The Nature of Technology

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Implications for Learning and Teaching

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In memory of Neil Postman who said what needed to be said despite it not being popular. His writings and personal communication were the impetus for this book.

MPC and JKO

To David B. Owen, for his friendship and significant influence on my thinking that has sharpened my work and made many insights possible. *Ancora imparo*.

JKO

For Isaac, his contemporaries, and future generations who must learn to wisely use technology rather than permitting it to use them.

MPC and JKO

In memory of contributing author David H. Jonassen, a prodigious and prolific scholar. He was my friend.

DSN

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INTRODUCTION

The first portion of this book's title, *The Nature of Technology*, may appear odd to readers. Articles, books and other information media abound addressing particular technologies and how to use them. This book has a different and more important purpose. Meaningful technology education is far more than learning how to use technology. It includes an understanding of what technology is, how and why technology is developed, how individuals and society direct, react to, and are sometimes unwittingly changed by technology. In this book we place these and other questions regarding the nature of technology in the context of learning, teaching and schooling. Our intent is to introduce educators to the nature of technology, its relevance to teaching and learning, and how they can effectively teach students about the social and ethical issues that are always present with technology.

Thus, the intent of this book is akin to efforts in the science education community to promote teaching and learning about the nature of science. Both science and technology have enormous and pervasive impacts on society and culture. All science education reform documents state that promoting scientific literacy demands attention to the nature of science. A scientifically literate citizenry should understand what science is; how science works; the limitations of science; how science and technology are different, yet related; and how science impacts and is impacted by society. Much research exists regarding effective nature of science teaching and learning, but while the phrase *nature of science* is widely recognized by science teachers, accurate and effective instruction regarding the nature of science is still not widespread.

The phrase *nature of technology* has only recently entered the conversation among educators, and attention to the nature of technology among educators and education researchers is still in its infancy. The National Educational Technology Standards recommend addressing the social, ethical, and human issues inherent in technology, but are vague regarding specific issues that ought to be addressed in educating students about the nature of technology. Thus, unsurprisingly, educators rarely consider the nature of technology, use this understanding to make appropriate pedagogical decisions, or attempt to help their students understand this important matter. The nature of technology and its impact on education must become a significant object of inquiry among educators, and students must come to understand the nature of technology so that they can make informed decisions regarding how technology may influence thinking, values and action, and when and how technology should be used in their personal lives and in society. Prudent choices regarding technology cannot be made without understanding the issues that this book raises.

When educators and the general public do consider the pros and cons of technology, they usually do so only in Orwellian (Orwell, 1949) terms - the explicit and overt

Michael P. Clough, Joanne K. Olson and Dale S. Niederhauser (Eds.), The Nature of Technology: Implications for Learning and Teaching, 1–4.

ways that technology affects individuals, groups and society. The impetus behind this book draws on Postman's (1985) argument in *Amusing Ourselves to Death* to take on the more difficult task of addressing technology education in Huxlean (Huxley, 1932) and Bradburean (Bradbury, 1953) terms. That is, how does technology change individuals, social institutions, and cultures when it is embraced without critique? Asking teachers and students to critically examine technology in Orwellian terms is fairly easy, but asking them to do so in Huxlean and Bradburean terms is far more difficult. In the first case, the technology is forced upon us by outside forces such as businesses, schools, employers, governments, the marketplace, etc. In the latter case, we willingly embrace technology for a variety of reasons (because it is interesting, novel, labor saving, entertaining, eases communication, and/or reduces some burden). In Orwellian terms, the technology is easily seen as needing to be critically examined. In Huxlean and Bradburean terms, people wrongly believe they have already done so.

Neil Postman tirelessly wrote and spoke about the nature of technology, both in general terms and in terms of schooling. He clearly was not against technology, and wrote in the *End of Education* (1995) that being against technology makes no more sense than being against food. But critically thinking about food—what we eat, when we eat, what portions we consume, and knowing when to push ourselves away from the table—is crucial for individual and societal well-being. Postman repeatedly warned that unexamined adoption of technology, much like indiscriminate eating, has severe negative ramifications for how we live, and that these ramifications extend beyond individuals to impact society and culture. The first chapter of this book is a speech by Postman, and we hope it and the many references to his work throughout this book will encourage widespread reading of his and similar work.

As Postman and others have noted, most people only see technology in a positive light, and rarely step back and consider the trade-offs that result. As Rees (2011) noted in his praise of *TechNo-Fix: Why Technology Won't Save Us or the Environment*:

> This is the new age of "unreason." …Even as the impacts of technology destroy the ecosphere, the faithful preach that technology alone can salvage civilization.

As a personal example of this unexamined faith in technology, over a decade ago, the first two editors of this book wrote a cautionary note regarding the use of technology in education (Olson & Clough, 2001). The reaction to that published work was surprising to us. Despite the analytical and measured position taken in that article, we were seen as attacking a cherished belief that technology would of course improve education. People wanted to debate us, we were asked to give radio interviews, and we even heard whispers in our own department that we had written a negative piece about technology in education. We were accused of being "Luddites" and "Fuddy-duddyism" (a personal favorite). Why, we wondered, does making technology the object of analysis result in the swift emotional response of many to immediately dismiss the authors as taking a hostile negative position?

The hostile emotional response to those who do seriously consider the pros and cons of technology demands that anyone who dare make technology an object of inquiry must apologize in some way for making the case that technology is not neutral or, in the words of Postman, technology is always a Faustian bargain—that when we uncritically embrace technology, we also unknowingly agree to its inherent consequences. This is particularly intriguing when one considers that technology optimists never apologize for their uncritical adoration of technology.

