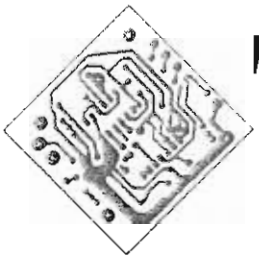
IN THE ABSENCE OF THE SACRED



The Failure of Technology & the Survival of the Indian Nations

JERRY MANDER

AUTHOR OF Four Arguments for the Elimination of Television

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SEVEN NEGATIVE POINTS ABOUT COMPUTERS

WITHOUT COMPUTERS, THE megatechnological age simply would not happen. Computers are basic to every new technical innovation, whether in communications, the military, genetics, transportation, automation, or multinational corporate activity.

Because of this universality of applications and implications, computers have been celebrated more than any technology since electricity. Educators, corporate leaders, presidential candidates, futurists, and the media sing a unified chorus of praise.

The situation is ludicrous. Computer technology has sprung us headlong into an entirely new existence, one that will permanently affect our lives and the lives of our children and grandchildren. It will speed up profound changes on the planet, yet there is no meaningful debate about it, no ferment, no critical analysis of the consequences. As usual, the major beneficiaries are permitted to define the parameters of our understanding.

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During 1988 alone, the microcomputer industry spent more than one billion dollars in advertising (most of it on television). You have only to watch your TV tonight to be repeatedly told that neither you, your business, nor your child can survive the future without computers. These messages from the microcomputer industry are in addition to those from other industries in praise of computers. Auto commercials promote their computerized features. Military recruitment ads trumpet the high-technology training

the military offers: "High technology is taking over the world/Keep up with it or be left behind/Be all you can be/Join the Army." And if anyone failed to get the high-tech message from the ads, TV news images of the Iraq-U.S. war left no doubt about the glamor of computerized weaponry.

Watches, telephones, stereo equipment, and instruments of all kinds boast of their digital operation. I know one chief executive of a wilderness travel company who advertises the company's "data bank" of wilderness experiences.

Even environmentalists have failed to maintain the usual skepticism about corporate claims, accepting the apparent short-run benefits of computers without grasping that computers actually steer society in a direction that *contradicts* environmental goals.

And writers! I must have been asked two dozen times how I can say that computers are negative when they are so useful to writers. They save time and drudgery, they rearrange, they spell, they sort information, and you can play some fun video games with them, too. But are any of those features really the point?

Unfortunately, the major question about computers is not whether they serve you or your organization or your business well. I wish it were so simple to just take this personal view. We must look at the totality of how computers affect society, and life on Earth. We need to dredge each dimension of their impact and put it all together into one picture before we can judge their existence as beneficial or harmful.

This chapter, therefore, is an attempt at a holistic analysis of computers, divided into seven categories: 1) pollution and health, 2) employment, 3) quantification and conceptual change, 4) surveillance, 5) the rate of acceleration, 6) centralization, and 7) the worst-case scenario: automatic computer warfare.

1. POLLUTION AND HEALTH

Since its birth, the microelectronics industry has enjoyed a reputation as something apart from, better than, and cleaner than the old smokestack industries. Maybe this reputation goes with the neat design of the computers themselves, or maybe it's that the primary product is information rather than turbines or ball bearings. Perhaps it's the kind of people drawn to high-tech management, who reflect a New Age, "can-do," cutting-edge self-confidence; who exude the idea that "we are the future." Or maybe as my friend Ellen Weis of the Museum of Modern Mythology believes, it's

the silence of the computers that sustains this squeaky-clean image. "Everything seems to happen by magic," says Ellen. "No moving parts."

Anyway, this reputation is not deserved. Computers are not the "free lunch" they were promised to be. Health and environmental problems are visible in the communities in which the machines are built, among the workers who build them, and among the people who use them on the job.

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Computer manufacturing employs millions of gallons of acids and solvents that are eventually disposed of at toxic dumps. In communities where computers are manufactured, serious problems have arisen. In Silicon Valley, California, for example, high concentrations of trichloroethylene, (a solvent that the EPA has called carcinogenic) have seeped into the drinking water. At one point, computer manufacturers, while not admitting guilt, passed out truckloads of bottled water in the affected communities. The Environmental Protection Agency has identified eighty similar chemical spill sites associated with computer manufacturing, and expects the problem to escalate.

Suburban communities affected by toxic waste have been able to organize to mitigate the problems. But workers who manufacture computers and who have suffered health problems have been less effective. This is because most computer factory workers are nonunion and many are non-English-speaking and undocumented. So they have a hard time telling their story to management and/or the press. Lately, however, workers have succeeded in publicizing high rates of miscarriages and reproductive disorders, as well as hair loss, chronic asthma, and other conditions apparently resulting from exposure to toxic chemicals and gasses involved in manufacturing.

According to attorney Ted Smith of the Silicon Valley Toxics Coalition, "Workers and the general population are being exposed to the most deadly chemicals that have ever been synthesized." And Dr. Joseph La Don, chief of the Division of Occupational and Environmental Medicine at the University of California, San Francisco, has said, "The computer industry has an incidence of occupational illness more than three times that of the average manufacturing industry." Many companies have responded to such statements by moving manufacturing abroad to Korea and Southeast Asia, where workers are less informed and can be paid less, too.

