Chapter 2
'Seeing' and 'Interpreting' the Human-Technology Phenomenon

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This chapter formulates and addresses the dual challenge of how to understand Technology, and how this might inform the development of Technology Education for the future. Philosophy, in its role as critical toolbox, offers hermeneutics as a device for technological interpretation and meaning-making. By setting up a series of binaries, a hermeneutic approach can be used not only to explore Technology holistically and analytically, but also to look to cultural, historical and political relationships. The idea of binarial hermeneutics enables Technology's complexity to become manageable through a focus on issues, which include: local and global, traditional and emergent, product and process, technical and designerly, and academic and practical. These binaries are not 'either-or' but 'at-once-both', enabling analysis along a spectrum. Such a binarial approach offers a way of interrogating the rich and complex areas of Technology Education in order to develop informed ways forward.

Introduction

This chapter explores the interplay of philosophy, Technology and education and how they relate to curriculum futures. Technology educators have jobs to get on with and curricula to deliver but, as any study of the history of the field will show, ours is not a static field of education. If Technology is our bag then change is inescapably ours too. Understanding change makes us better able to accommodate the future—whether we do so actively or passively! A philosophical engagement with one's field is a powerful way to maintain perspective, to entertain deeper questions and uncertainty, and to think about futures.

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In what follows, *Technology* (big T) addresses the field of Technology-as-phenomenon while *technology/ies* (little t) refers to single or multiple potentially identifiable and specific technologies. *Technology Education* is used as a generic term representing varying formulations and namings for a field of educational activity—which can vary significantly within and across jurisdictions. These varied namings are themselves problematic and cannot be taken to be synonymous.

In this chapter a twofold problem is envisaged—one aspect is about how to explain and understand the rich concept of Technology—how to 'see' Technology—while the other is about how what is seen might inform Technology Education for the future. I think of these problems as *the phenomenon* and *the irony*. Both offer serious challenges to which there are no simple answers. Both signal a need for deeper debate, research and reflection before new settlements can present themselves. In an attempt to address these challenges I introduce an 'interpretive device' to help locate some of the big issues at play.

The *phenomenon* can be put as follows: we humans cannot 'be' without Technology and Technology 'is' by human intention and (inter)action. That is, technologies and humans co-exist intimately. However, despite this intimate human-Technology phenomenon, there is a huge *irony*: why, then, do we not have a parallel education to help understand the phenomenon? Of course we do have Technology Education and its variants around the world and we might argue that it is not their place to wrestle with the complexities of the phenomenon itself but, rather, they should/can only attend to local matters in a timely and manageable way. However, on closer examination, we can see that the phenomenon and practice in schools are not readily separated—or if they are, only a partial Technology Education may be taking place (and I use the term 'partial' here in two senses: of being limited and being biased). We soon see that the phenomenon and the irony both beg special attention through curriculum and teaching.

The challenge is to investigate possibilities that not only help develop our understanding of the phenomenon but also help address the irony. Such investigations can inform future directions for Technology Education. To these ends, the chapter is presented in three broad sections. First, an overview is given of some of the ways in which Technology has been explained by philosophers and theorists who grapple with its complexity. Following the philosophical overview, the interpretive device of *binarial hermeneutics* is introduced. This has been developed with the dual aims of (a) helping identify and locate some key aspects of the human-technology phenomenon and (b) using these aspects to inform 'future directions' that the profession might envisage.

Technology Education from the early years to university, while gradually forming its own philosophical base, still has much to learn from Philosophy of Technology. So, informed by the outcomes of the interpretive device the final section of the chapter looks to some of the educational implications and issues—such as curriculum formulation, teachers' personal professional philosophies, and pedagogical practices—that could be considered on such journeys.

Philosophy and Theories of Technology—A Brief Overview

> We speakers of English. . .seem to be able to tolerate a high level of ambiguity with respect to our use of the term 'technology'. (Hickman 2001, p. 11)

> The philosophy of technology is more like a mosaic of many different ideas and suggestions. Yet, there is a lot that one can learn from this mosaic. Mosaics anyway do have their charm. (de Vries 2005, p. 7)

Despite the prevalence and ubiquity of technologies there is a sense in which they remain largely invisible to us. Once technologies become accepted and cease to be 'new' they are 'normal' and unremarkable and we become uncritical of them. They embed in and form part of our lives, cultures, societies, and our 'being'. So food, clothes, and travel just become part of our way of life rather than being seen as 'technologies'. Technologies cease to be familiar and fade into the background. Similarly, we 'take for granted' the technologies that we are born to—we knew no different so we have no reason to question them. Not only are they part of what we constitute as 'normal' (were we ever to consider them) but they also become our benchmark for what counts as 'old' (before *our* time) and 'new' (not yet experienced).

Technologies shape our lives, our identities, our environments, our cultures, our thinking, our working, indeed our very way/s of being in the world. To what extent is the converse true? Of all the technologies we experience, which ones have we had some say in their introduction, in their design, in their use, or in their positioning of us? Do we really have any control over our technologised being or do we just rather passively adjust our behaviours to accommodate technologies? If we wish to engage such questions, that is, to actively critique technologies, then we are called to explore them from multiple perspectives, interests and uses and in doing so we enter into a world of big questions and issues. Here, the case for education arises.