Those who question technology and/or choose not to use it are often labeled with derogatory terms like "laggard" (Rogers, 2003) or "resister" (Rossing, 2012). Technology enthusiasts often ignore legitimate issues and arguments raised about technologies, and when forced to address such issues and arguments, they brush them aside, wrongly claiming that any negative consequence is merely due to how the technology is being used. The upshot is that they impetuously dismiss reasoned arguments that technology is not always good, certainly not neutral, and requires analysis so that we can use it rather than, in the words of Postman, let it use us. And yet, we still feel the need to assure readers and explicitly state that the purpose of this book is one of analysis, rather than to promote an "anti-technology" position.

Perhaps, as Postman asserted, people do worship technology. In *The End of Education*, he wrote:

> At some point it becomes far from asinine to speak of the god of Technology—in the sense that people believe technology works, that they rely on it, that it makes promises, that they are bereft when denied access to it, that they are delighted when they are in its presence, that for most people it works in mysterious ways, that they condemn people who speak against it, that they stand in awe of it, and that, in the born-again mode, they will alter their lifestyles, their schedules, their habits, and their relationships to accommodate it. If this be not a form of religious belief, what is? (Postman, 1995, p. 38)

This revering of technology is most evident in pervasive attitudes that conceptualize solutions to most personal and societal problems in terms of technological development. In schooling, this reverence for technology is apparent in narrow efforts to *redesign* schools, teaching, curriculum and even children to achieve greater efficiency and a better product (i.e., higher test scores); and also in STEM education efforts that hijack the science curriculum with engineering objectives, promote STEM education primarily in terms of job training and future technological development, and marginalize the value of the humanities.

The nature of technology raises serious issues for schooling, teaching, learning and teacher education that are in desperate need of significant attention among educators and education researchers. This book is intended to raise such issues and stimulate thinking and action among teachers, teacher educators, and education researchers. Toward those ends, the six chapters making up section one in the book introduce philosophical and historical issues in the nature of technology. The eight chapters in section II continue this effort but with explicit attention to their implications,

both pro and con, for education. Section III consists of three chapters addressing the role of teacher education for promoting attention to the nature of technology among teachers and the accurate and effective teaching about the nature of technology. The authors of chapters appearing in section IV put forward practical considerations for teaching the nature of technology to students. That section IV contains only four chapters is evidence that attention to the nature of technology in education is in its early stages, and we hope that a second edition of this book will contain far more examples of successful efforts to teach the nature of technology.

We sincerely appreciate the patience of the chapter authors throughout this book project. When we first sent out the call for book proposals nearly five years ago, few in the education community appeared to even understand what the nature of technology meant and addressed. The rejection rate for submitted book chapter proposals exceeded 80 percent. As books, articles, and other forms of popular media outlets began raising questions about how technology was changing individual, societal and cultural values, what we think, how we think, and even our relationships with others (see the recommended reading list on pages 447–448), and as these ideas began to make their way into educators' consciousness, we received many additional chapter contributions. We are cautiously optimistic that a more balanced attitude toward technology (attention to its Faustian bargain as Postman would say) will become more widespread and that this book will assist in that end.

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SECTION I

PHILOSOPHICAL & HISTORICAL ISSUES IN THE NATURE OF TECHNOLOGY

CHAPTER 1

NEIL POSTMAN

INFORMING OURSELVES TO DEATH[1]

The great English playwright and social philosopher George Bernard Shaw once remarked that all professions are conspiracies against the common folk. He meant that those who belong to elite trades – physicians, lawyers, teachers, and scientists – protect their special status by creating vocabularies that are incomprehensible to the general public. This process prevents outsiders from understanding what the profession is doing and why – and protects the insiders from close examination and criticism. Professions, in other words, build forbidding walls of technical gobbledegook over which the prying and alien eye cannot see.

Unlike George Bernard Shaw, I raise no complaint against this, for I consider myself a professional teacher and appreciate technical gobbledegook as much as anyone. But I do not object if occasionally someone who does not know the secrets of my trade is allowed entry to the inner halls to express an untutored point of view. Such a person may sometimes give a refreshing opinion or, even better, see something in a way that the professionals have overlooked.

I believe I have been invited to speak at this conference for just such a purpose. I do not know very much more about computer technology than the average person – which isn't very much. I have little understanding of what excites a computer programmer or scientist, and in examining the descriptions of the presentations at this conference, I found each one more mysterious than the next. So, I clearly qualify as an outsider.

But I think that what you want here is not merely an outsider but an outsider who has a point of view that might be useful to the insiders. And that is why I accepted the invitation to speak. I believe I know something about what technologies do to culture, and I know even more about what technologies undo in a culture. In fact, I might say, at the start, that what a technology undoes is a subject that computer experts apparently know very little about. I have heard many experts in computer technology speak about the advantages that computers will bring. With one exception – namely, Joseph Weizenbaum – I have never heard anyone speak seriously and comprehensively about the disadvantages of computer technology, which strikes me as odd, and makes me wonder if the profession is hiding something important. That is to say, what seems to be lacking among computer experts is a sense of technological modesty.

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After all, anyone who has studied the history of technology knows that technological change is always a Faustian bargain: Technology giveth and technology taketh away, and not always in equal measure. A new technology sometimes creates more than it destroys. Sometimes, it destroys more than it creates. But it is never one-sided.

The invention of the printing press is an excellent example. Printing fostered the modern idea of individuality but it destroyed the medieval sense of community and social integration. Printing created prose but made poetry into an exotic and elitist form of expression. Printing made modern science possible but transformed religious sensibility into an exercise in superstition. Printing assisted in the growth of the nation-state but, in so doing, made patriotism into a sordid if not a murderous emotion.

