

Technology as "Big Magic" and Other Myths

Since the publication of his book *Autonomous Technology* in 1977, political scientist Langdon Winner has been known for his provocative, beautifully-written critiques of technological development.

In the 1980s, Winner published a second much-read book (*The Whale and the Reactor*, 1986) and held teaching positions at M.I.T., the University of California at Santa Cruz, and the University of Leiden in the Netherlands.

Winner is now Professor of Political Science at Rensselaer Polytechnic Institute in Troy, NY. He recently completed a ten-year stint as a columnist at M.I.T.'s *Technology Review*. A June 1997 profile in the *Wall Street Journal* called him "the leading academic on the politics of technology."

In addition to his scholarly credits, Mr. Winner worked as a rock critic and contributing editor for *Rolling Stone* magazine in the late 1960s and early 1970s, and has contributed articles on rock and roll to *The New Grove Dictionary of Music and Musicians* and

Prof. Langdon Winner can be reached at Rensselaer Polytechnic Institute, 5118 Sage Hall, Troy, NY 12180; email: winner@rpi.edu.

The Encyclopaedia Britannica. He writes regular commentaries on technology and social issues for the on-line journal *NetFuture*, and he contributes regular commentaries on environmental issues for "Living on Earth," a National Public Radio program.

Dr. Winner received his B.A., M.A., and Ph.D. degrees in political science from the University of California at Berkeley.

He spoke with T&S Managing Editor Terri Bookman on Feb. 25, 1998, at IEEE offices in New York City.

HISTORY'S TWISTS AND TURNS

Terri Bookman: Dr. Winner, in a recent article entitled "Look out for the Luddite label," [*Technology Review*, Nov./Dec. 1997] you said: "Technical change ought to be guided by principles of social justice, psychological harmony, and personal dignity, rather than the untrammelled pursuit of efficiency and profit." I'm sure those inspiring concepts sometimes are carried



out. But I wonder if the big picture, in terms of technological change, is that there really isn't a strong focus on social justice, psychological harmony, or personal dignity. Is there really hope for any of this? Hope that we can affect the process of technological development in beneficial ways?

Langdon Winner: I believe there's much to be hopeful

about. If people become aware of important choices about the interweaving of technology and society and speak up clearly about alternatives, history can take some surprising turns. The sudden shift in the nuclear arms race is a case in point. During the late 1970s and early 1980s the peace activists who called for an end to the balance of terror seemed foolish to most "responsible" political observers. Yet groups like Physicians for Social Responsibility and cantankerous souls like Helen Caldicott persisted in calling for the elimination of the instruments of mass destruction. I believe their voices were highly influential in ways not

widely recognized. Eventually there were hundreds of thousands of people demonstrating in major cities around the globe. By October 1986 the idea of nuclear disarmament had become so powerful that the Reykjavik summit between Ronald Reagan and Mikhail Gorbachev hinged on proposals to eliminate the bombs and rockets altogether, much to the dismay of the policy advisors for both men. What seemed utter folly a few years earlier began to seem entirely feasible as the Cold War wound to a close.

Of course, there are still far too many nuclear weapons targeted and ready for use. But one thing that's changed significantly in the lives of my children and my students is that they don't live from moment to moment with the idea that they could be vaporized in a nuclear flash.

TB: Another example might be anti-nuclear power efforts.

LW: That's right. It's another case in which the unexpected twists and turns of history lent support to those who resisted what once seemed inevitable. Social movements of the 1970s that called attention to the hazards of nuclear power appeared rather futile in the beginning. But their message eventually intersected with growing economic problems within the industry. As the general public became aware of these combined troubles, what had been firm support for "the friendly atom" quickly vanished.

Another example of positive change in public attitudes and policies can be seen in the revolt against smoking and the tobacco industry. It turns out that when people finally have good information, a clear sense of who's at fault and an idea of what remedies are open to them, they often act quickly and resourcefully. This is especially true in matters over which people feel they

have direct control; Americans today are willing to make substantial changes in diet, exercise, and other health related habits if they believe it will contribute to their well-being. But it's harder for them to get their hands on deeply entrenched, institutionalized forms of power that cause problems in our society and environment.

CHALLENGING INSTITUTIONALIZED POWER

TB: What sorts of "institutionalized forms of power" are you talking about?

LW: There are many of them. One can begin with the extraordinary concentration of power within the mass media. A few large corporations now control much of the content of radio, television, movies, book publishing, and other sources of information people encounter.

TB: OK. But when it comes to issues like the mass media being concentrated in the hands of a few corporations or people's frustration with computerization, the problems don't seem so specific. Its not like organizing against nuclear power plants.

LW: That's right.

TB: How do we find ways to deal with matters as broad as, say, the power of mass media?

LW: It requires a lot of imagination and ingenious strategy. One of my favorite political writers, Niccolò Machiavelli, once observed that "Men make quite a number of mistakes about things in general, but not so many about particulars." It's always good policy to identify certain specifics that one cares about and act affirmatively to create new options and new possibilities. One interesting organization that's tackling the hold of the mass media is the Adbusters group which studies methods used to

promote new products and to analyze the content of advertising campaigns. The group focuses upon ways in which people are manipulated by the media in subtle and not so subtle ways. In one of its "uncommercials" the group demonstrates how ads make women feel that their bodies are inadequate. In another one, the camera circles a young man sitting watching TV. A voice softly proclaims, "The living room is the factory. The product being manufactured...is you."