Perhaps the most significant health problems associated with computers concern their use in the office or at home. If growing suspicions about the medical effects of personal computers are verified, tens of millions of people could be affected, and the orderly march of computers into

every nook of American commercial and personal life will be slowed considerably.

There have been medical reports for many years about complaints such as fatigue, eye strain, migraines, cataracts, and, among pregnant women who use VDTs (video display terminals), miscarriages, birth defects, premature births, and infant deaths. At first it was not believed that computers could have such effects. Recent research, however, has concentrated on computer-related radiation. VDTs generate a range of electromagnetic radiation, from X-ray, ultraviolet, and infrared, to low-frequency (LF), very-low-frequency (VLF), and extra-low-frequency (ELF) wavelengths.

At one time it was believed that these low-frequency radiations were incapable of causing harm to human beings, but it has now been shown that people are far more sensitive to any radiation than previously believed, and that causal relationships are beginning to emerge. A large medical literature has now developed in the field to which, unfortunately, I cannot give justice in these pages. (For a very thorough overview, however, I refer you to Paul Brodeur's brilliant three-part series, "The Annals of Radiation," in the June 1989 *New Yorker* or his book, *Currents of Death*.)

Meanwhile, I will say this: The idea that computers are cleaner than other industrial products is wrong, and dangerous. Just as this book goes to press, the city of San Francisco has become the first to acknowledge this fact by creating some minimal standards for safer use of VDTs in the workplace. Hopefully, others will follow with more comprehensive rules. But, such new standards notwithstanding, if I were a woman contemplating having children, I would not work at a computer terminal.

2. EMPLOYMENT

At the 1940 World's Fair, American industry promised that computers and automation would eliminate toil, and thus free us to pursue higher goals. In the 1980s industry said computers would open new careers and new kinds of industry and would ease the burden of office workers. In reality, these claims are just advertising pitches attuned to the popular concerns of the moment. What automation and computerization actually do achieve is the elimination of jobs, which liberates human beings to stand in unemployment lines.

The utopian vision of a work-free society, in which machines do most of the work while all the humans relax, could only be realized if the economic benefits of automation and computerization were somehow shared by the workers. It would take a revolution to make this happen. For in capitalist society, the benefits are disproportionately allotted to the people who own the machines. Computers allow them to get the same job done with fewer pesky humans demanding increased wages, job safety, and health insurance. As my friend Jack Edelson, who runs a small manufacturing business in San Francisco, told me, "The worst thing about computers is that they are eliminating the middle class. Blue-collar workers are losing their jobs to robots; they can't afford to buy houses anymore. And we're soon going to be a country with more rich people and a lot more poor people. Big industry says automation is going to create jobs, but that's baloney. There are new jobs around, but they're at McDonald's at minimum wage."

As for easing the burden for office workers, that is hardly an open-and-shut case. Computers *have* eased the burden for managers, because the technology facilitates a level of on-the-job surveillance that makes personal observation virtually unnecessary.

A friend of my son Kai works as a 411-information operator for Pacific Bell. He told me about the experience: "The computer knows everything. It records the minute I punch in, it knows how long I take for each call, it knows how many calls I handle per hour, how long I take on my break, and exactly when I leave. I am supposed to average under eighteen seconds per call, and achieve a certain number of calls per day. Everything I do is reported to my supervisor on his computer, and if I've missed my numbers I get a written warning. I rarely see the guy. I am not allowed to be one minute late for work, ever, or to take longer than exactly fifteen minutes for coffee. It's intense. It's me and the computer all day. I'm telling you, at the end of the day I am wiped out. Working with computers is the coal mining of the nineties."

Diana Roose, who is research director of the National Association of Working Women (9 to 5), told me: "Since the introduction of the computer into office work, job design for secretaries has changed in negative ways. The typing part gets easier, but workers hate many aspects of these machines. . . . For the first time, secretaries have to deal with production quotas. Performance on the job is evaluated much more in strictly objective terms. It used to be that an office worker would also be evaluated for her personal, human contribution of energy and ideas. Now there is hardly any variety in office work. The jobs are dead-ended, and because the human connection is eliminated, jobs are less secure. Some people are calling office work the electronic assembly line."

3. QUANTIFICATION AND CONCEPTUAL CHANGE

The July 1984 issue of *New Age Journal* featured a story by R. H. Ring called "The Computerized Forest," which lamented the conceptual changes among U.S. Forest Service workers who are now asked to do their jobs mainly via computers. The entire forest system, says Ring, has been divided into "management units" containing "habitat capacity" models and "maximum sustainable yield" computations, all of which reduce the needs of species, and the workers' understanding of them, to quantified formulas.

Computers were introduced into forest management, like everywhere else, for the sake of "efficiency," the implication being that this would help preserve nature. In fact, the objective was to more efficiently account for forest *resources*—trees, animals, water, minerals—and to better develop them as part of commodity society. A former head of the Forest Service, John Crowell (who also formerly worked for Louisiana Pacific) said candidly that he favored "thinking of the natural world in terms of 'commodities' rather than 'amenities.'" So now the Flathead Forest in Montana has a planned "output" of 200 grizzly bears. And old-growth forest is called "accumulated capital."