Another way of saying this is that a new technology tends to favor some groups of people and harms other groups. School teachers, for example, will, in the long run, probably be made obsolete by television, as blacksmiths were made obsolete by the automobile, as balladeers were made obsolete by the printing press. Technological change, in other words, always results in winners and losers.

In the case of computer technology, there can be no disputing that the computer has increased the power of large-scale organizations like military establishments or airline companies or banks or tax collecting agencies. And it is equally clear that the computer is now indispensable to high-level researchers in physics and other natural sciences. But to what extent has computer technology been an advantage to the masses of people? To steel workers, vegetable store owners, teachers, automobile mechanics, musicians, bakers, brick layers, dentists and most of the rest into whose lives the computer now intrudes? These people have had their private matters made more accessible to powerful institutions. They are more easily tracked and controlled; they are subjected to more examinations, and are increasingly mystified by the decisions made about them. They are more often reduced to mere numerical objects. They are being buried by junk mail. They are easy targets for advertising agencies and political organizations. The schools teach their children to operate computerized systems instead of teaching things that are more valuable to children. In a word, almost nothing happens to the losers that they need, which is why they are losers.

It is to be expected that the winners – for example, most of the speakers at this conference – will encourage the losers to be enthusiastic about computer technology. That is the way of winners, and so they sometimes tell the losers that with personal computers the average person can balance a checkbook more neatly, keep better track of recipes, and make more logical shopping lists. They also tell them that they can vote at home, shop at home, get all the information they wish at home, and thus make community life unnecessary. They tell them that their lives will be conducted more efficiently, discreetly neglecting to say from whose point of view or what might be the costs of such efficiency.

Should the losers grow skeptical, the winners dazzle them with the wondrous feats of computers, many of which have only marginal relevance to the quality of the losers' lives but which are nonetheless impressive. Eventually, the losers succumb, in part because they believe that the specialized knowledge of the masters of a

computer technology is a form of wisdom. The masters, of course, come to believe this as well. The result is that certain questions do not arise, such as, to whom will the computer give greater power and freedom, and whose power and freedom will be reduced?

Now, I have perhaps made all of this sound like a well-planned conspiracy, as if the winners know all too well what is being won and what lost. But this is not quite how it happens, for the winners do not always know what they are doing, and where it will all lead. The Benedictine monks who invented the mechanical clock in the 12th and 13th centuries believed that such a clock would provide a precise regularity to the seven periods of devotion they were required to observe during the course of the day. As a matter of fact, it did. But what the monks did not realize is that the clock is not merely a means of keeping track of the hours but also of synchronizing and controlling the actions of men. And so, by the middle of the 14th century, the clock had moved outside the walls of the monastery, and brought a new and precise regularity to the life of the workman and the merchant. The mechanical clock made possible the idea of regular production, regular working hours, and a standardized product. Without the clock, capitalism would have been quite impossible. And so, here is a great paradox: the clock was invented by men who wanted to devote themselves more rigorously to God; and it ended as the technology of greatest use to men who wished to devote themselves to the accumulation of money. Technology always has unforeseen consequences, and it is not always clear, at the beginning, who or what will win, and who or what will lose.

I might add, by way of another historical example, that Johann Gutenberg was by all accounts a devoted Christian who would have been horrified to hear Martin Luther, the accursed heretic, declare that printing is "God's highest act of grace, whereby the business of the Gospel is driven forward." Gutenberg thought his invention would advance the cause of the Holy Roman See, whereas in fact, it turned out to bring a revolution which destroyed the monopoly of the Church.

We may well ask ourselves, then, is there something that the masters of computer technology think they are doing for us which they and we may have reason to regret? I believe there is, and it is suggested by the title of my talk, "Informing Ourselves to Death." In the time remaining, I will try to explain what is dangerous about the computer, and why. And I trust you will be open enough to consider what I have to say. Now, I think I can begin to get at this by telling you of a small experiment I have been conducting, on and off, for the past several years. There are some people who describe the experiment as an exercise in deceit and exploitation but I will rely on your sense of humor to pull me through.

Here's how it works: It is best done in the morning when I see a colleague who appears not to be in possession of a copy of *The New York Times*. "Did you read The Times this morning?," I ask. If the colleague says yes, there is no experiment that day. But if the answer is no, the experiment can proceed. "You ought to look at Page 23," I say. "There's a fascinating article about a study done at Harvard University." "Really? What's it about?" is the usual reply. My choices at this point are limited

only by my imagination. But I might say something like this: "Well, they did this study to find out what foods are best to eat for losing weight, and it turns out that a normal diet supplemented by chocolate eclairs, eaten six times a day, is the best approach. It seems that there's some special nutrient in the eclairs – encomial dioxin – that actually uses up calories at an incredible rate."

Another possibility, which I like to use with colleagues who are known to be health conscious is this one: "I think you'll want to know about this," I say. "The neuro-physiologists at the University of Stuttgart have uncovered a connection between jogging and reduced intelligence. They tested more than 1200 people over a period of five years, and found that as the number of hours people jogged increased, there was a corresponding decrease in their intelligence. They don't know exactly why but there it is."

I'm sure, by now, you understand what my role is in the experiment: to report something that is quite ridiculous – one might say, beyond belief. Let me tell you, then, some of my results: Unless this is the second or third time I've tried this on the same person, most people will believe or at least not disbelieve what I have told them. Sometimes they say: "Really? Is that possible?" Sometimes they do a double-take, and reply, "Where'd you say that study was done?" And sometimes they say, "You know, I've heard something like that."