The Adbusters have gone the full distance with these campaigns, even raising money to air their spots on national television. But the broadcasters have usually refused to run the "uncommercials" because they run counter to the whole drift of TV production and marketing. The name for this

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response is, I suppose, "freedom of speech." But its interesting to see an organization push the power holders in the media to admit what the essence of their business is all about. I wish there were guerilla strategies like that at work in other industries where arrogant power mocks the public's trust.

CHANGING PERCEPTIONS OF TECHNOLOGY

TB: *Do you think the understanding of the relationship between technology and society has improved over the past 20 years?*

LW: Yes, in some respects. When I started reading in this area, in the middle 1960s, the available literature on technology and society was simply deplorable. Its range of vision was limited to stories about heroic men and their wonderful inventions — the telegraph, telephone, radio, airplane, and the like. The general framework of explanation centered on notions of

progress and modernization which today seem naive. Books, magazines, and news stories contained a very strong belief in the inevitability of technological change and the need for people to adapt without questioning anything.

Most writers showed very little understanding of the ways in which inventions and technological innovations are the product of complicated social processes, of the

many-centered human networks involved in all attempts to introduce new tools, instruments, techniques, and systems to the world. Of course, the contributions of women, ordinary workers, and non-Western people to our stock of technical abilities were totally ignored.

Since that time we've seen the rise of a variety of scholarly fields and the fields of journalism in which the notion of a socially shaped, socially created, socially constructed technologies has risen to prominence. Prominent myths formerly accepted as true have been replaced by some richer, more complex and, I believe, more accurate ways of understanding how technologies enter the world and how they interact with patterns of human activity. Scholarly interpretations here are far less deterministic than they were thirty years ago, far more inclined to understand changes in technology within a wide range of social, cultural, political, and intellectual contexts.

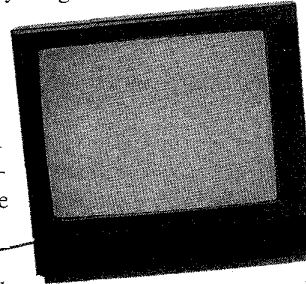
As fruitful as these developments have been for intellectuals, however, they have not done much to modify popular conceptions of technological change in the press and in general conversation. Most journalists, politicians, and ordinary folks are perfectly happy with the old, threadbare narratives.

Here's the implement; here's the user; here are the wonderful possibilities it opens up; here are the "impacts" upon society. Even the "Nova" programs on PBS still peddle the same old stories, basically myths, about "those wonderful men and their flying machines" that seem to have come straight from the 1920s, only now its those wonderful men and their microchips and biotech projects.

For its own reasons, advertising still shows us technologies that arrive as if by miracle — the latest shiny automobile on a wide open highway free of congestion, for example. There are now even ads that show the highway lifting literally out into space; now we're cruising the planet! But there's still only one driver, and one automobile in the realm of ecstatic fulfillment. There's no sense of context, situation, connectedness, or of the social and ecological relations involved in any of these things. In that way our common notions about technology and human life are still based in tawdry illusions.

TB: *Are there more examples of old myths that have been replaced, at least in a scholarly context, by more complex understandings?*

LW: Take the rise of microelectronics. The best social histories talk about the matter in terms of the decades of government subsidized research and development, much of it directly connected to the military. Social scientists have described the formation of complex networks that link the universities to industry and, particularly in the early stages, to the military. To create a place like Silicon Valley you need decades of collective projects, publicly funded in large measure, producing not only spe-



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cific products, but a vast social and material infrastructure that allows technical innovation to occur. Along with this there are all kinds of interesting, shared ideas and ideologies that emerge to help inform people's sense of what they are about, ideas about highly amorphous organizational arrangements and people shifting from firm to firm overnight. There are ways in which the complex social, economic, and political relationships involved here could be conveyed within the histories and policy discussions that most folks receive. But when it comes to writing magazine stories and TV programs about Silicon Valley, the publicists and journalists always gravitate back to the myth of the heroic inventor in his garage, coming up with the personal computer, modem, Web browser or whatever "it" happens to be that month.

TB: *Apart from myths about the origins of technological developments, what about myths about the results of a technology, such as electronics or the Internet? Do you think there's a difference between what the general public believes about the results of certain technologies, and the true impacts of those technologies? Also, while the average person may hold some mythological belief about a technology, in their daily lives they may feel frustrated by the same technology. Are there two different forces going — people feel frustrated, but also —*

LW: Yes, there's a real sense of excitement and promise.

TB: *Or, at the least, there's a tremendous media hype about information technology.*

LW: Exactly. And what the hype does is deflect people from asking questions they might otherwise raise if they were, say, buying a house — check out the market,

check out the neighborhood, look for possible resale value. We are not especially clever or careful as we approach heavily promoted new technological innovations. A very good case is the rush to install computing in schools. People often don't ask some very basic, obvious questions. I occasionally sit down with members of school boards who are proposing to buy hundreds of thousands of dollars of PCs and network devices. Sometimes they're even preparing to take their districts into bonded indebtedness to accomplish what they see as a necessary technology upgrade. I ask them, "Do you realize the stuff you're proposing to buy on a 30-year bond issue will be obsolete in 2 years? Is that wise? And have you looked carefully at the software you'll be purchasing? That's really the heart of the pedagogical promise of these tools. If the software appeared in book form, would you be equally enthusiastic about buying it and requiring every student to use it?"