When it comes to scholarly interrogation, the rich and exciting field of Technology offers a constant dynamic of contestation, possibilities and pitfalls. In some ways, the field's late start in the 'philosophy of' club is due to it having been an object of intellectual curiosity for other academic fields (e.g., history, sociology, psychology, anthropology) thereby having been colonised by them. The field of Technology continues to live somewhat in the shadow of science. In such scenarios the true identity of Technology remains obscured. Furthermore, there are wide differences of understanding both within the Academy and within public discourse about the nature of Technology and how it should be engaged.

Recently, Feenberg (2010), introducing his philosophy of technology said:

> Though we may be competent at using many technologies, most of what we think we know about technology in general is false. Our error stems from the everyday conception of things as separate from each other and from us. In reality technologies belong to an interconnected network the nodes of which cannot exist independently *qua* technologies. . .. It turns out that most of our common sense ideas about technology are wrong. (p. 3)

It is no longer possible to describe technologies simply as 'things' or as 'hi-tech' or as 'applied science' or as 'tools' or as only that which is 'new' or as their being 'neutral'.

In respect of this and to the field's benefit there is a rich and growing number of astute commentators on whom we can draw: Ellul (1964); Feenberg (1991, 1999, 2010); Haraway (1991); Heidegger (1954/1977); Ihde (1979, 1990, 2002); Latour (2007); Lyotard (1979/1984); Mitcham (1994) and Winner (1977, 1986) are a few. Of these, Mitcham offers a comprehensive introductory analysis of Technology's philosophical history, manifestations and interpretations. Elsewhere, Kaplan (2009b) and Scharff and Dusek (2003) offer comprehensive edited collections of readings. All these authors have wrestled with Technology's ubiquity and complexity and have generated invaluable critiques, yet they are far from agreeing on interpretations.

To explore Technology is to engage with multiple philosophical fields: moral philosophy (on ethics and what is 'right'); metaphysics, which includes ontology (on being and existence) and epistemology (on knowledge and knowing); phenomenology (also in some ways on knowledge and on being but especially on subjective experience and consciousness); axiology (on values and aesthetics); political philosophy (on democracy, rights, ideology); philosophy of mind (on intentionality, determinism, mind-body, mind-machine); and, philosophy of language (in a small way used in this chapter, on hermeneutics). However, this is not to suggest that we have to start from such philosophical fields 'cold'. The lived realities of how Technology presents itself in the world offer us multiple alternative starting points.

Critiques of technologies and our relationships with them often present themselves as *issues*, for example: the environment; surveillance; waste; obsolescence; communications; production techniques; genetic engineering; xenotransplantation; identity; democracy; inter-species and environmental justice; consumerism; mechanisation; un/employment; urbanisation; robotics; transport; privacy; and so on—all of which are problematic. There is extensive literature and research on all of these, and more, technological issues.

In the light of such realities it is unsurprising that different approaches to theorising Technology and technologies have emerged that are contributing to debates and bringing new ways of engaging with the field. Four examples, *very* simply presented, serve to illustrate this. First, *critical theory* (e.g., Habermas 1971) with its roots in the Frankfurt School of the 1920s suggests that, as well as looking to identify *what* knowledge should count to make up this or that subject (e.g., technology), we should also look to whose interests are served by the knowledge. Three 'knowledge-constitutive' interests are nominated: the technical (which enables us *to do*); the practical-hermeneutic (which enables us *to understand*); and the critical-emancipatory (which enables us *to be*, that is, to operate as autonomous individuals). These are all readily presenced in and through all technologies: Do we simply use a technology? Do we understand the technology for its social context and the values it embodies? Do we knowingly select, reject and critique technologies? This is not a hierarchy—all three 'interests' matter in education, as can be witnessed in the formulation of technological literacy

developed for children in the South Australian Design and Technology curriculum (Department of Education, Training and Employment 2001), that is, it is a Technology Education intended to go beyond the merely technical.

Actor-network theory (ANT) (Latour 2007) developed out of studies of complex technological systems. Strictly speaking this is less a theory than a method but the key aspects are that, within any system, human and nonhuman components are attributed equal respect in terms of their significance. Two forms of relations are explored within systems—the material (things) and the semiotic (concepts)—both being key to understanding technologies. ANT, although sometimes charged with vagueness and circularity, certainly offers new insights into the study of human-Technology-social relations, such as understanding how multiple values are attributed to, and by, technologies; and in turn how power is distributed and attributed in technological systems.

For a third example of robust theorising of Technology we can look to Ihde's (1979) phenomenological approaches to the philosophy of Technology advocating what he terms *variational theory* (Ihde 2009; Ihde and Selinger 2003; Sobchack 2006): "...a series of multiple perspectives to recognise the shape, structure, and complexity of the phenomenon (being investigated)" (Eason et al. 2003, p. 125). Such an approach facilitates a richer critique of, and engagement with, Technology and technologies because it recognises notions such as complexity, holism and dynamics (of the phenomenon) alongside the subjective nature of individual and collective perceptions and consciousness. Hermeneutics, simply put as the business of interpretation, is key to phenomenological work.