As Ring wrote, "The ecosystem is not so easily reduced to computerized bytes. The needs of most wildlife species, their interrelationships and dependencies on their forest habitats, are not completely understood."

It ought to go without saying that certain elements of forests resist objectification: the unnameable feelings and moods, the subtle relationships. At one time, according to Ring, forest managers learned these more subtle dimensions of forest life by direct experience—by physically being out in the woods—and they integrated what they learned into their planning. But as management goals changed from preservation to development, the tools changed as well, and with those tools changed the concepts and the job. Ring reports that now Forest Service workers themselves are changing; the new breed does not come to the task with a basic loyalty to and personal involvement with the land. They are more concerned with production goals and budgets.

Of course, computers cannot be blamed for this change in direction for forest management. But they have made possible a new information system and an accelerated pace of development, which accommodates the desires of the prime movers in our society. Meanwhile, with nuances, moods, and personal observations subtracted from the information model—the very elements by which humans and nature have traditionally communicated with one another—the end result is passionlessness: a net loss in intimacy with, caring for, and love of nature. Workers who are not comfortable with this new mode of reckoning leave the Service, and are replaced with workers who don't mind the change.

The government of Canada has been as aggressive as the United States in introducing quantified, computerized resource management. At a recent conference of Circumpolar Peoples (Inuit and Indians) of the far north, the Canadian government announced a new initiative for bringing computers and computer training to native resource managers. The intention was ostensibly to be helpful, but the net result will be to destroy traditional resource management systems, and, perhaps along with that, native resistance to large-scale exploitation. The assumption is that objective data of the sort that computers emphasize will improve upon methods natives have employed for millennia.

Computers are actually antithetical to information sources that traditional societies have used: personal observation, sensory interaction, historical and geographic contexts, and teachings about the human-wildlife relationship that have been passed down from previous generations. These sources offer a broader spectrum than mere numerical data, and recent studies have shown them to be just as effective. The viability of native economic practices will be discussed at length in Chapter 14, but I want to suggest here what will be lost if computers take over the management of native peoples' resources.

• • •

Canadian anthropologist H. A. Feit, of McMaster University, Ontario, speaking at the 1986 Symposium of the Alberta Society of Professional Biologists, described the resource management methods of the Waswanipi Cree of northern Ontario. Their methods, used for thousands of years as they are today, are based on a philosophical premise of reciprocity among humans and animals. But they also lead to highly efficient management and accounting:

> In the culturally constructed world of the Waswanipi, the animals, the winds and many other phenomena are thought of as being "like persons," in that they act intelligently and have wills and idiosyncracies, and understand and are understood by people. Causality in the Waswanipi world is not mechanical or biological, it is personal. . . .

> Waswanipi hunters say that they only catch an animal when the animal is given to them. They say that in winter it is the spirits, especially the north wind, and the animals' spirits themselves which *give* animals to the hunters and their families so that they will have what they need to live and survive. . . . The body of the animal a hunter receives nourishes him, but the soul returns to be reborn again, so that when men and animals are in balance, the animals are killed but not diminished, and both men and animals survive. . . . In return for the gifts, the hunter has obligations to the animals and the spirits to act responsibly, to use what is given completely, and to act respectfully towards the bodies and souls of the animals. . . . It is expected that men will kill animals swiftly, and avoid causing them undue suffering . . . not to kill more than he is given, not to kill animals for fun or self-aggrandizement.

Apparently, for thousands of years, the Waswanipi have divided their territory into hunting regions, ranging in size from 250 to 1,500 square kilometers. For each territory, an elder is appointed as steward, based on his personal "ties to spirits and the land, within a system of communal rights," says Feit. "The stewards, by repeatedly returning to the same tracts of land, have the opportunity to observe and assess the condition of the game populations . . . Stewards generally have the right and obligation to decide whether a hunting territory should be used for harvesting of big game and fur-bearers during any year, and they allocate [land] to hunters who do not have their own. They can thus decide how many hunters will use a territory, and they can indicate to those who do, how many of various kinds of game animals they may harvest. . . . their supervision is usually respected."

Feit reports that the stewards receive detailed reports from hunters returning from the fields on what has been caught and what has been seen:

> Mature hunters can usually state whether there are more beaver colonies now than there were a year ago, or five years ago, or when the hunter's first child was born, possibly thirty years before. . . . They do not usually remember exact numbers but report relative quantities or trends. Hunters can often comment on whether the number of beavers per colony has been going up or down, on whether females are having more or fewer young per year; on trends in the frequency of different age/size categories, on changes in "shyness" to traps, on changes in the rates of wolves and other predation, and on changes in forest composition, regeneration, and the availability of food for beaver.

All of this is done without computers. The point is this: Given the detailed field-observation practices of native peoples, of whom the Waswanipi Cree are only one example, computer-based systems would probably not produce numbers much different from present estimates. (In fact, Dr. Feit gave examples of comparative research that proved this point.) What computers *would* achieve is a direct assault on an age-old system of human and animal relationships that is at the very heart of native cultures and that underlies the basic philosophical, social, and economic systems of Indian societies. Eventually, the Inuit, Indian, and other native groups who are given computers will begin to conceptualize nature in the objective terms used by Western development interests ("sustainable yield," "animal units"), while the more powerful mythical, sensory, and spiritual outlook that has informed and sustained native cultures for millennia is sacrificed. In the end, this destroys Indian culture and leads to overdevelopment.