There are a good many very practical, no-nonsense questions that people ought to ask about all this apparatus. But often they set aside the most elementary common sense because they've come to regard technology as something like Big Magic. Behold: this will transform our lives for the better! Oh, don't ask how. Getting beyond these fantasies is a crucial task for any intelligent inquirer.

TECHNOLOGY AND EDUCATION

TB: *In Technology and Society Magazine we have a special issue coming up on "computers in the classroom" this December. The Guest Editor of that issue, Kenneth Foster (who is also the current President of SSIT), asked me to ask you about it. He mentioned that there have been complaints published in some of the popular press about the "wired classroom"*

being a lot of hype. Do you agree with that criticism?

LW: Again, I think you have to look at these proposals within the context as a whole. My approach to technology stems from questions in social and political theory. I begin by looking at practices, institutions, and patterns of human relationships. How do people associate? How do they live together? Which rules, roles, relations, and institutions are the good ones, which aren't so good, and how can we tell the difference? From that standpoint, I view technologies of various kinds as institutional components and varieties of practice that strongly affect who we are and what we do. What possibilities are afforded? Which constraints and conditions are imposed?

If you look at what is happening with the introduction of computer networks into the schools you have to ask what these devices replace or eliminate. And you need to identify what these instruments require of those who use them. Very often we see that as lots of money and resources are being given to computers in the classroom, at the same time arts education is being cut, physical education is being eliminated, foreign language teaching curtailed. The coming of the machine is the occasion for a whole set of institutional choices made invisible by the Big Magic of the computer.

TB: *So you're saying that computers are replacing these other areas of education.*

LW: Yes, in effect. You have to look at the whole situation and ask: What conception of quality education is being proposed? My own view is that in the best of circumstances every student ought to have access to the broadest array of opportunities, books, materials, equipment, and high quality teaching possible. In that light there's an educational

center that I'm particularly fond of in Troy, NY, called The Ark.

TB: *You've written about that. ["Computers and Hope in an Urban Ark," Technology Review, May-June 1997.]*

LW: Yes. One interesting feature of the place is that its material culture is fairly diverse. The Ark contains a good many musical instruments that people in the community have donated, along with a small library of books, and supplies and equipment for doing art — pottery wheels, kilns and the like. That wealth of equipment is made available to about 150 poverty-level, minority kids along with very good after-school tutoring and just plain human care. What captures the headlines, of course, are the state-of-the-art computers where the children make their own Web pages. But for the people who run the Ark and for the many volunteers who give their time, computing is just one among a rich set of possibilities made available to the boys and girls.

Alas, that sense of balance is often lacking in education these days. Computers are pushed into schools as if they were a source of redemption. They are treated as a one-dimensional solution to what is actually a very complex question: how does one inform and enliven young minds and souls?

TB: *So if you have a classroom where everyone has a computer on their desk that is hooked to the Internet, that is being used as the learning tool, getting information over the Internet, then that becomes what consumes everyone's attention almost all the time. Everything becomes Internet focused, and the students become Internet-philies —*

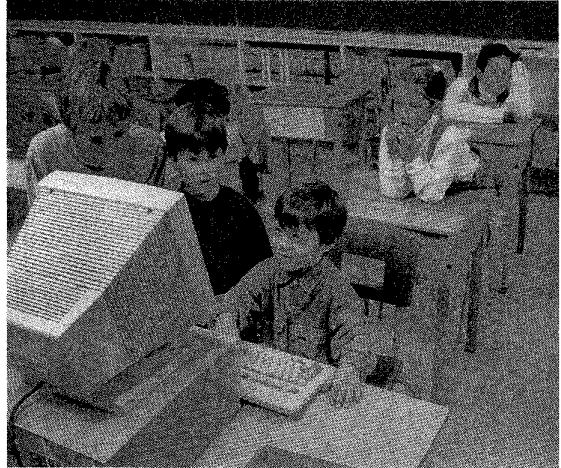
LW: Yes, it's amazing the devotion a box of silicon chips can inspire. What fascinates me is how reluc-

tant people are to consider the evidence for productivity or lack of productivity from these innovations. There's a great deal of research available on the effects of technological applications in education. One prominent

finding centers on the principal of "no significant difference." Study after study shows that information technologies help some students' learning, hinder others, but produce no significant difference for the great majority. [See T.L. Russell, "Technology Wars: Winners and Losers," *Educom Review*, vol. 32, no. 2, Mar./Apr. 1997.]

My own observations suggest this has probably been true for decades. American schools have been introducing the latest technological wonders into the classroom since World War I: motion picture machines, radio, tape strips, television, cable television, language laboratories and the like. I remember that in the 1970s when I first stated teaching, a number of my colleagues believed the camcorder was going to "revolutionize education."

The idea was that you could return knowledge production to the students. They would go out into the world and make their own television programs, thereby controlling the learning experience. It was a fabulous dream. But no one is calling for a television revolution or camcorder revolution in education today, despite the fact that the technology has gotten better and cheaper. Isn't that interesting? Now many people believe that the Internet will achieve the wonderful results that have eluded us in previous "revolutions." But if the research shows that the introduction of new tech-



nology makes no significant difference for the vast majority of students, why are we spending all this money on these boxes?