A fourth theoretical approach is that of *narrative theory,* which Kaplan (2009a) uses to point to the 'narrative' or the 'story' of technologies as a way of 'reading' them. He argues that such reading shouldn't just give a *contextualised* (scene-setting) portrayal of a technology, calling for the *critical* to be ever-present: "[A] critical reading of technology evaluates technical things and systems in terms of their role in achieving social justice and happiness. Technology should...not only be contextualised but read in relation to universalist concepts, such as truth, impartiality, and equality" and he talks of "...narrating things differently to create new ways of seeing the world so that we might imagine, argue for, and create new ways of being in the world" (p. 96). Pointing to simple oppositions that are often posed, he argues that:

> Our choice is not between bad/abstract or good/concrete interpretations of technology, but between conventional readings that leave everything as it is or critical readings that challenge unjust social practices and institutions. Critical narratives connect and relate just as much as they disconnect and interrupt our ordinary contexts of action. They invite us to step back, reflect and deliberate with each other about what is true, right and appropriate and, in so doing, establish the terms of social cooperation. Above all, stories of technology create a common world of meaning for the specialists with technical expertise and the rest of us who just like a good story. (pp. 96–97)

All four of these theoretical approaches offer ways of 'seeing' technologies, and their methods collectively embrace critique, translation, interpretation, reading, describing, explaining, and so on. Like the fields of philosophy, they can help us

grasp the richness of the human-technology phenomenon but neither the philosophical nor the theoretical approaches can give us concrete answers or 'truths'. What is worth remembering is that 'seeing' can happen at different levels. For example, we can see rather passively at a surface level but we can also see in deeper ways that expose meaning and bring understanding.

Mitcham's (1994) comprehensive exploration of philosophy of technology issues juxtaposes *engineering philosophy of technology* with *humanities philosophy of technology* and he presents a dialogue between the two. In the spirit of theories, stories and dialogue I'll now introduce some tools to engage with the technological issues. This is done with a technology curriculum for the future firmly in mind.

Tools to Help Us Understand Technology

What tools might help us not only *see* Technology but also to *better understand* the phenomenon? Might it be possible to develop a method of enquiry that is accessible to researchers and practitioners alike? From what has been said so far, one starting point is to use philosophy itself as a tool. As Hickman (2001) says: "...philosophy is one of the most effective tools we have for tuning up technology" (p. 41). A second tool, coming from within philosophy's toolbox, is that of hermeneutics (the theory of interpretation and understanding). A third device—that of binaries—is used to access Technology's complexity and locate the hermeneutical investigations.

Philosophy as a Tool

Recent economic-rationalist times have seen philosophy being devalued and driven from the Academy. Ironically, the case for its inclusion in education and in everyday discourses may never have been greater. A century ago, Bertrand Russell (1912/1959) had this to say:

> The value of philosophy is...to be sought largely in its very uncertainty. The man [sic] who has no tincture of philosophy goes through life imprisoned in the prejudices derived from common sense, from the habitual beliefs of his age or his nation, and from the convictions which have grown up in his mind without the cooperation or consent of his deliberate reason. To such a man the world tends to become definite, finite, obvious; common objects rouse no questions, and unfamiliar possibilities are contemptuously rejected. (p. 91)

Such statements can be (re-)read with Technology in mind. This is exemplified when, more recently, Quinton (1995) offers this perspective:

> Wherever there is a large idea whose meaning is in some way indeterminate or controversial, so that large statements in which it occurs are hard to support or undermine and stand in unclear logical relations to other beliefs we are comparatively clear about, there is opportunity and point for philosophical reflection. (p. 670)

Otherwise, we can think of philosophy as: the criticism of assumptions; thinking about thinking; critique; analysis or framing; or as an aid to the formation of beliefs, knowledge and ethics. Equally, philosophy offers an excellent playground for the development of new theories or new ways of looking at phenomena. This is not to suggest that theorising is not highly practical—it can be a means to an end. As Singer (1993) says of ethics:

> Ethics is practical, or it is not really ethical. If it is no good in practice, it is no good in theory either. Getting rid of the idea that an ethical life must consist of absolute obedience to some short and simple set of moral rules makes it easier to avoid the trap of an unworkable ethic. (p. 204)

Hermeneutics as a Tool

Historically, hermeneutics was concerned with the interpretation of religious texts to establish what meaning they carried and what the whole–parts relationships of the text might be. However, over the past century hermeneutics has moved well beyond text as its subject matter and has also refined and deepened its methodological approaches (see, for example, Bohman 1999; Gadamer 1977, 1975/2004; Habermas 1971; Mitcham 1994; Palmer 1969).

To work hermeneutically is not only to explore holistically and analytically, but also to look to cultural, historical and political relationships. Having grown from more formal, language-based methods of interpretation, hermeneutics has become an actual existential event for the interpreter. That is, hermeneutics is today seen as much for how the hermeneutic act itself shapes us as for how it serves as an interpretive tool.

When we work hermeneutically, understanding comes of one's own historical and cultural positioning and new possibilities present themselves to us. In hermeneutics, all of analysis, synthesis, critique, judgement, dialectical and logical reasoning, and reflective practice (with oneself and with others) combine to bring new understandings. The familiar is made strange and new ways of seeing emerge. In all these ways, hermeneutics is about *both* interpretation *and* understanding.