Now, there are several conclusions that might be drawn from these results, one of which was expressed by H. L. Mencken fifty years ago when he said, there is no idea so stupid that you can't find a professor who will believe it. This is more of an accusation than an explanation but in any case I have tried this experiment on non-professors and get roughly the same results. Another possible conclusion is one expressed by George Orwell – also about 50 years ago – when he remarked that the average person today is about as naive as was the average person in the Middle Ages. In the Middle Ages people believed in the authority of their religion, no matter what. Today, we believe in the authority of our science, no matter what.

But I think there is still another and more important conclusion to be drawn, related to Orwell's point but rather off at a right angle to it. I am referring to the fact that the world in which we live is very nearly incomprehensible to most of us. There is almost no fact – whether actual or imagined – that will surprise us for very long, since we have no comprehensive and consistent picture of the world which would make the fact appear as an unacceptable contradiction. We believe because there is no reason not to believe. No social, political, historical, metaphysical, logical or spiritual reason. We live in a world that, for the most part, makes no sense to us. Not even technical sense. I don't mean to try my experiment on this audience, especially after having told you about it, but if I informed you that the seats you are presently occupying were actually made by a special process which uses the skin of a Bismark herring, on what grounds would you dispute me? For all you know – indeed, for all I know – the skin of a Bismark herring *could* have made the seats on which you sit. And if I could get an industrial chemist to confirm this fact by describing some

incomprehensible process by which it was done, you would probably tell someone tomorrow that you spent the evening sitting on a Bismark herring.

Perhaps I can get a bit closer to the point I wish to make with an analogy: If you opened a brand-new deck of cards, and started turning the cards over, one by one, you would have a pretty good idea of what their order is. After you had gone from the ace of spades through the nine of spades, you would expect a ten of spades to come up next. And if a three of diamonds showed up instead, you would be surprised and wonder what kind of deck of cards this is. But if I gave you a deck that had been shuffled twenty times, and then asked you to turn the cards over, you would not expect any card in particular – a three of diamonds would be just as likely as a ten of spades. Having no basis for assuming a given order, you would have no reason to react with disbelief or even surprise to whatever card turns up.

The point is that, in a world without spiritual or intellectual order, nothing is unbelievable; nothing is predictable, and therefore, nothing comes as a particular surprise.

In fact, George Orwell was more than a little unfair to the average person in the Middle Ages. The belief system of the Middle Ages was rather like my brand-new deck of cards. There existed an ordered, comprehensible world-view, beginning with the idea that all knowledge and goodness come from God. What the priests had to say about the world was derived from the logic of their theology. There was nothing arbitrary about the things people were asked to believe, including the fact that the world itself was created at 9 AM on October 23 in the year 4004 B.C. That could be explained, and was, quite lucidly, to the satisfaction of anyone. So could the fact that 10,000 angels could dance on the head of a pin. It made quite good sense, if you believed that the Bible is the revealed word of God and that the universe is populated with angels. The medieval world was, to be sure, mysterious and filled with wonder, but it was not without a sense of order. Ordinary men and women might not clearly grasp how the harsh realities of their lives fit into the grand and benevolent design, but they had no doubt that there was such a design, and their priests were well able, by deduction from a handful of principles, to make it, if not rational, at least coherent.

The situation we are presently in is much different. And I should say, sadder and more confusing and certainly more mysterious. It is rather like the shuffled deck of cards I referred to. There is no consistent, integrated conception of the world which serves as the foundation on which our edifice of belief rests. And therefore, in a sense, we are more naive than those of the Middle Ages, and more frightened, for we can be made to believe almost anything. The skin of a Bismark herring makes about as much sense as a vinyl alloy or encomial dioxin.

Now, in a way, none of this is our fault. If I may turn the wisdom of Cassius on its head: the fault is not in ourselves but almost literally in the stars. When Galileo turned his telescope toward the heavens, and allowed Kepler to look as well, they found no enchantment or authorization in the stars, only geometric patterns and equations. God, it seemed, was less of a moral philosopher than a master mathematician. This discovery helped to give impetus to the development of physics but did nothing

but harm to theology. Before Galileo and Kepler, it was possible to believe that the Earth was the stable center of the universe, and that God took a special interest in our affairs. Afterward, the Earth became a lonely wanderer in an obscure galaxy in a hidden corner of the universe, and we were left to wonder if God had any interest in us at all. The ordered, comprehensible world of the Middle Ages began to unravel because people no longer saw in the stars the face of a friend.

And something else, which once was our friend, turned against us, as well. I refer to information. There was a time when information was a resource that helped human beings to solve specific and urgent problems of their environment. It is true enough that in the Middle Ages, there was a scarcity of information but its very scarcity made it both important and usable. This began to change, as everyone knows, in the late 15th century when a goldsmith named Gutenberg, from Mainz, converted an old wine press into a printing machine, and in so doing, created what we now call an information explosion. Forty years after the invention of the press, there were printing machines in 110 cities in six different countries; 50 years after, more than eight million books had been printed, almost all of them filled with information that had previously not been available to the average person. Nothing could be more misleading than the idea that computer technology introduced the age of information. The printing press began that age, and we have not been free of it since.

But what started out as a liberating stream has turned into a deluge of chaos. If I may take my own country as an example, here is what we are faced with: In America, there are 260,000 billboards; 11,520 newspapers; 11,556 periodicals; 27,000 video outlets for renting tapes; 362 million TV sets; and over 400 million radios. There are 40,000 new book titles published every year (300,000 world-wide) and every day in America 41 million photographs are taken, and just for the record, over 60 billion pieces of advertising junk mail come into our mail boxes every year. Everything from telegraphy and photography in the 19th century to the silicon chip in the twentieth has amplified the din of information, until matters have reached such proportions today that for the average person, information no longer has any relation to the solution of problems.