TB: *The answer that springs to my mind is that people are concerned that students, when they leave school, will not have total familiarity with the computer. To ensure that they are prepared to leave school and enter the working world, it needs to be introduced on their desks now.*

LW: You mean that exposure to computers acclimates students a particular work environment. That's probably true. The question is how well does this experience correspond to the goal of a getting a good education?

I was interested to see the results of the Third International Mathematics and Science Study released recently. The report compared test scores of students from the U.S. and fifteen other nations. Americans ranked consistently at the lower end of the scale. Even Cyprus scored higher than the U.S. in physics, for example, and there were no countries that scored significantly lower than the U.S. in advanced math. These were tests of twelfth graders taken in 1994-1995. This was, of course, exactly the generation of students bombarded with personal computers and widely heralded software

like the Seymour Papert's Logo program during the grand and glorious computer revolution of the 1980s. How is it that when you test these students as they are leaving high school, they still do so poorly? The U.S. students lagged behind countries like Norway where there is very little computing in the classroom, just a strong emphasis on high standards in math, science, and other teaching. In my view, the American obsession with computers in education has begun to resemble a cargo cult.

TB: What is a "cargo cult"?

LW: Cargo cults were millenarian movements that arose sporadically in New Guinea and other islands in the Pacific during the past century or so. Some native people believed that the material goods they saw carried on ships and later on airplanes from distant places were actually meant for their benefit, but had been misappropriated by people from other lands. The cults conducted elaborate rituals, building bamboo ships or airplanes and tending them, in the conviction that the "cargo" would eventually arrive.

But, eventually, even members of a cargo cult have to ask: how well are the rituals working? Are our efforts bearing fruit? Many schools, for example, never figure in their planning the amount of staff support or repair expenses that computing equipment requires. They discover that, over time, more and more resources have to be devoted to making the software work, keeping the machines repaired. Around the country we see school systems hiring new computer support personnel at the same time they are laying off teachers.

SEEKING POSITIVE ALTERNATIVES

TB: I want to get back to the big picture, to not being in control of technology. Do Unabomber Ted Kazinsky's writings have any rele-

vance to this issue? What would cause someone to go "over the edge" like he did? What might that say about the relationships between technological development and people in our society today?

LW: If the Unabomber Manifesto, "Industrial Society and Its Future," hadn't been written by a serial killer, no one would notice it. It's fourth rate anarchist social theory of the most thick-headed kind. The essay describes the thoroughgoing domination of a system of technological economic arrangements that robs people of their autonomy, turning them into cogs in the machine. The same technological civilization, in the Unabomber's account, is rapidly destroying nature, producing an ecologically depleted planet. Ideas of that kind are common in a tradition of social thought that goes back to Thomas Carlyle and other early critics of industrialization. In the nineteenth century, writers like John Ruskin and William Morris in England and Henry Adams in the United States all offered strong critiques of a society in which machines prevail.

This tradition continues in the 20th century with writers like Lewis Mumford, Theodore Roszak, and other humanists who've warned about the spread of megatechnics.

What distinguishes that grand tradition of technology criticism from the writings of the Unabomber is worth noting. The best thinking in this vein draws a strong contrast between where our civilization is headed as compared to where it ought to go. These writers take care to offer positive, hopeful answers to the questions about technological and social alternatives. Lewis Mumford, for example, spent a lifetime describing the same kind of maladies that Kazinsky became fixated on. But his central purpose was to think about what human beings could become, what resources there were

to help people lead rich, fulfilling, thoughtful lives and which social and material arrangements were compatible with the good life.

I think it's a sign of Kazinsky's madness that he thought himself into a corner from which he could not escape. He came to believe that we are so thoroughly overwhelmed by the power of modern technology that only the calamitous destruction of modern civilization would remove the ills. This is a totally unpalatable variant of technology critique which, unlike the teachings of Gandhi or Lewis Mumford or E.F. Schumacher, dwells upon fear, hatred and violence. At a certain point you've got to put aside analysis and explanation of what's wrong in the world and turn your attention to sources of cooperation, hope, love, and renewal, sources that are inexhaustible, if one knows where to look.

TB: You gave some examples earlier of groups working towards or seeking positive alternatives to certain technological and social developments. Aren't groups of this kind exceptions — small "pockets" of activity in a larger picture?

LW: I'm not so sure they are only small pockets. In most places that I'm aware of — cities, towns and neighborhoods — people are involved in trying fashion good places to live. Very often these days people have to confront technology-centered forces that make it more difficult to build livable, flourishing communities. Recent waves of downsizing, automation, offshore production, the dismantling of old workplaces, and the construction of new ones that don't have the wage rates or even the kinds of interesting work that the old places had — all of these are conditions that people have to contend with nowadays.

One "pocket" of renewal that I find quite interesting is the idea of community supported agriculture.

The idea that digital electronics necessarily allows greater access to information and therefore enhances the power of ordinary citizens is one of the recurring myths of the computer age.

There are about six hundred of these C.S.A.s in the U.S. now, using organic agricultural methods and contract marketing to bring farms back into production and revitalize farming as a way of life. When the Department of Agriculture recently tried to propose standards for labeling products "organic," there was a surprising flood of mail and email, much of it from ordinary folks, who objected to the inclusion of foods grown in sewage sludge and bioengineered plants on the list. Many people believe that the voluntary spread of truly organic agriculture would be good both for them personally and for the health of the planet. As a more general matter, I think there's lots of evidence at that people are taking a closer look at patterns in their lives — energy use, relationship to transportation, consumer habits, and so forth — looking for

ways their actions can more closely match their deeply held beliefs.

