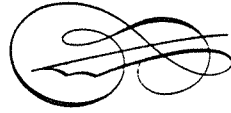


MASTERING TECHNOLOGY:  
Beyond Machine Dreams



*Fenton Johnson*

A dreamer, not a pragmatist, my father had ready access to the raw materials and blowtorches and cheap labor (his wife, his children) he needed to invent his own technology. Now that he is dead, we the cheap labor are left to deal with his contraptions, most notably a western Kentucky vacation cabin whose heating systems we can't figure out.

The cabin at Rough River is heated by water-filled pipes that snake through the fireplace, where they're warmed by the flames; a pump circulates the heated water through baseboard radiators. But since we can't puzzle out the particulars of the system, we can't use it. We can't even use the fireplace, from fear that the damned thing will explode.

An organized man — a self-made engineer — my father left pages of instructions (numbered, labelled, color-coded) for the pumps and valves and pipes. In April 1986, after the space shuttle explosion but before the disaster at the Soviet nuclear power plant at Chernobyl, I decided to decipher the Rough River heating system, and set aside three days to tackle it.

First I tried to open the boiler room, to find that its door had warped with the settling of the cabin foundation. I spent my first day cutting through the steel door with a hacksaw. When I broke into the room, I found the floor littered with labels. Moisture and roaches had attacked their glue, and their colors were faded to a uniform gray. I sealed up the room and spent the third day of my vacation sitting in the spring sun, sipping whiskey under the greening branches of the Rough River beeches.

Those hours hacking at a metal door gave me plenty of

time to question my father's mania for things technological, a mania that is cousin to the enthusiasm that has brought America, as a nation, to spend billions to launch seven men and women on a space exploration lasting at most a few days, and ending, in the most recent attempt, in disaster. Then Chernobyl exploded, adding force and an ugly seriousness to my thoughts. I came in hot and tired from an afternoon attacking with a hacksaw my father's innocent tinkering, to face an innocent-looking head of romaine. Should I wash this lettuce twice? Should I eat it at all? No doubt the lettuce is safe . . . don't be foolish . . . but who's to tell me if it's not?

Who indeed? In the Age of Technology, news can be transmitted around the world in a nanosecond — except that in those first days after Chernobyl there was no news to transmit. Then there was little news, then again no news; then *The News* ("Twenty Thousand Die?" asked the *San Francisco Chronicle*; "Two Die," replied the Soviets), that seemed either patently exaggerated, to sell newspapers (in the case of the *Chronicle*), or else patently false, to conceal embarrassing ignorance (in the case of the Soviets). Now, months after the fact, the real story is still muddled, and will no doubt remain so. Those who would clarify what happened are silent or dead.

Across those months, the U.S. Committee for Energy Awareness has taken out full-page ads in major publications entitled "Why what happened at Chernobyl did not happen at Three Mile Island." We know, of course, that it nearly did happen, and not only at Three Mile Island. Besides, when a Soviet nuclear accident — a *small* accident, compared to what might have happened — raises radiation levels half a world away, it hardly matters in what country the explosion happens, or how unlikely it is to happen elsewhere. Yes?

Well, no, judging from the reassuring tone of the Committee's advertisements, and from the glee with which many American partisans greeted this graphic illustration of the supposed inferiority of Soviet technology. But the

duplicity of the Committee's advertisements matters less than the assumptions that underlie them. The ads tell us that *Our Reactors Are Built Better*. Behind the copy lies the presumption: Built with American technology, how could they be otherwise?

That the question is assumed to be rhetorical — that the Committee can so casually evade the troubled record of domestic nuclear energy — depends on our collective faith in the superiority of American technology and brainpower. It's a way of thinking that dates from well before Chernobyl, though that incident served as its contemporary catalyst. It depends for its effects on Americans' cherished belief that we are a chosen people — smarter, bolder, better — whose destiny is to dominate the world.

The idea is usually associated with nineteenth century notions of manifest destiny, but it continues to hold sway over our private and public domestic and foreign policy. Only the tools proposed as our means of domination have changed. In the nineteenth century and the first half of the twentieth, our weapons and generals and armies won wars of expansion and domination on the North American continent and abroad. Then came our debacle in Vietnam, casting doubt on military might as a means of throwing our weight.

Those were the dark days for the American *hubris*. Mired in a bloody and unpopular foreign conflict, facing guerrilla warfare in our own cities, it seemed as if we were the contemporary equivalent of an earlier England — a giant tied down. Then, at the darkest moment of the Vietnam morass, we won a race, indisputably; the evidence was on television, broadcast to the world. "One small step for a man, one giant leap for mankind," proclaimed Neil Armstrong, and suddenly, in the midst of domestic turmoil and foreign defeat, we had conquered the moon. And we conquered it first. The Russians might have beaten us to the punch with Sputnik, but we had more than come back; we had beaten them, soundly, at the technological game.