The tie between information and action has been severed. Information is now a commodity that can be bought and sold, or used as a form of entertainment, or worn like a garment to enhance one's status. It comes indiscriminately, directed at no one in particular, disconnected from usefulness; we are glutted with information, drowning in information, have no control over it, don't know what to do with it.

And there are two reasons we do not know what to do with it. First, as I have said, we no longer have a coherent conception of ourselves, and our universe, and our relation to one another and our world. We no longer know, as the Middle Ages did, where we come from, and where we are going, or why. That is, we don't know what information is relevant, and what information is irrelevant to our lives. Second, we have directed all of our energies and intelligence to inventing machinery that does nothing but increase the supply of information. As a consequence, our defenses against information glut have broken down; our information immune system is

inoperable. We don't know how to filter it out; we don't know how to reduce it; we don't know how to use it. We suffer from a kind of cultural AIDS.

Now, into this situation comes the computer. The computer, as we know, has a quality of universality, not only because its uses are almost infinitely various but also because computers are commonly integrated into the structure of other machines. Therefore it would be fatuous of me to warn against every conceivable use of a computer. But there is no denying that the most prominent uses of computers have to do with information. When people talk about "information sciences," they are talking about computers – how to store information, how to retrieve information, how to organize information. The computer is an answer to the questions, how can I get more information, faster, and in a more usable form? These would appear to be reasonable questions. But now I should like to put some other questions to you that seem to me more reasonable. Did Iraq invade Kuwait because of a lack of information? If a hideous war should ensue between Iraq and the U.S., will it happen because of a lack of information? If children die of starvation in Ethiopia, does it occur because of a lack of information? Does racism in South Africa exist because of a lack of information? If criminals roam the streets of New York City, do they do so because of a lack of information?

Or, let us come down to a more personal level: If you and your spouse are unhappy together, and end your marriage in divorce, will it happen because of a lack of information? If your children misbehave and bring shame to your family, does it happen because of a lack of information? If someone in your family has a mental breakdown, will it happen because of a lack of information?

I believe you will have to concede that what ails us, what causes us the most misery and pain – at both cultural and personal levels – has nothing to do with the sort of information made accessible by computers. The computer and its information cannot answer any of the fundamental questions we need to address to make our lives more meaningful and humane. The computer cannot provide an organizing moral framework. It cannot tell us what questions are worth asking. It cannot provide a means of understanding why we are here or why we fight each other or why decency eludes us so often, especially when we need it the most. The computer is, in a sense, a magnificent toy that distracts us from facing what we most needed to confront – spiritual emptiness, knowledge of ourselves, usable conceptions of the past and future. Does one blame the computer for this? Of course not. It is, after all, only a machine. But it is presented to us, with trumpets blaring, as at this conference, as a technological messiah.

Through the computer, the heralds say, we will make education better, religion better, politics better, our minds better – best of all, ourselves better. This is, of course, nonsense, and only the young or the ignorant or the foolish could believe it. I said a moment ago that computers are not to blame for this. And that is true, at least in the sense that we do not blame an elephant for its huge appetite or a stone for being hard or a cloud for hiding the sun. That is their nature, and we expect nothing different from them. But the computer has a nature, as well. True, it is only a machine but a

machine designed to manipulate and generate information. That is what computers do, and therefore they have an agenda and an unmistakable message.

The message is that through more and more information, more conveniently packaged, more swiftly delivered, we will find solutions to our problems. And so all the brilliant young men and women, believing this, create ingenious things for the computer to do, hoping that in this way, we will become wiser and more decent and more noble. And who can blame them? By becoming masters of this wondrous technology, they will acquire prestige and power and some will even become famous. In a world populated by people who believe that through more and more information, paradise is attainable, the computer scientist is king. But I maintain that all of this is a monumental and dangerous waste of human talent and energy. Imagine what might be accomplished if this talent and energy were turned to philosophy, to theology, to the arts, to imaginative literature or to education? Who knows what we could learn from such people – perhaps why there are wars, and hunger, and homelessness and mental illness and anger.

As things stand now, the geniuses of computer technology will give us Star Wars, and tell us that is the answer to nuclear war. They will give us artificial intelligence, and tell us that this is the way to self-knowledge. They will give us instantaneous global communication, and tell us this is the way to mutual understanding. They will give us Virtual Reality and tell us this is the answer to spiritual poverty. But that is only the way of the technician, the fact-mongerer, the information junkie, and the technological idiot.

Here is what Henry David Thoreau told us: "All our inventions are but improved means to an unimproved end." Here is what Goethe told us: "One should, each day, try to hear a little song, read a good poem, see a fine picture, and, if it is possible, speak a few reasonable words." And here is what Socrates told us: "The unexamined life is not worth living." And here is what the prophet Micah told us: "What does the Lord require of thee but to do justly, and to love mercy and to walk humbly with thy God?" And I can tell you – if I had the time (although you all know it well enough) – what Confucius, Isaiah, Jesus, Mohammed, the Buddha, Spinoza and Shakespeare told us. It is all the same: There is no escaping from ourselves. The human dilemma is as it has always been, and we solve nothing fundamental by cloaking ourselves in technological glory.

Even the humblest cartoon character knows this, and I shall close by quoting the wise old possum named Pogo, created by the cartoonist, Walt Kelley. I commend his words to all the technological utopians and messiahs present. "We have met the enemy," Pogo said, "and he is us."

