stakeholder interests alone.) Design can be understood, too, as a way of being. When all of these interpretations or understandings are embraced, the educational significance of design can be truly appreciated.

Fourth, there is the interplay of competing stakeholder interests (ranging across the gamut of human enterprise viz. economic instrumentalism, professional specialist groups, ecological sustainability, girls and women, defenders of participatory democracy, and liberal educators), (Layton, 1994). Such a spectrum of interests in shaping D&T curriculum warrants a strong and well-educated D&T profession. The resolution and balancing of these interests is a matter of reasoned ethical judgement.

Finally, there are the challenges presented by short-termism and narrowness. The former comes from calls to meet the special needs of this or that industry or the political agenda of a party-political approach to an elected term of office. The latter comes from premature pressure to specialise in a subject with a view to a particular pathway – be it vocational training or a university degree – or a restricted curriculum interpretation of technology education.

How then can these challenges be met and what is the value of a quality design education to the individual and to the common good of a society? The principal answer to this question recognises the significance of design education as general education, that is, an education which the society deems compulsory for all students up to a certain age. It is not an education from which some may 'opt out'. It is deemed good for, and necessary for, the individual and the society alike. Herein lies a significant debate and it is an ethical one that should be lead by the profession.

Design education's role in a democracy will best be articulated by the practice of ethical discourse. All design issues involve the weighing of competing values. Here, immediately, is the basis of ethical discussion – ethical in both the issues faced and in the means of conduct. This is democratic practice. As such, it may not be design practice as currently considered but if an ethically defensible (designed) technological future is a desired target then ethically modelled design practices will serve it well.

Design activity articulates more than values-resolution issues. There are many emotional states that can be encountered, nurtured and learned about – risk-taking, doubt, discomfort, delight, anxiety, celebration and so on. There are many thinking modes (for example, analytical, divergent, convergent, synthesising, reflection, critiquing) to be applied and the associated discipline of using these appropriately is a rich educational practice. There are personal and interpersonal skills to develop. There are multiple communication skills and strategies to practice. Creativity, innovation, discrimination and problem-solving are all enabled through design activity.

Experienced D&T practitioners have long known that through the practice of design the subject (or field) can meet the needs of any preferred learning style and introduce students to new ways of thinking and doing. The empowerment and fulfilment of the individual student can be realised through design activity too. Designerly traits such as creativity and critiquing are, arguably, entitlements of any student as an educational right to self-expression and self-realisation.

Each student, as a person, also has an entitlement to an education in breadth – to education as introduction to possibilities and as

initiation in practices and ways of doing things. These are matters of their existence in, and for, democratic life. The closer design education is able to replicate the technological and social issues of the day and of the future, the richer and more meaningful the education of the student. This does not require students developing the capacity to replicate the *manufacture* of every conceivable technology. There is no need for this. Their better position is to understand the human-technology relationship, to learn about free will and choice-making and to consider what the ethically designed life and co-existence could be like and how it might be achieved.

Such an education cannot happen through narrow technicism, through skilling alone, or through trying to meet any one stakeholder agenda. It cannot happen by encouraging the deterministic invisibility or false 'inevitability' of technological development. It cannot happen through the uncritical acceptance of the technological status quo. Design is a demonstrably powerful learning medium that can serve the individual and the common good alike – and it must always do so in ethical ways that serve democratic global co-existence.

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