TB: *You work at a university, you live in the academic world, the people you associate with see things from a similar perspective, so it's easy to keep affirming that and keep going in that direction.*

LW: Right.

TB: *But the further you get from that academic environment, the harder a person has to work to keep that perspective.*

LW: I don't find that to be the case at all. I live in a small town — with ordinary people, people who run contracting businesses, plow the snow, go to the churches and run the PTA.

TB: *Do they go to the organic farm?*

LW: Some do, but I'm not talking only about that. I'm talking about the networks of social support, support for the elderly, or what's required to keep the local economy vibrant, keep public spaces interesting, or to attend to the needs of young people growing up.

TB: *You're talking about community.*

LW: Exactly. These are not people who've read great works of philosophy or social theory. But they understand a lot about how real communities operate. Around the country in recent years people have rallied, for example, when they thought the arrival of a Wal-Mart would pound a spike through the heart of the community as expressed in its downtown shops. There are some places where people say, oh fine, a Wal-Mart is coming in. But there have been lots of cases in New England, Washington State, all around the country, where people have correctly seen that the market

power of a Wal-Mart, power based in electronic inventory systems, can be destructive to the economy of towns and neighborhoods. On occasion communities have stopped or at least modified the introduction of these stores.

I'm often surprised by the grasp of public issues exhibited by ordinary folks. In communities near my home, townspeople have battled environmentally and socially destructive developments proposed by the New York State Thruway Authority, McDonald's, and a large mining company. They've shown themselves to be a tough as nails in preparing environmental impact assessments, organizing campaigns aimed at the news media, and lobbying decision makers.

TB: *Are there types of technological change that are not so locally based, that are in a sense, truly beyond people's immediate control?*

LW: Yes, there are some kinds of technological change that demand much more than a local response.

TB: *What are some of the areas of technological change that you see coming up that are of concern, yet not so easily affected by, say local organizing against the introduction of a particular store.*

LW: First, in my view, is the overall influence of digital technology which affects every corner of social life. For better or worse, most social practices and social spaces are being renovated to accommodate digital electronics.

Second are the various arrangements of flexible production. Some of these involve new hardware and software, while others are based on social policies, i.e., the use of temporary workers for many tasks. This new flexibility and ephemerality is changing how people experience their jobs, professions, family lives, and leisure.

A third area I would mention is the

rapid development of genetic technology in agriculture, industry, and health care which now presents a great challenge to how we understand all life forms and life processes.

All of these changes require widely shared, systematic responses that apply to every corner of the planet. That means that we'll have to find ways to connect specific local concerns to much broader patterns and to people in distant places who have similar problems.

TECHNOLOGICAL DETERMINISM

TB: *So let's get back again to the idea of technology being "out of control." What does that term mean?*

LW: It's not really one idea, but a collection of related themes. For example, in fields of technical practice where things are changing rapidly, coming from so many sources, one sometimes hears even the most competent participants say that the technology has a "life of it's own." This means that no one controls or could possibly control what happens next.

Another version of the idea stems from a phenomenon that the ancient Greeks understood, that because the effects of any action are potentially limitless, we never fully control what we are doing. That's just as true of action through technology as any other kind. But because technology is seen as a distinctive domain of rationality and control, the unpredicted ramifications of seemingly insignificant acts are all the more astonishing. The Y2K problem, the millenium bug in computer software, is a perfect illustration.

TB: *What about "technological determinism?" Is that idea still important?*

LW: The basic thesis is that technological change has a necessary, linear trajectory and that technological development is the most

forceful determinant of changes in society. As I mentioned earlier, this idea has gone out of fashion among most scholars. But it is still common in other quarters. Among cyber-libertarian thinkers, those who write for *Wired* magazine and right-wing foundations in Washington, DC, there is still a very pungent technological determinism. They argue that various technological waves are crashing over us and that people will simply have to adapt. They usually don't say: Here's a process of social creation with many wide open possibilities available to us, so let's make sure everybody is included in making the key choices. No, the message has to do with what is inevitable and necessary.

TB: *This is the idea we always hear, that the world is changing so fast, and you have to keep up, for example, that you must have a certain hardware or software.*

LW: Right. We are all advised to worship at the shrine of Our Lady of Perpetual Upgrade.

TB: *All right then, why do people want to convince other people that things are or must be a certain way in terms of the inevitability of technological development?*

LW: Quite often it's because they have something to sell or a position of power to protect. I think we had a very good example of this in how the so-called information superhighway was presented to the public. The images offered in news magazines and elsewhere had an extremely odd slant. At the top of the highway map were enormous information providers, the media networks, Time-Warner and Disney, for example, where the corporations control the content and pass it on to you. It was an extended

model of cable TV. Many people still have this model in mind. Time-Warner spent an estimated hundred million dollars on creating the Full Service Network, one that tried to link shopping, news, entertainment, and information services all in one package. That particular system flopped. But rhetoric in these episodes is always the same: persuade people that a particular pattern is "inevitable" and they have no power to negotiate. Go along with Plan A or be rendered obsolete. Bow down! It cometh!