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What do you think about the computer takeover in schools? Computer fever is sweeping through the educational establishment. Computer manufacturers are successfully convincing school systems that they cannot get along without them. Many companies are supplying free computers to classrooms, with the eventual goal that each of fifty million high school and college kids will own a personal computer. The long-run potential for the computer industry of having every kid computer trained is obvious.

"Computer literacy" is already required in many colleges and high schools. Computers are replacing teachers and teaching functions. And they are changing the content of the information learned in schools, from the more subtle information that goes with the traditional teacher-student relationship, to the more hard-edged, data-based objective content that goes with the machine-user relationship. It has happened so quickly that there has been little systematic evaluation of what computers do that teachers don't, or vice versa. But it already has enabled school systems to get along with fewer teachers.

Ironically, one of the highly praised aspects of computers in schools has been its "personal" quality. The computer gives the assignment, the student responds; when all goes well, the computer gives "user-friendly" praise and encouragement. The student feels rewarded. Computer advocates say teachers are often too busy to be that "personal." Computers are also infinitely patient, never tiring of working with slow learners. And when completing, say, repetitive drills in math or science, the machine can advance students to new levels and keep the process going, even when there may not be a teacher on the same floor of the building.

The questions are these: What sort of person does this educational process produce? And what sort of knowledge is attained? Marian Kester, writing in the *Toronto Globe,* put it this way: "If children are separated from their parents by hours of TV, from their playmates by video games, and from their teachers by teaching machines, where are they supposed to learn to be human?"

The next question is: Do computers make kids smarter?

Seymour Papert of MIT has said that learning computer programming leads to "conceptually clear thinking," and that children who do so can better deal with complex problems elsewhere. But Joseph Menosky, writing in *Science* magazine, disagrees. He reports that Roy Pea of the Bank Street College of Education tested kids who had learned LOGO, the computer language from MIT, to see if those kids organized their work better or more clearly.

"According to Pea," said Menosky, "the children displayed 'production without comprehension.' In other words . . . children can seem to understand while only going through the motions. This is consistent with studies of college computer science majors with thousands of hours of programming who yet fail to understand the priciples that underlie even the brief programs. These studies raise serious doubts about the sweeping claims made for the cognitive benefits of learning to program."

I worry that the increased use of computers in education will produce three results:

First of all, as with the Inuit and the Forest Service workers, objective, linear knowledge will begin to dominate while other, more subtle forms will recede. Like the wilderness, which has disappeared from the landscape and from our minds, many ways of thinking will also disappear.

Second, as computers replace teachers, the certainty of computer programs will replace the subtlety of student-teacher interaction. I am not saying that all teachers are better than computers for all subjects at all times. It's just that something goes on among humans that is definitely not present in human-machine relationships.

Third, replacing teachers with computers will create an ominous uniformity of knowledge. Corporations already provide a vast amount of "educational materials" to schools; when they also provide the computer programs that kids interact with, especially in the absence of a mitigating human presence, they pave the way to an officially sanctioned, unified field of knowledge. That field will be narrower than at present (though perhaps deeper in a few areas, such as science), and it will be consistent with corporate values.

4. SURVEILLANCE

In terms of everyday life, the greatest danger of computers may be the level of surveillance they make possible. Computers have enabled the major institutions of our society—corporations, government agencies, the police, the military—to keep records well beyond what was previously possible. *New York Times* reporter David Burnham's splendid book *The Rise of the Computer State* covers this subject so thoroughly that I will devote only a few paragraphs here to summarizing it.

Burnham offers the example of TRW Corporation, which holds in its computers the credit records of 120 million Americans. These reveal where you bank, how much money you have, what your income is, how much you owe, what you own, where you shop, how much you spend, who your dependents are, whether or not you have a criminal record, how well you pay bills, where you work and live, your telephone number, your social security number, and names of the rest of your family.

The Medical Information Bureau has files on about 20 million people. Metromail, a direct-mail ad agency, has files on about 74 million Americans. AT&T has a comparable number.

Burnham acknowledges that the quantity of contemporary record keeping could have been managed before the invention of computers, but as a practical matter, it would have been absurd to attempt it. The collection process would have taken many times longer than it does now, and once collected, information retrieval would be extremely difficult, since it would involve an incredible amount of manual searching. "Computerization has now greatly reduced the economic disincentive to [gather and] inspect the files," says Burnham. So now the data *is* gathered.

The federal government is not to be outdone by the private sector. Every year government officials collect about four billion separate records about the people of the United States—an average of seventeen records per person. Most of these files are held by the FBI, CIA, and NSA, which share interlocking networks with local police and private security agencies. You and your organization are surely included.

What's more, only one or two remaining laws restrict these police and government agency networks from interlocking their data with your social security file, your phone number, your zip code, your IRS records, your employer, your bank accounts, your insurance, and all the private records that are now held by corporations. And soon, the interlock will be able to include your own dear home computer, the one that makes you "free."