We are at once *a part of* the hermeneutic act (subjectively) and *not apart from it* in an 'objective' sense. There is a sense that we are in a reflective conversation with the phenomenon (in our case, Technology). Thus, we look to how the phenomenon 'speaks' to us but we *reflect back to* and *reflect on* what we perceive. The 'conversation' that we have will almost certainly not be the 'conversation' that others have with the same phenomenon. In this way, when we understand that technologies are contradictory, arbitrary, controversial or contested it is because our hermeneutic (and ontological) experiences differ from those of others. Multiple reciprocations take place. Through hermeneutic engagements we not only get to understand the phenomenon of Technology better but we also get to understand ourselves (personally and collectively) better too.

When Mitcham (1994) counterposes his engineering philosophy of Technology with his humanities philosophy of Technology he reminds us of the significance of

hermeneutics: "...because of the central place interpretation occupies in all such humanities reflection...The hermeneutic or interpretive enterprise is pervaded by personal, interpersonal, and historically conditioned elements, and thus tenuously articulated within a human world of fluctuating intersubjective consensus" (p. 63). Hermeneutic work around technologies can take us away from the mythologies that come with the field (e.g., technologies as 'neutral', 'hi-tech', 'applied science', 'new', 'good', etc.) and it becomes possible to develop new language, terminologies, theories and analyses.

Given the complexity of Technology and the vast multiplicity of technologies, where could appropriate hermeneutic investigations begin? How could they be located? A clue comes from Gadamer (1975/2004), who reminds us that "Hermeneutic work is based on a polarity of familiarity and strangeness" and that "*(t)he true locus of hermeneutics is (the) in-between*" (p. 295, original emphasis). This brings us to the use of binaries.

Using Binaries as a Device to Locate Hermeneutic Work

First, some clarification of terms... The question could be asked: "Why binaries, why not dualisms?" The answer lies in the meanings and varied applications of the respective terms. Whilst 'binary' in mathematics means 'having a base of two' it has also acquired a popular sense of *either-or*, which is in fact what dualism means. Dualism occurs in philosophical discourse with particular reference to two *distinct* things—the mind-matter dualism of Descartes being the classic example. In contrast, binary means *both-at-once, two-together*, a *compound* or, perhaps, a *co-dependence* (which all serve well the intentions of this chapter in eschewing polarisation and/or separation of entities, phenomena or positions). Where dualism is about distinction, binary is about indistinction. This validates the hermeneutic approach.

It is also helpful to say something about dialectics and hermeneutics. In the Kantian distinction between analytic logic and dialectic logic, the latter is less about facts than about a style of reasoning. For Hegel, dialectics was a method of overcoming (seeming) opposites—sometimes expressed in simple form as: [a] thesis posed, [b] antithesis counterposed, and [c] synthesis (drawn out of the arguments of both [a] and [b])—creating a new settlement. While dialectics is a most appropriate tool for addressing incompatible dualisms, dialectic methods can be fruitful in hermeneutic enquiry. However, as has been indicated, dialectic reasoning is not the only hermeneutic method.

If the phenomenon of Technology is complex and the number of technologies is immeasurable then a way is needed to try to address, frame or manage the problem. This is *not* about reducing the problem. While hermeneutics offers engagements with complexity, using binaries is a means of focussing the approach. The idea is to use binaries as sites to locate, expose or invite hermeneutic enquiry. Using binaries allows us to capture or signal a range of issues that we may wish to address (including some that might appear in Technology Education). The nomination of

any binary intentionally *foregrounds one aspect of Technology* while backgrounding (but still accommodating) others. In short, the binaries locate spectra of issues while the hermeneutics bring forward interpretations across the spectra.

To give an example. . . (All the binaries that follow are expressed as 'Technology as *at-once-both*. . .' to remind us of the co-dependence issue.)

We can set up a binary of 'Technology as *at-once-both arts and science*'. If we try to say that technology is *only* arts (perhaps in the sense of crafting and creativity) or that it is *only* science (perhaps in the sense of objective study) we come unstuck because we cannot argue the exclusivity of one over the other. On the hermeneutic journey we might explore: what constitutes a science or an art; in what ways technology reveals itself to us as art, as science; whether technology is 'applied science', a branch of science, or (after Lueckenhausen 1989) is art made useful; Mitcham's (1994) juxtaposition of engineering with humanities; whether/how art and science meet in technology; how a technology can be both science and art at once; and so on.

What the hermeneutic journey opens up here are questions of: epistemology, where technique sits, where Design fits, the nature of creativity, how we understand disciplines, form and function (or aesthetics and instrumentalism), human experience, objectivity-subjectivity, and more. By engaging with the binarial issues present across the arts-science spectrum we work hermeneutically and discover new ways of seeing and understanding that which we think we 'know'. The outcome would be deeper understandings of the nuances of Technology, as well as clearer understandings of whatever we mean by 'arts' and 'science' *and* whether such a binary is helpful in exploring Technology. The educational point is not to resolve a dualism but to learn from the understandings and meanings that develop from the hermeneutical practice—to interpret fruitfully.

Subsequently, understandings gained from the hermeneutic explorations of any big-T Technology binary can also be *tested and refined* by applying case studies of particular small-t technologies to triangulate findings, refine thinking, and imagine new possibilities. For example, the submission of a washing-up brush, an aeroplane or a bridge to hermeneutic scrutiny within the arts-science binary can validate the enquiry as well as help clarify philosophical thinking.