TB: *Are you saying that there is an underlying political basis, or agenda, for theories of technological determinism?*

LW: There is an ideology prevalent among today's economic, technological, and political elites that focuses on unfettered freedom in the marketplace. This idea of freedom turns out to be not only a justification for start-up entrepreneurs, but an ideology in defense of global capital. The underlying message is that the world is propelled by technological trends and global economic forces and that in such a world you're only responsible for yourself. That sounds fine until you begin to notice that you are no longer obligated to have any responsibility to community, to humanity, to the biosphere, to other people. Everyone's goal is

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With technological determinism, everyone's goal is assumed to be the sheer creation of wealth - if you run into people who aren't doing well, you say, well they're losers, they've just failed.

assumed to be the sheer creation of wealth. If you run into people who aren't doing well, you say, well they're losers, they've just failed. And certainly we don't need the action of government to provide public services other than the bare necessities like airports, roads, or bridges, and the like. Today the right-wing libertarians are not even sure public schools are necessary; perhaps private education and vouchers would be preferable. What we have here is an "I'm all right, Jack" ideology of a very comfortable elite, proclaiming freedom while they advise dismantling social programs that help ordinary folks and the poor (people without stock options and lavish mutual fund portfolios) get by from week to week.

ROLE OF ENGINEERS

TB: *What should be the role of the individual engineer in controlling technology, and what should be the role of the professional engineering society in controlling technology?*

LW: Engineers are often well situated to look at the changes that will affect the future of society and to make decisions that affect the broader public interest. They can, depending on how well they understand their place in the world, act to push a pattern of development in directions that would be safer, or more socially convivial, or more inclusive. I believe that a great many engineers already act responsibly in this respect. One reason that we don't hear about technology failures more frequently is that engineers do a good job quietly insisting on high standards in the domain of work in which they operate.

I especially admire the engineers who recognize that they have a role in communicating with the broader public and involving non-experts in decisions about technology. Computer Professionals for Social Responsibility does a very good job in its sphere of concern.

TB: *Or SSIT.*

LW: Yes. And very often these organizations take positions that shift the whole direction of public debate. Physicians for Social Responsibility started saying in the early 1980s, if the bombs start falling, don't call your doctor; your doctor can't help you. That message attracted considerable attention and helped redefine the arms race as an issue for public health. Many people simply hadn't thought about nuclear war in that context before.

In my view, technical professionals — people who are involved in transportation, industrial production, electronic systems, and so

forth — ought to be involved not just in preparing these systems, but in helping focus debate on the best and worst that developments in their fields might bring.

TB: *Do you mean focus debate within the professional organization?*

LW: Yes, there ought to be focused debate within professional societies, but also within public forums at large. One area of technological development that deserves more attention than it's getting right now is the development of electronic data collection and electronic surveillance. Much of what people do in their everyday comings and goings is being watched more closely than ever before. Electronic systems in the workplace monitor people's performance and their email. What people do in the realm of network computing is recorded and tracked. In addition, an increasing range of public and private gathering places — social spaces such as offices, shops, malls, streets — are covered by surveillance cameras and other devices that keep an eye on us. There is a new social world being created here in the name of safety and security. It contains some menacing possibilities.

Who builds these systems? Well-educated technical professionals employed by business firms and government agencies. As surveillance increasingly pervades society, most people receive the news almost as a kind of rumor. Oh, oh, the data banks and cameras have been installed and now we'll just have to put up with them. To impose conditions like that is a highly irresponsible form of professional practice. I'm surprised there hasn't been a greater outcry from engineering societies about these developments.

TB: *So are you saying that the engineers themselves who are designing these systems should be*

looking at the ethical implications of what they are doing on their own jobs, and that they should be talking to people about that?

LW: Yes, definitely.

TB: Or publicly saying, I have concerns about this — for example, writing an article in, or letter to, the local newspaper about their concerns about the work they are doing?

LW: Right. In this case, technical professionals could write about the need to balance the concerns organizations have about security with public concerns for reasonable protection against surveillance. They could argue that truly good technologies ought to include these protections, but that for reasons of haste and cost-cutting, the best systems are not being installed. Presenting the issue in this way could create new bonds between engineers and the general public and help re-open debate about important policy decisions.

TB: Is that asking a lot of someone whose livelihood may be at stake? Would you ask someone to quit their job so they can talk about what they were doing there?

LW: Sometimes that's necessary. As a teacher and writer I've quit jobs and been fired over matters of principle. It's part of the business. For engineers the decision to stay with an organization or leave is often a way of affirming deeply held values. These are very personal decisions, ones that outsiders can't easily judge. But I admire those who weigh concerns for public well-being heavily in their professional choices.

TB: Explain more about how an engineer would incorporate such concerns into his or her professional choices.

LW: In addition to being knowl-

edgeable, competent, creative workers they need to see how what they are doing has a moral and political component. The belief that technical skill somehow renders us immune from these matters is something the teaching of engineering ethics always struggles to overcome.

You've probably heard the joke about the engineer and the guillotine. During the French Revolution, three people have been condemned to death: a priest, a politician, and an engineer. The priest puts his head in the slot, down comes the blade, but it gets stuck. The executioner tells the priest, you can go, and the priest stands up and proclaims, "I've been saved by the will of God, glory halleluia." The next victim is a political leader, but the blade gets stuck again. As he is released, he says, "I've been saved. It's the will of the people!" The next person to be guillotined is the engineer, who walks up to the apparatus, puts his head in the notch, sees where the blade is supposed to fall and says, "Hey, I think I see your problem..."