Thus far, civil libertarians have held the line against meshing all these identification systems into one omniscient central computer file. But these are the years that people get elected president for trashing the ACLU.

5. THE RATE OF ACCELERATION

In recent years, there has been resistance to the idea that bigger is necessarily better. People like Leopold Kohr and E. F. Schumacher, as well as movements like the Greens and Bioregionalism, have argued that the sheer size and scale of the economies and technologies of modern countries create insurmountable organizational problems, and lead to alienation among people, hostilities among countries, and destruction of the environment. But if *small* is beautiful, as the cry goes, what about *slow*? Few people have noted that speed is an important dimension of scale.

Today's largest institutions—the military, corporations, governments, banks—can only be as large and as globally far-reaching as they are able to quickly communicate mind-boggling amounts of data among their diverse branches. Computers, combined with satellite telecommunications, have shattered the now-obsolete physical limits of size. An institution can now spread itself outward to encompass the entire planet. National boundaries are anomalies.

As computers have accelerated and geographically broadened the information cycle within large institutions, human beings have had to move quickly to keep up. And as institutions and people have sped up economic activity—satellite mapping of resources, entry into previously untouched areas, instantaneous movements of funds, development of infrastructures—the face of the planet has been changing more rapidly than ever before. Corporate activity accelerates, impact on the planet accelerates, and human activity does as well. Is this good?

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In our society, speed is celebrated as if it were a virtue in itself. And yet as far as most human beings are concerned, the acceleration of the information cycle has only inundated us with an unprecedented amount of data, most of which is unusable in any practical sense. The true result has been an increase in human anxiety, as we try to keep up with the growing stream of information. Our nervous systems experience the acceleration more than our intellects do. It's as if we were all caught at a socially approved video game, where the information on the screen comes faster and faster as we try earnestly to keep up.

Video games are in fact a great example of this. They are often defended with such claims as "they speed up hand-eye coordination." Commercial video game parlors effectively claim this when defending against parents' groups that seek to ban them from a neighborhood. But *why* is it good to speed up hand-eye coordination? The only real benefit would be to improve one's basketball skills, or to prepare for the next sped-up video game. (Ronald Reagan praised video games as good training for the new generation of bomber pilots, like those who flew in Iraq, whose instruments resemble video games.)

For 400,000 generations human hand-eye coordination was attuned to an environment operating at what you might call natural speed. Everything that human beings had to deal with moved at speeds appropriate to our abilities. It had to be that way in order for our species to survive; species need to keep up with the tasks at hand.

With the Industrial Revolution, many things began moving at mechanical speeds. As the natural environment was paved over, and as human life moved into human-made environments, the natural rhythms of our reactions gave way to industrial rhythms. We learned to interact with mechanical speeds, as assembly-line workers and most auto drivers know. Now that machines move at electronic speeds, the wheel of activity turns even faster, with us on it.

Computer video games *are* good training for the faster world. When we play a video game, our goal is to merge with the computer program. The electronic symbols on the screen enter our brain, pass through our nervous system, and stimulate the fight-or-flight reaction that still lives within us and that expresses itself here through our hands. Very little thinking is needed or used. The object is to respond *without* thought, instantly.

A skillful video-game player stimulates the computer program to go faster, and as the cycle (computer program to nervous system to hands to machine to computer program) speeds up, the player and the machine become connected in one fluid cycle; aspects of each other. Over time, and with practice, the abilities of the human being develop to approximate the computer program. Evolution is furthered by this sort of interaction, but this is a notably new form of evolutionary process. Where evolution once described an interaction between humans and nature, evolution now takes place between humans and human artifacts. We coevolve with the environment *we* have created; we coevolve with our machines, with ourselves. It's a kind of in-breeding that confirms that nature is irrelevant to us.

Video games and computers accelerate a process that had already been stimulated by a generation of television viewing. Most people think of TV

viewing as passive—which it is—while video games and computers are interactive. But the hyperactivity of TV imagery, while pacifying the brain, simultaneously speeds up the nervous system. TV makes us both dumb and speedy. In the end, television viewing just prepares us for the appropriate mental state for video games and computer fixation. And together, the technologies combine to produce a generation of people too sped up to attune themselves to slower, natural, primordial rhythms.

Video games. Television. Computers. Walkmans. Kids carrying those big radios down the street. And the *street*. And the assembly line. And the freeway. They are all part of an acceleration process that spins our lives faster and faster, making it seem more exciting when actually it is only hyperactive.

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The prevailing paradigm that speed is inherently good benefits some elements of society more than it does others. Those who benefit most are the largest institutions, which can translate speed of transactions and travel directly into money and power. For most of the rest of the world, the emphasis on acceleration is harmful. It is surely harmful for workers. It is harmful for relationships among people. It creates anxiety. And it has very important ramifications for the survival of diverse non-Western cultures.

Indigenous peoples tend to operate in small-scale economic communities, by collective processes, with all decisions made by consensus. This presupposes a high degree of intimacy among the people of the community. Since time is one of several luxuries that indigenous peoples enjoy more readily than we do, communications are often characterized by deliberate slowness; people are not in a hurry. They don't believe in accomplishing more in less time, because there is sufficient time to accomplish what needs to be done. They revel in the personal engagement that *not* rushing allows. When things do have to get done, they get done by the group acting in concert.