NOTE

[1] A speech given at a meeting of the German Informatics Society (Gesellschaft fuer Informatik) on October 11, 1990 in Stuttgart, sponsored by IBM-Germany.
http://w2.eff.org/Net_culture/Criticisms/informing_ourselves_to_death.paper

CHAPTER 2

GORDON HULL

KNOW THY CYBORG-SELF

Thoughts on Socrates and Technological Literacy

> "We are our own best artifacts, and always have been."
>
> – Andy Clark (2003, p. 192)

There are no doubt many good reasons to encourage a general technological literacy. Here is one: U.S. society purports to aspire to democracy. Insofar as we live in a technologically-mediated society, if we want that democracy to amount to more than the rule of an ignorant mob, the "people" need to have some understanding of the technologies surrounding them. At one level, this is clearly a political question, and questions about the limits of popular knowledge, how much technical skill is necessary to qualify as technologically literate, what sorts of reference frames can and should be brought to one's understanding of technology, and so forth, immediately present themselves. But, as the term "democracy" suggests, it is also a question of values. Is it possible to give the question more teeth, and propose that the values in question are not just political, but moral? At the very least, is it possible to blur the boundary between political and moral questions in this case? Here I will argue that it is, particularly in the case of information technologies.

The essay proceeds as follows. In the first part, I discuss competing views of the relation between technology and human nature, with particular attention to recent theories to the effect that technology is fundamentally dehumanizing. In the next part, I suggest that both the utopic and dystopic variants of this story share the assumption that human nature is somehow detachable from its technological environment. I then provide evidence from recent discussions of human cognition that this assumption is unwarranted. In the final sections, I discuss three examples of how knowledge that we are tied to our technological environment should motivate concern about that environment: the practice of anonymous reading, the relative importance of amateur and professional culture, and the Platonic critique of books, which I interpret as an example of the problem of information glut. I will both start and end in the supposed birthplace of Western philosophy, ancient Athens.

Michael P. Clough, Joanne K. Olson and Dale S. Niederhauser (Eds.), The Nature of Technology: Implications for Learning and Teaching, 15–34.

1. WELCOME TO THE MACHINE

On trial for a variety of charges centered on the claim that he was corrupting the morals of the youth of Athens, Socrates offers three images of the philosopher: someone who does not fear death (29b),[1] someone who cares for his soul (29e), and a gadfly, *i.e.*, someone without whom the Athenians might very well "go on sleeping till the end of your days" (31a). The three images coalesce around the same thought: the philosopher is someone who, unlike his fellow citizens, will give "attention or thought to truth and understanding and the perfection of [one's] soul" (29e). Socrates and his fellow citizens agreed on only one point: he was not like them. After he failed to convince them that the presence of such a person as he was desirable, he famously remarked in sentencing that "examining both myself and others is really the very best thing that a man can do, and that life without this sort of examination is not worth living" (38a). Having further failed to convince the Athenians of either this point or that he should be rewarded by "free maintenance at the state's expense" for his efforts "to persuade each one of you not to think more of practical advantages than of his mental and moral well-being" (36d), Socrates was condemned to death.

I recount this well-known episode from the history of philosophy, and the context of the Socratic "know thyself" in order to provide a context with which to frame a contemporary question: what can philosophy tell us about the human aspects of technology? Admittedly, ancient Athens does not look like a promising place to start, as the Athenian distaste for the manual arts has been well-established. Aristotle even said that citizens should be kept away from the mechanical arts, lest their ability to govern themselves be corrupted (see Winner, 1995 for a quick summary). Aristotle also drew a fairly bright line between natural and artificial objects, proposing that art imitated nature. By the late medieval period, this line had hardened considerably, with a mainstream view insisting on the metaphysical priority of nature over art. Nonetheless, in a world that many think is fundamentally characterized by its abundance of technologies, the question is very much the Socratic one of an examined life and of the sort of political environment we want to live in.

How one interprets the injunction to know oneself depends on what one thinks it means to be human. Is there some sort of human nature that separates humans from other things in the world? Does this human nature exist independently of the environment it is in, such that some content can be given to "human nature," enough to ground ethical and other normative projects? The Greek concern about the corrupting influence of technology suggests precisely such a view of human nature. This sort of view would not deny that people in different contexts are in many ways different, but it would insist that there was some sort of core humanity present in every case, marking the human as authentically such. Of course, many people will not fulfill their nature, and their lives could then be criticized on ethical grounds, in the same way that Socrates criticized his fellow Athenians for failing to attend to what was most essential about themselves, instead frittering away their lives on idle amusements. Such a view would thus provide a clear way to evaluate the ethical

implications of technology: does the presence of a certain technology fundamentally enhance or detract from our ability to fulfill our natures?

During the early part of the scientific revolution, which roughly coincided with the development of "modern" philosophy, the emergent view was that technology could remove many of the limitations placed on us by nature. Grounded in correct science, the capacity for such practical philosophy to enhance human life was essentially unlimited. Descartes can be taken as exemplary of this view. New principles in physics, he suggests "opened my eyes to the possibility of gaining knowledge which would be very useful in life, and of discovering a practical philosophy which might replace the speculative philosophy taught in the schools." By means of this philosophy, we might "make ourselves, as it were, the lords and masters of nature." He had particular hope for medicine: "we might free ourselves from innumerable diseases, both of the body and of the mind, and perhaps even from the infirmity of old age, if we had sufficient knowledge of their causes and of all the remedies that nature has provided" (1637/1985, pp. 142–3).[2]