Technology's Binaries—Putting Binarial Hermeneutics to Work

When the three tools of philosophy, hermeneutics and binaries are gathered to frame and investigate the philosophical dimensions of the phenomenon of Technology, the term given for the practice is *binarial hermeneutics*. Selected binaries set the context, and a hermeneutic approach invites interpretations and revised understandings of philosophical interplay with technologies. By investigating a range of binaries it becomes possible to identify technological-philosophical threads or themes for further critique and analysis.

The binaries that follow are signifiers of Technology discourses in which there are multiple possible positions—they echo the *arbitrary* nature of the phenomenon of Technology and the notion of technologies being *multistable* (Ihde 2002; Ihde and Selinger 2003) or *polypotent* (Sclove 1995). There is nothing sacrosanct about the binaries—they are starting points and there are certainly other binaries which could be nominated. Further, the binaries are not necessarily qualitatively the same—some allude as much to informed (or ill-informed) public discourse as they do to orthodox philosophical enquiry.

The Arch-Binary of At-Once-Both Human and Technology

It occurs that there is one *arch-binary* that stands out as the epitome of the challenges under investigation. This was expressed in the chapter's introduction and it is the binary of *at-once-both human and technology*. Simply put, the phenomenon of *Human* cannot *be* without reference to technologies and the phenomenon of *Technology* cannot *be* without reference to humans. This binary is the arch-binary because it is the arena for the acting out of all other binaries. As such, it is also the arena of most of the major philosophical discourses—epistemology, ethics, metaphysics (including identity, ontology and religion), philosophy of mind (including states of mind, mind-body, mind-machine, the will, determinism, and intentionality), and political philosophy.

There are many entry points to this arch-binary. Some possible explorations might be:

- simply expressed, through the question: how human are technologies, how technological are humans?
- around identity, free will and the ways in which technologies and humans shape each other;
- analysing decision making: whether human choice-making, human design decisions, or technologically programmed decision-making (e.g., genetic, robotic, digital);
- examining *transhuman* and *posthuman* (in the technologically-framed sense) scenarios that, tenable or not, are both culturally and politically significant while also offering unknown futures (Bostrom 2009; Broderick 2001; Kurzweil 2005);
- reflecting on Foucault's (1989/2000) postmodern reminder that 'man' is 'a recent invention';
- considering whether *humanity*, *human-beingness*, and *humanism* are constructs that may not be sustainable (posthumanity in the postmodern framing, see Badmington 2000);
- critiquing Kurzweil's (2005) view that 'technology is evolution by other means' and understanding scenarios of soft and hard posthumanism (technological, postmodern or otherwise).

Despite the postmodern terminology, what is presented here indicates the kinds of debates and issues that are needed to accompany our technologically sophisticated developments (an insipid phrase in the circumstances, perhaps). As emergent technologies combine and interact in new ways and with humans (and other species and environments), so multiple aspects of human practice change and new discourses are warranted. In line with technological shifts there are strong grounds for parallel shifts in educational, professional, political and social discourses—our future shared directions.

Such discourses could conceptualise *Technological-being* on a level footing with *Human-being*—to treat both phenomena with some 'symmetry' (drawing on ANT and the constructivist principle of symmetry as it can apply to the study of technological controversies). In such a way the human and the technological might each be scrutinised and celebrated for what it gives to and takes from the other. This would be a matter of continuous reciprocal critique rather than an attempt at simple balancing of the books of bias or of power distribution. Ultimately, hermeneutic imaginings of the *degree* of qualitative, as well as quantitative, merger of the two is a scenario in which education, formal and otherwise, could play a key role.

What, then, might other candidate binaries be? First, a range of binaries of Technology is presented.

At-Once-Both Visible and Invisible

This has been signalled earlier. When technologies become so accepted, so unquestioned that they become almost invisible (that they are everywhere yet nowhere at once) does a taken-for-grantedness occur? To what extent is the phenomenon questioned, or do we passively accept our technological circumstances? What are the disruptions to such circumstances that remind us of what has become invisible—major catastrophes, shortages, climate issues, disruptive technologies? Is the invisibility of the everyday matched by an invisibility of our evolution? How might the foreground-background question (in phenomenology) be considered? In other words, when are our technologies present with us, foregrounded and part of our active existence/being? When are they backgrounded and part of our passive existence/being? What do we 'see' as technology—are education, law, language, 'the arts' all technologies? Philosophical questions around epistemology, existence and identity are engaged here.

At-Once-Both Positivist and Antipositivist

The *seemingly* tangible nature of technologies and traditional ways of assessing them ('Does it work/does it do the job?') have meant that Technology has found itself framed as addressing the instrumental and the material and being aligned with

science. This has been countered by antipositivism, which resists what is seen as simplification and narrowness of interpretation. However, in its most radical form, antipositivism has been charged with creating mires of relativism that are difficult to penetrate. While technology is just 'obvious' to some, to others it is nebulous.

Between any positivist and antipositivist extremes lie multiple epistemological issues and interests. Hermeneutic work would unveil varying 'knowledge constructions' of both simple and contested types—constructivist, propositional/procedural, situated, tacit, experiential, embedded, dis/interested, etc.—collectively, in their postmodern articulation, 'knowledges'. Questions of what is valid knowledge and what constitutes valuable knowledge present themselves—as do engagements with reductionism and holism.