The outcome of that decade-long race was by no means the takeoff point for America's fascination with technology, but it did provide a launching pad for the role technology has since assumed. Whether from coincidence, desperation or some trait of national character, technology has become our new weapon. Across the country, we hear it praised in editorials and by politicians of both parties. Ronald Reagan has featured praise for the promise of technology in his State of the Union addresses. The concept was central to Gary Hart's 1986 Presidential campaign, and will doubtless be so in 1988. In the 1986 California Senatorial primary, Silicon Valley Representative Ed Zschau defeated a crowd of more traditionally conservative Republicans with a campaign built on the same cornerstone. American technology, we are told, has given us the edge in the economic and political race; American technology can keep us there.

But what are we racing towards? And why need we, or anyone, get there first? To ask these questions is to challenge our national fascination with technology, and our insistence on viewing it as a means to the end of staying Number One. It is to call up for examination two of our most cherished assumptions: that advanced technology necessarily benefits society; and that *American* technology must benefit it best of all.

Traditional songs speak of working for "the Man" — "You got to work for the Man," "when the Man calls, you got to answer." In our time, the Man has become the Machine, more than we care to acknowledge. Witness the relatively insignificant attention paid to the most significant aspect of the Chernobyl disaster: only three months after an accident that threatened to annihilate thousands and to poison that country's principal food-growing region, the Soviets have reactivated the damaged reactor's neighbors, even though those reactors are of similar design and construction to the faulty facility.

The Soviet technological establishment must surely

realize the dangers of so hastily resuming operations at Chernobyl, yet as surely they see themselves as having no choice. Their options have been foreclosed, their choices narrowed, by the machines on which they have come to depend. The *New York Times* reported recently that the Soviet economy is slowing, to the point where its status as an economic superpower is seriously threatened. No doubt the Soviets see themselves as trailing in this particular race — they must have that power, regardless of its cost and potential hazards.

Depending on our points of view, we may see this step as unfortunate (“too bad the Soviets haven’t planned alternative power sources”) or typical (“the Russians haven’t the gumption to study and reinforce the neighboring reactors before reactivating them”). But to my mind, the Chernobyl reactivation poses larger issues of responsibility for Americans as well as Soviets.

In any race, the leader sets the pace; the leader keeps up the pressure. And in this technological race, America is the leader. We are setting the rules, calling the shots, pointing the way; and in almost every case, the way we point out lies along the path of unfettered technological development.

In theory, of course, any government has the option simply of dropping out of this race. Nations may choose not to participate — Austria, for example, completed one nuclear power plant, only to abandon it before start-up.

But technology has changed the rules here. Ironically enough, Austria is the closest of Western nations to the Chernobyl reactors; Czechoslovakia has nuclear plants ranged along the Austrian border. The point is that for smaller nations, a unilateral decision to refrain from participating in the technological race is an exercise in public relations and not much else. (For poorer countries, summarily abandoning their roles as suppliers of technology’s raw materials would be economically disastrous. Robbed of self-sufficiency across years of colonial domination, lacking

in their own sources of investment capital, these countries have no choice but to follow more powerful countries' technological path.) For a significant re-evaluation of man's commitment to technology to have an impact, it must be undertaken by the leaders in the race. Which means America, and the few nations that exert something close to America's economic and political clout.

The dilemma is not domestic but international, of course. Other nations (notably the Soviet Union and the major industrial powers, among them Japan, West Germany, perhaps — in the near future — China) share the burden of responsibility here. But more than any nation, America fostered the Age of Technology. Perhaps most importantly, we remain the largest single producer and consumer of technology's products. We have the option of concerted, powerful action of a sort that is not likely to emerge from the fragmented nations of Europe, or from the impoverished nations of the Third World.

This is why America's choices are so important: We are the largest and most powerful of the few nations that still have the luxury of choice. It is also why we must consider our choices carefully, along with the assumptions and goals on which they are based. To continue unquestioned our preoccupation with technological development, in tandem with a dogged pursuit of technological superiority, only leads us to accept on blind faith the pronouncements of our men in white coats, and diverts our attention from technology's domestic and global problems.

At a recent debate between supporters and opponents of genetic engineering, a scientist stood to ask if the opposition advocated a return to being hunters and gatherers. Her question epitomizes the suspicion and paranoia on the part of the technological establishment regarding the intentions of its questioners. After all, in addition to a long fascination with technology, America has a tradition of anti-intellectualism, and scientists, for this purpose any-

way, see themselves as among the embattled intellectuals.

In answering the question, farmer and writer Wendell Berry pointed out the questioner's misconception. The issue here is not whether we are to move forward or backward, he said; the issue is whether we are capable of envisioning the kind of world we want to live in, and doing what is necessary to achieve that vision.

We cannot return to being hunters and gatherers. Even if this were desirable, which I doubt, it is not an option, and only a fool would advocate it. We can, however, develop and reward a mature skepticism regarding the products of human cleverness.