I highlight early-modern optimism primarily to contrast it with more recent pessimism. Particularly in post-war Europe, a lot of recent work in the philosophy of technology views technology as fundamentally dehumanizing; the general claim is thus that a technologically saturated environment is, all things considered, a hindrance to being fully human. Adopting the worldview that living in such an environment encourages would thus be an ethical failing of the first order. The most philosophically significant exponent of this line of thought is probably Martin Heidegger. Heidegger, whose early work centered around Plato and Aristotle, and who explicitly pointed to the Aristotelian art/nature distinction, thought that there was something deeply and profoundly alienating about the technological ability to disrupt natural processes. Rather than let nature happen, technology treats nature as a "standing reserve," a set of resources reordered to provide energy on demand for the needs of an integrated technological system. As he puts it, technology "puts to nature the unreasonable demand that it supply energy which can be extracted and stored as such" (1977, p. 322). The integration of natural objects into the technological system changes what they are; thus, a dam on the Rhine makes the river "what [it] is now, namely, a water-power supplier, derives from the essence of the power station" (1977, p. 321). Of course, the river is still a river, but Heidegger's point is that we no longer think of it in any other way. Industrial agriculture provides another of his examples:

> The earth now reveals itself as a coal-mining district, the soil as a mineral deposit. The field that the peasant formerly cultivated and set in order appears differently than it did when to set in order still meant to take care of and maintain. The work of the peasant does not challenge the soil of the field. In sowing grain it places seed in the keeping of the forces of growth and watches over its increase. But meanwhile even the cultivation of the field has come under the grip of another kind of setting-in-order, which *sets upon* nature. It

> sets upon it in the sense of challenging it. Agriculture is now the mechanized food industry. Air is now set upon to yield nitrogen, the earth to yield ore, ore to yield uranium, for example; uranium is set upon to yield atomic energy, which can be unleashed either for destructive or for peaceful purposes (1977, p. 320).

In other words, the peasant initiates or occasions a process that is fundamentally a natural one. The process of industrial agriculture, on the other hand, is all about controlling nature.

At one level, all of this sounds either banal and obvious, or like the worst kind of luddism. Of *course* we extract energy from nature – we like to eat! One of Heidegger's main points – and this emerges more clearly in his other writings – is that we should find it odd that we do not find our relation to technology surprising. He claims that his essay is to prepare us for a "free relation to technology" (1977, p. 311), and a substantial part of that preparation is in making the current state of affairs seem abnormal. Most importantly, what this line suggests is that Heidegger's primary interest is ethical, and not in technology *per se*. Indeed, over the course of the essay, it becomes apparent that a central problem is that people treat themselves as technological resources; "the current talk about human resources, about the supply of patients for a clinic, gives evidence of this" (1977, p. 323). Maybe this is all for the better; Heidegger's point is that it ought to at least give us pause. As he puts it, the question is "whether we actually experience ourselves *as* the ones whose activities everywhere, public and private, are challenged forth by enframing" (1977, p. 329).

What emerges from a Heideggerian analysis of technology, is a general suspicion that immersion in technology-rich environments takes us away from something essentially human about ourselves. Even worse, we all go along for the ride, and so do not even recognize the problem as a problem.[3] The call to ethics, in this sense, is a call for people to return to themselves. It is at that level inherently Socratic. It also comes with a profound distrust of technology, or at least of the tendency of technologists and popular culture to make utopian claims about a world with more and more technology. As we will see, in this, too, it is profoundly Socratic.

2. THIS IS YOUR BRAIN ON TECHNOLOGY

So: people use tools. At some point, there are enough tools, and we are serious enough about them, that we cross a tipping point into modern technology. Embracing modern technology either puts us on the golden road to unlimited material progress, or takes us away from our essential humanity, whatever that is. Can a philosophical understanding of technological literacy do better than to vacillate between these alternatives? The problem, I would suggest, is an assumption common to both views: the assumption that "human nature" can be separated from technology. One effect of making this assumption is that the political and ethical questions raised

by technology can be too quickly reduced to matters of personal ethics. On the utopian version, the only relevant questions are about efficiency: since technological progress is a good thing, we ought to adapt ourselves to whatever sets of policies will most efficiently bring about the greatest amount of that progress (these days, it is usually assumed to be free market competition). These decisions can best be left to experts in economics and the relevant technologies. On the dystopic version, we ought to turn away, as individuals, from using too much technology. Again, there is no need to inquire into the specifics of the technologies in question; since too much technology is a bad thing, the question is how best to minimize its diffusion. Langdon Winner takes the utopian version to dominate most American discourse about technology, and underscores that "it is important to note that as our society adopts one sociotechnical system after another it answers some of the most important questions that political philosophers have ever asked about the proper order of human affairs" (1986, p. 40). For example, should society favor large, bureaucratic organizations over smaller communities? Because of their economies of scale, most twentieth-century technologies apparently favored the former; many enthusiasts of the Internet think it favors the latter. If Winner's analysis is correct, and if either of these technologies is adapted for reasons of economic efficiency, then the calculus of "efficiency" effectively hides the fact that we've made some important ethical decisions about what-sized society we prefer without even knowing it.[4] The point I want to notice here is that the assumption that human nature is somehow independent of our technical systems generates an ethics, the most important questions for which have to do with how adopting a particular technology will affect our abilities to live according to our nature. If we reject this assumption as unsupported, then the ethical questions will be correspondingly transformed. As I will suggest, they will become both more fundamental and more political.

Let us return to Heidegger for some clues as to how this might be done. On the one hand, there does seem to be something profoundly correct in the way Heidegger puts matters: we do somehow "change" in the face of technology. Ordinary experience – of, for example, writing directly into a word processor versus writing by hand – and ordinary language – the way we say that "he is changed when he gets behind the wheel of a car" – both lend their support to the intuition. The problem is that Heidegger apparently couples this insight with an assumed "authentically human" baseline to generate what looks like an anti-technological position.