At-Once-Both Utopian and Dystopian

Technology is basically good. Technology is basically bad. Here philosophical questions arise around values, existence, ethics, post/humanism, determinism, and eco-philosophy. Does Technology result from the realisation of our best (design) intentions or are the intentions not actually 'good'? Why are there unintended consequences from technological developments? How might hermeneutic enquiry explore questions of control, free will, power distribution, psychological wellbeing, discourses around wellness, optimism, and pessimism? What is the place of critiques of markets, production, waste, sustainability and surveillance? What is the role of technological rejection, cynicism, scepticism, or faith? What is the Technology-Nature relationship? Is there dissonance between human progress and technological progress? What of Frankenstein and Faust? Do technologies enable us and enrich us or are we 'encapsulated in artifice' (Nye 2007)?

At-Once-Both Subject and Object

Technology provides us with rich experiences—quantitatively and qualitatively—but can we clarify what we know (or think we know) about technological objects and experiences and, further, how what others know and experience is the same as us? Humans and technologies are capable of being either subject or object or (through the binary) always-both. In ANT, "Objects too have agency" (Latour 2007, p. 63). Thus, within systems, who/what is the subject/object? For emerging technologies, what do we really know about how they will shape/interact with ourselves, others, other objects and systems? To what uses can we put a phenomenological hermeneutics (of perceptions and experiences) of human-technology relations (Ihde 1990)?

At-Once-Both Democratic and Non-democratic

How do technologies serve or deny democracy? What are the citizenship issues? Who has access to data? Does our use of Technology lessen the quality of life of others? At what point in a technology's development is ethical critique or democratic engagement allowed, for example, at pre-conception, at the design phase, during creation, after manifestation? (Keirl 2009). Philosophical questions arise around politics, ethics, existentialism, determinism (and volition). Who is empowered, disempowered? What is the role of education? Should decision-making and guidance be left to experts or a technocracy? Are our engagements with technologies open and free or does Technology entrap and constrain?

At-Once-Both Generic and Specific

Here the Technology/technologies interplay begs interrogation to open up epistemological, ethical and values issues. To what extent can the specific inform the general or the general the specific? Can there be any technological rules or propositions that might help us understand the phenomenon? Quantitatively or qualitatively are there particular or general values positions that can be taken regarding all technologies? Can we 'know' certain things about all technologies or only some things about some technologies? Hermeneutically, are there ways that technologies 'speak to us' either generally or specifically?

At-Once-Both Modern and Postmodern

While Technology is often framed as 'modern', postmodernism does much to challenge many of the 'givens' of Technology: the idea of 'progress'; of technological determinism; that there is one form of technological knowledge rather than multiple knowledges; that rationalism and optimism guarantee outcomes; and, further, it presents the case that there are no 'grand narratives' (Lyotard 1979/1984) or universal rules so far as Technology is concerned. While modernist faith in perceived technological certainties can be espoused, postmodernism might be celebrated for its ways of creating mystery, being reactive and critical, being playful and celebrating the absurd about technologies (Kellner 1991; Lather 1991).

At-Once-Both Natural and Artificial

While it seems 'natural' for us to be creative and to act technologically upon the world there are clearly ways that such actions work against nature. Is it just a matter of genetic disposition to 'use' nature for our purposes? Once we have created a technology (whether or not we draw upon natural resources) is the creation a solely artificial entity? What are our relationships with other species and environments? Is the only way we think and behave with regard to Technology anthropocentric? Taking Franklin's (2004) lead, how should we consider the biosphere-bitsphere relationship? What understandings can be gained from how cultures and faiths other than our own interact with technologies (Diamond 1998; Kraybill 1989/2001)? Are we creating, through our technological practices, behaviours and cultures that are further distancing us from nature? In working hermeneutically in this binary we engage with values analysis, epistemology, existentialism, phenomenology, and eco-philosophy.

Having presented a flavour of the potential of binarial hermeneutics for helping us understand Technology, how can such an approach be brought to Design and Technology education?

Technology Education Binaries

The idea of binarial hermeneutics can work well to inform the curriculum—whether through curriculum policy-making or through the delivered curriculum. In some ways the educational binaries reflect those for *Technology* and *technologies*. However, there are two senses in which the binaries for the educational context gain some piquancy. First, their resolution is now towards curriculum action rather than one of philosophical-hermeneutic reflection. However, we should note that the better our philosophical-hermeneutic explorations in the Technology-technologies arena, the better equipped we are to resolve the educational challenges. Second, matters become more explicitly political where curriculum arbitration is concerned since the binaries address questions of what experiences and learning students should gain.

We should also note that some of the binaries are applicable across the curriculum, that is, beyond Technology Education. They are included here precisely because of the particular way that the binary applies to Technology Education. This becomes an important part of building the integrity of Design and Technology in educational circles—it is a field of unique challenges and special circumstances that cannot be dealt with through blanket policy-making. These points made, what are the Technology Education binaries that present themselves for hermeneutical enquiry? The following, as with the Technology binaries, is a selection, they interplay, and other possibilities could be nominated.