If a joke can have any significance, I suppose this one's is that you need to ask who you're working for — whose interests are served by this project, innovation, or piece of equipment. And what exactly is your role?

As a teacher during the 1970s and 1980s, I would ask my science and engineering students to question seriously their projected roles in the military industrial academic complex which for many of them was a virtual certainty. So I would say deliberately provocative things like "Why don't you move to Seattle and work for some small software company." (Some of them did, and are now multimillionaires.) Today my advice would be rather similar, although the context has changed. Think twice as a responsible technical professional before you sign on to the agendas

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of the big transnational corporations and ongoing schemes of economic globalization. Perhaps your creativity would be better employed in a smaller organization, helping to rebuild economic vitality in a community closer to home or in the developing world. I don't think a message of this kind expects any great heroism. It asks people to ponder their roles and ask: What kind of world we are making here?

TB: Steve Unger, a long-time member of the IEEE-SSIT AdCom, raised some of these points in a question he asked me to ask you, about how engineering talent is being utilized today. He says, "there has been some, though not nearly enough, reduction in the percentage of engineers employed on war-related projects. But this reduction may have been more than compensated for by a channeling of engineers (particularly in the computer software area) into what I would label casino work, i.e., work for stock brokerage firms. It seems that an amazing number of our best students, at all levels, are being snapped up by such firms as Bears Sterns. They

are being paid very high salaries. Just as in the case of military work, I don't blame the engineers for doing work that is, in my view, nonproductive, but rather our system, which seems to focus on work that is least beneficial to people." Steve says he would be interested in what you would have to say about this.

LW: It's interesting that Steve would call working for brokerage firms non-productive. I see it that way as well. Very often the highest salaries are paid to the movers and shakers of the financial world, by the people who are interested in moving capital around the globe. Students who are thinking of joining such institutions might well ask themselves how comfortable they are in participating in corporations that are moving jobs overseas and trying to dominate the economic future of people on other continents.

TB: I wonder if some of them might feel pretty comfortable, for a

first job, especially if it seems like what the company is doing is not "all that bad," and you're 22 years old and it looks like you're being offered a lot of money.

LW: That's right. But it's always been that way, if you're only in it for the money.

TB: Well, maybe they're not only in it for the money. But maybe it's hard to see — particularly given the wider cultural acceptance — how what the corporation is doing is really so bad. And that kind of job might be a hard thing to turn down.

LW: That's true. But if people seriously look at the whole fabric of which they are a part, the kind of economic development that they are sponsoring, they may think differently about the matter. Today's corporate economy concentrates the world's wealth in the hands of fewer and fewer hands, creating millionaires and billionaires while average wage levels in the U.S. and the rest of the world are standing still or falling. I ask my students how comfortable they are with that.

The experience of David Korten, a businessman who taught at the Harvard Business School, is worth noting here. For many years he worked for organizations he thought were contributing to the economic development that would lift the fortunes of the poor and downtrodden. His book *When Corporations Rule the World* describes his realization that something quite different was happening. The actual policies of global corporations, he argues, degrade working conditions, living conditions, and environmental quality as they seek to increase profits. Eventually Korten recognized that his work was not compatible with his sense of what it meant to be a decent human being. He's now involved in efforts to educate people about how to reclaim their futures from this kind of maldevelopment.

THE INTERNET

TB: I am interested in any other comments you might have about the Internet.

LW: That's an enormous topic. In many ways I'm hopeful about what the Internet can do to enable people to express their ideas, eliminate barriers to communication and find information useful for their own purposes. But I have long criticized the idea that the spread of information technology is inherently democratizing. The idea that digital electronics necessarily allows greater access to information and therefore enhances the power of ordinary citizens is one of the recurring myths of the computer age — "mythinformation," I like to call it. That canard has received a new boost with publications like the "Magna Carta for the Knowledge Age" written by Esther Dyson and other so-called "conservatives" at the Progress and Freedom Foundation. They predict that the spread of new technologies like the Internet will liberate us, causing hierarchical structures to collapse and freedom to flourish. Research like that being done by political scientist Bruce Bimber gives a more balanced view. It turns out that those who already have power and have resources — those able to make use of newspapers, mass mailings, and other ways of mobilizing public opinion — are using the Internet to do this as well.

TB: You don't see it changing the balance of power, but as continuing the existing balance.

LW: Yes, it seems to reproduce existing forms of politics with a few new wrinkles. Bimber seems to be finding that involvement on the Internet by women and minorities is somewhat greater than one would expect. But predictions of a revolution that will produce substantial leveling in political society are

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probably mistaken. For the time being the effect of all media — radio, television, and the computer — seems to be to reduce participation and amplify the power of the already powerful. I hope the Internet and World Wide Web will provide new channels for citizen involvement. But to realize that promise will take a great deal of work.

TB: *You have a nice Web page.*

LW: *(laughs)* Well, I don't know about that — it's rather clunky actually. Like many Web pages, it does contain advertising for new products. My latest invention, the Automatic Professor Machine, marketed by Educational Smart Hardware Alma Marter, Inc., is on display there: www.rpi.edu/~winner.

It's interesting that during the popular spread of the Internet during the 1990s, the corporate broadcast model is not the one that seems to have taken hold. There's an amazingly diverse range of voices and interests, a lot of people who find it exhilarating to reach out to people with similar needs and problems. People who have certain kinds of illnesses, who need the support of others who understand what they are going through, find support on the Internet. Minorities of various kinds, gays and lesbians for example, discover ways of making contact that were more difficult previously.