In the past as in the present, the push of Western invading cultures has been to organize life along entirely different lines—clock time, schedules, goals—in order to increase surplus production. This, in itself, threatens the survival of non-Western cultures since it changes the people and their traditional institutions.

I thought of all this while reading an article in the October 1984 isssue of *Development Forum,* titled "Worshipping a False God," by Ken Darrow and Michael Saxenian. The authors have devoted much of their lives to bringing small-scale technology to villages in some of the world's poorest countries. The article reports on the computer craze—the same craze that

has overtaken American school systems—that has taken hold among international development agencies and staffers who advocate computer-satellite linkups for rural communities where technical information is scarce. According to Saxenian and Darrow, the assumption goes that computers will offer "unprecedented low-cost instantaneous communications" for village development, thus solving their "technical information needs." The authors conclude that this assumption is "dangerous nonsense," and make the following points:

- "In a poor country, using a microcomputer linked by satellite to an information system half-way round the world . . . is absurd." It is technological overkill. Most poor countries need much simpler technologies, such as typewriters, reference books, hand tools, bikes, tape recorders.
- Finding skilled repairers of computers is nearly impossible, forcing "many local groups to purchase complete back-up computers, which can be cannibalized for parts."
- "The telephone system already offers instantaneous low-cost communication. . . . The unique advantages of computerized networks are few and expensive. Do you really want to call your mother on a computer?"

6. CENTRALIZATION

I recently attended a National Bioregional Congress; 250 people working toward the disintegration of central political power in favor of local control, economic self-sufficiency, and small-scale nature-based principles—Green principles. Several participants publicly advocated a role for computers in building networks among the bioregions, thereby facilitating rapid exchanges of information. Although it was acknowledged this might create some centralization, it was also argued that computers are a "neutral tool" that could help groups whose goals are anathema to the large institutions that invented them and that dominate their application. This is a *hot idea:* we take their invention and use a kind of jiujitsu to turn it against its creators. Tempting, but it fails to reckon with the intrinsic aspects of computers that will inevitably result in centralization.

The issue is confused at the outset by the fact that computers have the look of a small-scale democratic technology. People have them at home and find them empowering for themselves and their organizations. They are helpful in many ways and offer considerable personal control, unlike non-yielding technologies like television. Small social and political groups find computers valuable for information storage, networking, processing

mailing lists, preparing clean copy, maintaining membership lists, keeping accounts, and so on. Yet all this begs the question. The real issue is not whether computers can benefit you or your group; the question is who benefits most from the existence of computers in society? The answer suggests that, for all of their small-scale benefits, the largest institutions have far more to gain, and they know it.

The computer invasion was not engineered by a group of high-minded technological do-gooders determined to further democracy. Though computers were invented in the 1920s, it was the American and British military that first put them to serious use, as guidance systems for missiles during World War II. Two decades later, IBM converted the technology to big-business uses. It wasn't until the 1970s that Atari and Apple launched the campaigns to put a computer in every home and schoolroom. Do-gooders didn't hit a plastic key until the mid-1970s, when the military and the large corporations had already integrated them deeply into their operations, with great benefit and greater geographical reach for centralized operations.

Computer technology is an intrinsic part of an advanced technical infrastructure; computers could only have emerged from a society already very far down a technical pathway. They are very costly to manufacture, they are intricately connected to centralized telephone systems, and some of their optimum uses, such as high-speed computation and satellite mapping of resources, are so costly that they are only available to the largest institutions.

Computers serve the economies of scale in the same way as other recently developed technologies, such as satellite communications, mechanical agriculture, robotics, pesticides. The larger an enterprise, the more computers it can afford. What's more, the computers will be more sophisticated, operated by better-trained staff, and have more interfacings among widely dispersed regions than in smaller institutions. As a result, larger businesses gain a comparative advantage. Though small businesses benefit from using computers, larger institutions benefit far more, since the scale and complexity and reach of operations that computers facilitate require much greater financial resources. Smaller businesses would actually be better off if computers had not been invented, since they are essentially one more tool that large businesses can use better.

Consider the role of computers for international banks and conglomerates. Moving money instantaneously from one market to another, feeding development here and then there, the multinational institutions of today could simply not operate as they do without computers in a satellite linkup. Computers have enabled these institutions to suddenly expand

into a dimension never before possible. They are beyond multinational now; they are truly global. The accelerated pace at which forests are felled in Indonesia and Borneo, oceans are mined in the Pacific, and dams are built throughout the world, reflects the increased ability of corporations to operate from a central management and still influence daily activities in all corners of the planet.

It is profoundly naive for people who work to prevent planetary devastation to speak of the computer as if it were neutral; as if it were as useful for decentralization as it is to centralized development interests. Large institutions that seek the latter benefit far more than the do-gooders who plan to use computers for a high-tech jiujitsu. It is only misunderstanding the big picture, and a certain conceit, that allows us to think any other way. Environmentalists, bioregionalists, and other progressive activists would be better off realizing that for all the little benefits they offer us, computers set our movements back. We ought to begin dealing with them as an urgent environmental and political issue in themselves.