At-Once-Both Status Quo and Change Agent

This is a classic binary for education itself. Is the role of the school to maintain the status quo or to bring about change? Technology Education's particular challenges are strongly evident here with shifting social and workplace practices and new technologies constantly evolving. Curriculum, schools and the profession find themselves continuously facing change and adaptation. Which techniques and technologies are to be valued or abandoned? Should Technology Education be taught uncritically or critically? Should social issues and challenges be engaged or bypassed?

At-Once-Both Local and Global in Perspective

Is the curriculum inward- or outward-looking? Does a local curriculum operate, that is, is it determined locally around the community's needs? Or is curriculum determination centralised and controlled? Whatever the organisational control, what international and global perspectives are articulated in the curriculum? In taking such perspectives, what kinds of contradictions around resources, values and ethics arise?

At-Once-Both Traditional and Emergent Technologies

Is the curriculum crafts-based, existentially sedentary, low production and low-tech—or hi-tech, existence-changing and (r)evolutionary (including technologies not yet disseminated in the community)? Whether new or old, do technologies serve the mass or only elites? What spectrum of technologies is celebrated and studied to show how lifestyles are shaped? To what extent are 'old' or 'new' technologies de/valued? What comparisons can be made between established and emergent technologies on the basis of costs, uses and consequences?

At-Once-Both Product and Process (For the Teacher)

With regard to the *pedagogy* of Technology Education, is learning best addressed through the creation of products—emphasising, say, technique, efficiency, quality, production methods and standards? Or is it a matter of process where students learn designerly behaviours and dispositions to work creatively in teams and alone? Is the 'output' of education to be the capacity to (re)produce or the capacity to adapt and (re)imagine new possibilities?

At-Once-Both Technical and Designerly (For the Student)

Is Technology Education about technical skilling alone—that is, in simply learning how to use tools or software? Or is it about a more embracing curriculum of critical-designerly behaviours for being-in-the-world—those that would serve the hermeneutical dispositions of the students? Should such education be restricted to creativity and imagination rather than technical can-do? Thus, is education to focus on a limited repertoire of skills developed in depth or is it to be more diverse and holistic in its practice? What kinds of knowledge are to be valued? Is Technology Education a seeding ground for student self-expression and identity formation?

At-Once-Both Instrumental and Liberal (For Society)

This binary is well articulated by Layton's (1994) research into the stakeholder interests in Technology Education. Is the primary aim to serve the needs of the economy or is there something special that Technology Education can bring to all students: "...a distinctive form of cognition, unique and irreducible. As such, all children should have access to it, as a matter of right and in order to develop their full human potential" (p. 17)? Are some goals for short-term employability and specific industrial and business needs while others are to create an educated citizenry?

At-Once-Both for Society and Student

The two binaries above can be considered in another way by juxtaposing the needs of the student with the needs of society at large (indeed, these days, we should perhaps expand the notion of society to embrace global citizenry). Is Technology Education about giving the richest and most fulfilling experience to all students or is it to meet society's needs for economic productivity, critical consumers, and active citizens?

At-Once-Both Academic and Practical

Although this framing should be a quirk of history in the twenty-first century, in many societies the hands-head divide (with no place for heart) remains embedded in educational culture dating from Ancient Greece and it materialises still in curriculum contestations that would see aspects of technology learning split amongst workshop-based manual arts and crafts or industrial technology, laboratory-based theoretical/experimental science (materials, testing, problem-solving), and

classroom-based language-rich technological social issues in social studies. Epistemological (let alone ethical) defences for separation within this binary are weak but the cultural traditions remain strong.

At-Once-Both Cross-Curricular and Subject

Several of the above binaries resonate with this classic curriculum organisation binary. How should Technology Education be formulated to address both Technology and technologies? It would seem that to deliver Technology Education as a *subject* would demand its being positioned at particular extremes of several of the binarial spectra—if only on the grounds of efficiency. Looking beyond the subject-alone position, while the arguments for some kind of broad technological literacy for all students are gaining strength, awareness is needed of the spectrum of framings of 'technological literacy' that exist. These can be from the technical to the critical-emancipatory (see, for example, Dakers 2006; Keirl 2006) and could serve widely differing agendas. Whatever the framing, the delivery of any comprehensive technological literacy is unlikely to be possible through a single subject or learning area but, rather, would become the business of every teacher and department in a school.

Hermeneutic understandings gained from this binary reflect some of the major issues facing curriculum designers and facilitators today. When the relationships between the general and the particular have to be considered, they are as apparent in the cross-curriculum/subject question as they are in the special nuances of Technology Education. Further, there are epistemological matters at play here when we have to arbitrate between holistic understandings of knowledge (constructivist, experiential, integrated) used thematically and subject-disciplinary knowledge.

Despite the apparent overlap between some of these binaries, any move to combine or merge them would defeat the whole point of 'opening up' new understandings via hermeneutic processes. There are many nuances at play and they matter. To reiterate, it is erroneous to see any binary as a dualistic 'either-or'—that would be a form of reductionism. Design and Technology's curriculum challenge is the management of Technology as holism while also addressing what counts as appropriate with regard to individual technologies/techniques. The binaries offer an approach to managing the holism of Technology's (and technologies') complex and contested values.

Conclusions. . .