In response to an interview question, Jacques Derrida offers the following, which I think nicely captures an appropriate ambivalence about Heidegger:

> Heidegger's reaction was at once intelligible, traditional, and normative. The tradition of these norms is often respectable, and its reserve considerable when it remains vigilant in the face of technological mutations. But it also gives rise, sometimes in its least naïve form, to a confident dogmatism, an assurance that we have to interrogate. For instance, Heidegger deplores the fact that even personal letters are now typewritten and that the singular trace of the signatory

> is no longer recognizable through the shapes of the letters and the movements of the hand. But when we write 'by hand' we are not in the time before technology; there is already instrumentality, regular reproduction, mechanical iterability. So it is not legitimate to contrast writing by hand and 'mechanical' writing, like a pretechnological craft as opposed to technology. And then on the other side what we call 'typed' writing is also 'manual' (2005, pp. 20–1).

Derrida's point could be extended to Heidegger's other examples. For example, it is not like the peasant farmer works in a time before technology: agriculture is a profoundly technological activity, and always has been. Conversely, even modern agribusiness involves natural processes.

The constant here seems to be that humans have *always* supplemented their "natural" abilities with technology, or at least, they have done so throughout recorded history and for a long period before that. If this is the case, would we not be better off adding to our view of human nature the criterion that we are naturally tool-users? Such a strategy, arguably already in Heidegger, poses difficulties for the sort of philosophy undertaken by Descartes in particular. Having defined the mental as the authentically human, he deployed a variety of arguments to show that humans did have minds, and followed with arguments to show that other entities did not. Hence, he claims that animals are like machines in that they move only according to the arrangement of their organs; evidence for this is that they lack language (even if they can make language-like sounds, "they cannot show that they are thinking what they are saying" (1637/1985, p. 140)) and that they are incapable of adapting to new situations:

> Whereas reason is a universal instrument which can be used in all kinds of situations, these organs need some particular disposition for each particular action; hence it is for all practical purposes impossible for a machine to have enough different organs to make it act in all the contingencies of life in the way in which our reason makes us act (1637/1985, p. 140).[5]

That Descartes already uses the language of machines to specify the uniqueness of the human mind underscores the fragility of this strategy. Humans, says Descartes, do and should use tools. The human mind can also be usefully explained on the model of a universal tool. What prevents the mind/tool boundary from collapsing – why can we not say that the mind is somehow changed by its use of tools? Or that the use of tools is a constitutive part of our rationality? Descartes is opposed to those who would derive mind from such material things as brains, and draws a line in the sand: "the rational soul … cannot be derived in any way from the potentiality of matter, but must be specially created" by God (1637/1985, p. 141).

The Cartesian line in the sand sounds rather more like an empirical question for cognitive psychology, and cognitive psychology is squarely against Descartes' claim that there is anything metaphysically special about the human mind, at least insofar as we are speaking about cognition. If that is the case, then a further question

arises: why stop at the brain? If all of the tool-language is apt, then should we say that somehow the *environment* is part of our cognitive processes? An affirmative answer to these questions forms the basis of Andy Clark's so-called "extended mind" hypothesis. According to this hypothesis, our cognition is in and through the environment. Clark's guiding intuition seems to be something like the following: we know from work in neuroscience that cognitive processes do not depend on specific neurons or arrangements of them to happen. Patients with substantial traumatic brain injuries, for example, are often able to re-learn to communicate using different parts of their brain. In this sense, one's exact neurological arrangement is a contingent feature of one's cognition. If that is the case, there is no particular reason to insist that all cognition be in the brain. For example, recent research into the way that people gesture strongly suggests that the act of gesturing itself does some cognitive work (Clark, 2007). Cognition, then, is an active, performative process (a point to which I will return in the context of fan fiction). But if all that is the case, then why should we stop at the limits of our body? Why can we not construe the environment as doing some of the cognitive work? Clark puts the intuition in a recent paper as follows:

> The cognitive scientist or philosopher of mind who chooses to treat the brain and central nervous system alone as the mechanistic supervenience base for mental states is rather like a neuroscientist who insists that neuroscience proper should not be concerned with the hippocampus or the cerebellum, because (they think) *all the real cognizing goes on in the cortex* (2008, p. 49).

Thus, just as "we need not care (within sensible limits) exactly where *within* the brain a given operation is performed, so too (it might be urged) we should not care whether … a certain operation occurs inside or outside some particular membrane or metabolic boundary" (2008, p. 50). In other words, given what we know about cognition within the body, the burden of proof ought to be on those who want to draw a cognitive boundary at the body's exterior.

Clark's argument is that, in fact, a great deal of our cognition can be said to happen in and through and with our environment. To think that cognition is somehow limited to our "skin bags" or our skulls is to miss the incredible richness of our interactions with the environment. He cites as an easy example: when someone asks you if you know what the time is, you first answer that you do, and then check your watch. Do you know the time? Yes, you do; "it is just that the 'you' that knows the time is no longer the bare biological organism but the hybrid biotechnological system that now includes the wristwatch as a proper part" (2003, p. 42). In an earlier paper, he and David Chalmers (1998, p. 12) propose the example of Otto, a patient with a mild case of Alzheimer's, who learns of an art show at the MOMA. Otto then looks into his notebook to learn where the MOMA is. How is this process, Clark asks, all that different from what happens when we pause for a moment to remember where the MOMA is? Or when we use mnemonic aids to recall things? Given the current advances in information technologies, this sort of cognitive enhancement