7. WORST-CASE SCENARIO: AUTOMATIC COMPUTER WARFARE

It was possible to annihilate the world before the invention of computers, but it was far more difficult and much less likely. The invention of the computer instantly changed the speed at which war could be waged, the scale of its impact, and the quantity of destruction.

Computer technology has already produced an unprecedented degree of military centralization. Generals sitting in an underground war room somewhere outside Washington can, in one moment, observe the position and readiness of all U.S. military hardware, and a high percentage of Soviet hardware, around the globe. Soviet generals outside Moscow can do likewise.

From military central it is also possible to fire missiles and track their progress via computerized displays not unlike those depicted in films like *War Games*. In fact, managing warfare now resembles playing a giant video game—following electronic blips on a massive screen—abstract, cerebral, removed from direct involvement. One could argue that this manner of waging war makes war more likely, since it separates humans from the consequences of their actions, unlike ground action, where you put bayonets through people's bodies and watched them bleed.

When enemy forces are reduced to blips on a video screen, impossible to verify by direct observation, there is a far greater chance of error. In one

eighteen-month period ending June 30, 1980, U.S. strategic forces experienced 151 "false alarms," five of which were significant enough to put our forces on "alert" status. In several of these cases, the "alert" was in response to flights of birds. In one case, it was the rising moon.

This problem of computer error in a military context is one of the main concerns of Computer Professionals for Social Responsibility (CPSR), a group of Silicon Valley corporate executives, programmers, and engineers who are concerned about the military potentials of computers.

According to CPSR, "In all but the simplest computer programs, hidden design flaws can persist, sometimes for years, even though the system appears to work perfectly. . . . There exist no known methods for eliminating this uncertainty in complex computer programs. . . . No amount of testing under simulated conditions can replace the testing that comes from embedding the system in the actual environment for which it was designed [in this case, nuclear war]. . . . But all experience with complex computer systems indicates that it is the circumstances that we totally fail to anticipate that cause the serious problems."

CPSR argues that computer error can only be mitigated by human intervention. What makes the current military-computer collaboration so terrifying is that the computers have reduced the time available for decision-making to the point where it is now virtually automatic; humans are nearly out of the loop.

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It will be informative to compare the situation in the 1940s with that of today. Even after the invention of atomic bombs, worldwide destruction was unlikely because of the amount of time and the degree of human participation that remained intrinsic to the process. Back then, bombers had to be physically loaded and then flown enormous distances at relatively slow speeds to their targets. The process took many hours, which allowed considerable time for circumstances to be altered. In addition, each bomb was carried by a group of human beings, rather than being fired automatically by a central button. Even if one bomb dropped, there might still be time to call things off before all the bombs dropped; the whole system did not hang on an irretrievable automatic "Go."

The invention of computers, which in turn made advanced rocketry possible, drastically shortened the time between the decision to act—to "push the button"—and the final outcome. Today, warheads do not fly in creaky bombers, but on computer-guided missiles, targeted and shot into space at astounding speed from military-computer-central. And now

there's the incentive to fire *all* missiles at once, since an enemy can react so quickly. If war starts, total destruction is not only possible but likely.

U.S. and Soviet missiles are presently six minutes from each other's border. If U.S. computers suggest that an enemy attack is underway, six minutes are available to verify the accuracy of the data, locate and inform the president, and then, in the time remaining, for the president to make a decision. In reality, there would be no time to carefully consider options; the decision would be preplanned. In modern computerized warfare, human involvement becomes so proscribed at the most critical moments as to be effectively meaningless.

In recognizing the difficulty of human decision-making in modern warfare, we hear talk of "launch on warning" (launching missiles instantly at the first computer warning) as a viable policy. The technical capacity is already in place for people to be dropped out of the decision loop, leaving us with automatic warfare: our comptuer program versus theirs. So what is called nuclear war is not that at all; it is really microelectronic war, software war. And the arms race has become a battle of computer programmers seeking to gain an edge in a war that, when fought, will happen automatically with no people involved—until the hardware starts landing on them.

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On October 28, 1983, the Defense Advance Research Projects Agency, a division of the U.S. Department of Defense, issued a document called the "Strategic Computing Plan." The SCP was a five-year, $600,000,000 program to develop a new generation of military applications for computers. The proposal included a thousand-fold increase in computing power and an emphasis on artificial intelligence. It envisioned "completely autonomous land, sea, and air vehicles capable of complex, far-ranging reconnaissance and attack missions." These vehicles would have human abilities, such as sight, speech, understanding natural language, and automated reasoning. The Strategic Computing Plan promoted the view that the human element in many critical decision-making instances could be largely or totally replaced by machines. In describing its "pilot's associate," for example, SCP argues that pilots are "regularly overwhelmed by the quantity of incoming data and communications on which they must base life-or-death decisions." Now the machine will do it. All that the pilot will do is take off and land.

The Computer Professionals for Social Responsibility has published an analysis of the Strategic Computing Plan. CPSR notes that the plan itself acknowledges certain problems, as expressed in this quote:

> Improvements in the speed and range of weapons have increased the rate at which battles unfold, resulting in a proliferation of computers to aid in information flow and decision-making at all levels of military organization. A countervailing effect on this trend is the rapidly decreasing predictability of military situations. . . . Commanders remain particularly concerned about the role that autonomous systems would play during the transition from peace to hostilities when rules of engagement may be altered quickly. An extremely stressing example of such a case is the projected defense against strategic nuclear missiles where systems must react so rapidly that it is likely that almost complete reliance will have to be placed on automated systems. At the same time, the complexity and unpredictability of factors affecting the decisions will be very great.