A binarial hermeneutic method has been used to locate and explore ways of 'seeing' and 'interpreting' the complexity of the Human-Technology *phenomenon* as well as to offer a way of looking at Technology Education and its curriculum. It is important

to remember that Philosophy of Technology is itself nascent and that much (mis)use is still made of culturally embedded myths and misunderstandings to explain what we think 'T/technology' is. Thus emerges the very educational need (the *irony* as I have construed it) that this book seeks to address. What might the future directions be for Technology Education?

While philosophy has been marginalised in the Academy in recent times and has certainly been dropped from many teacher education courses, I have tried to show something of its significance in helping frame the educational challenge. The key use of philosophy is as a tool—as a way of interrogating the status quo and introducing alternatives. However, as the binaries show, multiple values positions compete with each other and not all can be accommodated. If true *education* is the goal, then some tricky weighing up is needed if educational quality is to be maintained. Meanwhile, quantitatively, the crowded curriculum can only allow for so much. Sophisticated judgements are called for to consider both what should constitute 'good' Technology Education and how it should be articulated.

There are no signs that there is (or will be) a stable school of philosophical thought to which Design and Technology educators might relate. It is likely that there will always be multiple schools of thought—a simple reflection of how intimately the human-Technology experience is woven. In such a situation it is a matter for leading thinkers and practitioners in the field of Technology Education to assemble the most comprehensive overview of the issues as well as to consider how these might be best addressed. To such an end, the following are offered for consideration:

- there is an ever-growing body of literature (both from Philosophy of Technology and from Technology Education) which should be drawn upon—for the two fields respectively, Mitcham (1994) and de Vries (2005) are excellent starting points;
- both broad fields of enquiry (Technology and Education) are increasingly engaging discourses of postmodern critique, constructivism, feminist theory, phenomenology, and cultural studies;
- common to both fields is substantial work around critical theory and its application. In Education: enlightened curriculum iterations, curriculum design texts (e.g., Smith and Lovat 1991), the theorising of Freire, and the critical literacy movement. In Technology notably Habermas and Feenberg;
- design is key to any technology's coming into being yet remains somewhat invisible in Technology Education—a concern, given its potency as a vehicle of learning and for pedagogical practice;
- are technology curriculum wars a realistic possibility (Keirl 2012)? Might a division of ideological proportions create a split in the thinking and the organisation of the field? If so, is this a problem or a sign of good educational health?
- is a way forward to identify and agree upon a single robust strategy for the philosophical framing of Technology Education? One example might be to

focus on the three 'E's of *epistemology, ethics*, and *existentialism* articulated through a pedagogy and curriculum based on design and critical theory; and,
- of course, there are others. . .!

On a Political Note. . .

Education is a political act and in broad terms can be found in one of three forms across jurisdictions: neo-liberal, liberal/progressive, and socially critical. How Technology Education frames itself is a matter of political philosophy too. How Technology Education responds/reacts to the kinds of options presented through the binarial hermeneutics or, alternatively, which interpretations it chooses to apply will in most aspects amount to being a political act. Commonly, this will be because of education's role in relation to the state but is also simply a function of any educator's decisions about what constitutes education.

Curriculum Scenarios

I shall close with three possible prospective curriculum scenarios for Technology Education (they are by no means exclusive). They are:

- the dissolutionist case—that there are strong grounds to abandon the idea of Technology Education in any overtly identifiable form (e.g., as a subject) and that technological knowledge/learning can/should be adequately addressed elsewhere in the curriculum, for example, across the Arts, in Science, and in Social Studies;
- the specialist case—that there are strong grounds for a subject or learning area called (Design and) Technology Education to play a full part in a future-focussed curriculum and that this subject should be compulsory for all students throughout the compulsory school years;
- the comprehensive case—that there are strong grounds for both a subject called Technology Education and a formal articulation of technological literacy across the curriculum. This arrangement would utilise all of (a) the subject approach; (b) integrated cross-curricular project work with all other subjects/departments; and, (c) have a high level of technological literacy addressed though all other school activities.

While what has been set out in this chapter may seem remote *from* the classroom, it is my view that the issues are ever-present *in* the classroom. The essential case (the *irony*) is that the remarkable phenomenon called Technology is not at all well articulated by a matching Technology Education. Given that significant amounts of

philosophical activity generate around the arch-binary of the *at-once-both Human and Technology*, it seems plausible that Technology Education should in turn seek to be richly informed philosophically. A way forward for this has been offered using the triple tools of philosophy, hermeneutics and binaries—in combination. Anyone reading this chapter will hold a personal set of values and, one way or another, will hold values-positions on Technology and on Education. No less is the case for each Design and Technology teacher who, in their very pedagogy and curriculum planning, is an arbiter of the competing values that have been presented here in the binaries.

The Future, our personal and collective futures, and technologies, will all continue to become richer and more complex, and this will remain Education's challenge. This is Design and Technology Education's future and we must engage with it responsibly and in informed ways. Many of the issues are both age-old and perennial and, while technologies change and evolve, the underlying philosophical issues do not. Whatever our role in the future of Technology Education, we have good reason to be positive and optimistic about it and about our capacities to address its considerable challenges. However, to ignore the philosophical dimension and its fundamental significance would not seem advisable.

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