TB: *Does this mean that the Internet provides community of a certain kind?*

LW: I'm skeptical of the idea that community is enhanced greatly by the Internet and the World Wide Web. That has to do with my understanding of what community is about. These days people use the term to encompass people with very similar traits. But in a historical and sociological sense, living communities have been composed of people from different back-

grounds who found some way to come together in face-to-face interaction and work things out. I worry that the kinds of homogenization and social isolation that we see in other parts of society — the creation of "gated communities," for example — might be reinforced by Internet communication.

DESIGN AND ETHICS

TB: *Could you talk a little about engineering design, including its relationship to engineering ethics.*

LW: I see design as a crucial boundary between ends and means. Designs for architectural spaces, for example, have often been occasions for implementing important social policies. And designs for technological systems often express deliberate or unconscious choices about social and political values. The design of the federal highway system in the 1950s, for example, was actually a blueprint for the future of American society.

I spent some time recently finding out what engineers mean by design. Very often for them design is the point at which they narrow their focus and try to solve solve internal, technical problems — to get exactly the right size bolt or the proper configuration of electronic components. For me, the challenge of design is something different, even as it involves technology creation. Engineering design is the effort to relate decisions about technology to their context, to connect them ultimately to our ideas of the good life. Engineering design involves making a technical framework for what human activity ought to be. Both the ends and means of this "ought" should be matters for

widespread study and debate.

Much of my thinking and writing these days involves design. It is a topic around which professionals and students can come together to discuss creativity, problem solving, moral and political theory, and aesthetics in settings of practical significance. But design is an ambiguous notion; no one quite knows how to define it. Many people like to say, yes, we are doing design. Students often come to engineering school with idea that they are going to be making new things which will make life better. Often, when they get there, they find they are involved with something quite different than that — namely, the application of engineering science to narrowly defined tasks. In teaching, I see



design as an arena for inquiry that stretches across many disciplines. It provides good opportunities to talk about ethics. What should we make? What should we do?

TB: *Can you comment on your critique of the way engineering ethics is traditionally taught. I have a quote from your article "Engineering Ethics and Political Imagination" [in Broad and Narrow Interpretations of Philosophy of Technology, P.T. Durbin, Ed. The*

Netherlands: Kluwer, 1990] that I am told summarizes your views: "Ethical responsibility...involves more than leading a decent, honest, truthful life, as important as such lives certainly remain. And it involves something much more than making wise choices when such choices suddenly, unexpectedly present themselves. Our moral obligations must...include a

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willingness to engage others in the difficult work of defining the crucial choices that confront technological society and how to confront them intelligently."

LW: My objection is that engineering ethics is sometimes presented only in the crisis mode. What would you do if someone asked you to lie, or if you saw some obvious danger? Knowing how to respond to these crisis points is obviously important. But we need more from technical professionals than that. Somehow they must understand that their everyday work is profoundly connected to the moral life of society. They need to ask: Whose interests are embod-

ied in the project I'm engaged in? How does this match what I want my life's work to produce? Many engineers do ask these questions all the time.

It's the teaching of engineering ethics that concerns me. Sometimes classes dwell upon little cartoon problems and narrow case studies. Students end up thinking that ethics is pretty silly stuff. I believe that our teaching here ought to convey issues — ones about distributive justice in engineering decisions, for example — in ways that show why they are important and how they affect day-to-day engineering practice.

TOWARDS THE FUTURE

TB: I was wondering if there are any specific ways your thinking has evolved since your two books, *Autonomous Technology*, and *Whale and the Reactor*, were published - ideas that have changed or solidified. Of course a lot has changed in 10 or 20 years — some of what you wrote might seem more strongly confirmed, or then again, are there ways you have shifted in your thinking?

LW: Since the time I wrote *Autonomous Technology*, I've become more aware of the fragility of large sociotechnical systems. What appears to be a juggernaut or unstoppable colossus usually turns out to be something people hold together, or allow to fall apart, depending on how enough of them feel about it. Under the right set of circumstances it's possible for there to be rapid change in ideas, policies, and structures. In that way the Cold War dissolved and much of its supporting apparatus collapsed overnight. That's why I'm somewhat more hopeful than I

was when I wrote *Autonomous Technology*. And that's why I believe all the more strongly that people should persist in advancing even their most improbable ideas about human well-being.

TB: What part of the relationship between technology and society would you most like to see changed now?

LW: What would make me most hopeful is if I saw many more people stand up more frequently to announce their own agendas and needs for projected paths of technical and social change, rather than take somebody else's story as the one that defines the possibilities.

TB: Do you have a vision of the future?

LW: I believe I can see some of the questions that will be central in the coming century, although the answers remain unknown.

- Will a global, high-tech economy continue to foster radical inequalities of wealth and living conditions? Or will forces emerge to alter that destructive trend?
- Will regional conflicts spawn a new era of competition in nuclear, chemical, and biological weapons? Or will the arts of peace and reconciliation lead us in more promising directions?
- Will the world's people own up to pending environmental disasters, including climate change, in time to make a difference? Or will ecological decline become a dreary fact of life?
- Will the genomes of the world's species come to be regarded as an elaborate Lego set, subject to manipulation for fun and profit? Or will caution about these god-like powers prevail?

TB: Thank you very much, Dr. Winner, for sharing your knowledge and insights with our readers.