Reliance on computers has already accelerated the rate of battle beyond the point at which human beings can be expected to react effectively. The military's answer to that problem is to create computers that can think and react better than humans. Even if such "smart' machines can be created, a uniquely human attribute is dropped out of the process: common-sense reasoning. The Computer Professionals for Social Responsibility have addressed this loss:

> What distinguishes common-sense reasoning is the ability to draw on an enormous background of experience in the most unpredictable ways. In directing a friend to your house, for example, you don't have to give instructions about all the possible things that might happen along the way: fallen trees, accidents, flat tires, etc. . . . An extraordinary range of knowledge and experience [comes into play]; we never know what we'll need or when we'll need it. Nor do we usually even notice that we are using this background knowledge.

This is the kind of knowledge that leads us, when looking at a situation that seems perfectly clear-cut, to say, "Something doesn't make sense about this," to draw upon a subtle knowledge based upon years of experience in similar situations.

CPSR continues:

> The rules on which all computer systems are based treat the world as if it were built from a stock of predefined building blocks, put together in carefully prescribed ways. Artificial intelligence systems are particularly good at dealing with very complex configurations of these building blocks, often better than more traditional computer programs. But they are ill equipped to respond appropriately to new kinds of blocks. . . . In more complex environments, unanticipated events are liable to trigger anomalous reactions. That is why radar reflections off the rising moon fooled the NORAD system: Moons are not among the building blocks in terms of what had been programmed into the computer. . . . It is the job of programmers to anticipate ahead of time the range of problems that a computer system will encounter. . . . The behavior of the system depends entirely on the structure of the programs—on the rules and the ways in which they are put together. . . . [But] as the Strategic Computing Plan itself points out, it is the unpredictability of war that poses the gravest threat.

CAN WE BLAME COMPUTERS?

The big question is this: Is it fair to blame computers for any or all of the above scenarios? Most people, even those who see the relationship between computers and increased destructive potential, consider the computers themselves to be harmless. Value free. Neutral. "People invent the machines," is the common wisdom. "People program them, people push the buttons."

And yet, it is a simple fact that if there were no computers, the process of engaging in war would be much more drawn out, with a lot more time for human beings to change their minds or seek alternatives. It is only because computers *do* exist that a virtually automatic, instant worldwide war, involving total annihilation, even enters the realm of possibility. So, can we say that computers are to blame?

It is also a fact that if computers somehow totally disappeared, the world would be instantly safer. Even if atom bombs continued to exist, they would no longer have effective delivery systems. Pakistan could still drop an atomic bomb on India, but the presently envisioned, all-out nuclear war, which quite possibly could extinguish the human species, would be impossible.

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I know that this is a difficult position to accept. Critics call it throwing the baby out with the bath water. Just because computers are integral to modern systems of nuclear annihilation, does that mean we must rid ourselves of computers? I am not sure, but I think so.

This society upholds a fierce technological idealism. We believe we can get the best from a given technology without falling into worst-case sce-

narios of the sort described above. We maintain this idealism despite the fact that we have no evidence of technology ever being used at an optimal level, or even being sensibly controlled. This is certainly true of automobiles, which have virtually destroyed the natural world; and of television, which creates a common mental denominator; and of electrical energy generation, which is vastly overdeveloped to the detriment of the planet. Most technologies are actually deployed in the manner that is most useful to the institutions that gain from their use; this may have nothing to do with public or planetary good.

We are also influenced by the paradigm that technological evolution is a good thing, that no bounds should be put upon knowledge or possibility. Other societies have the concept of taboo to deal with destructive tendencies, but in our society the idea of taboo is itself taboo. And, as we have discussed, our society does not have mechanisms for evaluating the negative aspects of technology, so we bang ahead blindly, even in military development.

The military-computer matchup is irresistible; for them, it is a match made in heaven. It is intrinsic to military thinking to seek the ability to act in more centralized, more complex, faster, more far-reaching, and more destructive ways. If you are a general whose task is fighting and winning wars, you love computers. No single technology has ever offered so much aid in so many areas.

The U.S. military continues to be the largest single financial source for computer science research in the world. The attraction between the military and the computer sciences has an almost gravitational pull. In fact, one could argue that the recent *consumerization* of the computer is merely a glamorization, to help create public sympathy for its use as a panacea, when *military* use of computers is really the point.

Of all possible beneficiaries, the military benefits most from computers. Computers mean more to the military than they ever will to you and me, or to educators, or even to corporations and banks, though they run a close second. And of all the world-altering implications of computers, the military-computer collaboration is the most potentially devastating.

The possibility of computer-directed, instantaneous, worldwide holocaust is not theoretical. Every military in the world has attached itself to computers, and all military strategies are now computer based. The programs are written, the computers are ready to act. In the face of this reality, to speak of computers helping you edit your copy or run your little business seems a bit absurd.