Because we *can* do something does not mean that we *must* do it. This is the first lesson of childhood, the first step towards maturity: we *can* touch the inviting flame, but we must not. Like many childhood lessons, it is too obvious and simple for its importance to be grasped by adults preoccupied with the workings of a complex culture and society.

Could there be an analogy between the passage from child to adult and our own development as a species? Rarely in our history have human beings been smart enough, *mature* enough to observe and respond to the unfortunate side effects of our own cleverness. The side effects have wreaked havoc before we have acquired the knowledge needed to cope with them. But now we have developed a consciousness sufficiently sophisticated that we are able to remember and analyze our mistakes, from twenty years and twenty centuries before. Using advanced technology in historical and archeological studies, we have gained an understanding of past mistakes heretofore denied us. We know, for example, that intensive irrigation and overgrazing transformed into deserts the north coast of Africa and the lush valleys of Mesopotamia. We know that improper disposal of industrial wastes has poisoned the waters of upstate New York, and that we are draining the underground aquifers of the American west at a rate far greater than their replenishment.

Because of our ability to uncover and comprehend those experiences, we are presented for the first time with the opportunity really to learn from where we have been, and so to have some significant, positive impact on where we are going. As a species, we are presented with the opportunity to act with foresight and wisdom — to act, in a word, as adults.

And yet we continue to be fascinated more with technology itself than with its effects. We invent contraptions, set them loose on ourselves, then invent new contraptions to repair the mistakes perpetrated by the old: desalinators to purify waste water from massive irrigation projects; crops whose supergenes enable them to survive pesticides sprayed to control imported insects; cancer treatment for victims of environmental poisoning. All the while we assume that our only choices are either to accept without question or to ignore the certainty that our latest round of gewgaws will spawn their own environmental, social and psychological problems.

Are these our only choices? Must we continue profligate consumption and its attendant waste until we exhaust our resources and irretrievably pollute our world? Between a world of hunters and gatherers and a world in terror of Star Wars, is there a middle ground, and how might we best go about seeking it?

These are difficult, troubling questions, that challenge the assumptions on which our technological age is built. Considering them will require at least a bold assessment of where technology has brought us, and where it may lead. And yet surely the disaster at Chernobyl gives us a broad hint as to our general direction; surely our experiences at Three Mile Island demonstrate that the problem is not limited to the Soviets.

To date, we have not asked those questions but have evaded them. When we discover that the soil at Times Beach is so contaminated as to be carcinogenic, we bring in the cameras for the obligatory hand-wringing, dislocate



the residents, and spend a decade wrangling over who is "at fault," who should "pay up," when the damages by their nature are outside the realm of financial calculation.

This is not enough. These are reactive responses, serving only to assuage guilty consciences and to camouflage the fissures in the old, tired argument of deliverance from evil through the promise of technology. Our situation demands instead an active recognition of our limits and our need to live within them. Instead of touting (and funding) the race to outer space, we should be praising and rewarding the designers of a technology that begins with the presumption of human fallibility.

As the machines and products of technology age and decay, we can anticipate more environmental disasters. One need only survey the small-print headlines inside the back pages of any daily newspaper to find plenty of evidence of the decay of our technological infrastructure. And those disasters, however newsworthy, do not reveal the immeasurable psychological trauma we endure as a result of binding ourselves to technology's mass-production requirements: relationships depersonalized; individual responsibility diffused and degraded; family structures weakened; communities destroyed. In the long run, these effects may prove as harmful as our more widely publicized environmental troubles.

These are not new revelations. What *is* new is our understanding of the magnitude of the consequences of this decay, and our ability to analyze and act on that understanding. For the first time in our history, we have both a widespread understanding of the damage we are doing to ourselves, and knowledge of the means to do something about it. This is what we are called on to acknowledge: this is the lesson of Chernobyl and Canaveral, of Bhopal and Love Canal.

The Bible offers us the story of the Tower of Babel as the quintessential parable of the results of overweening

pride in human endeavor. Sophocles tells us of Oedipus, supremely confident of his own ability to control the world, ruined by his own deeds and by his own hand. Ovid tells of Daedalus, who invented wings to fly, and his son Icarus, who in his youthful exuberance ignored his father's instructions to follow "the middle course" and flew too close to the sun, melting his wings' bindings and falling into the sea. The lesson of these tales is both clear and archetypic: Excessive pride in human cleverness leads to human downfall.

These are tales born of memory and experience, of course, not of statistics and empirically-demonstrated knowledge. They convey the lessons of art, not of science. But it is exactly that dichotomy that hampers a thoughtful and mature consideration of the impact of technology on our lives. In our compartmentalized and specialized society, it is the concern of the business, educational, governmental and scientific communities to transmit knowledge: which genes control bacteria resistance, how many plutonium atoms are needed to induce leukemia. It is the concern of art to transmit wisdom: to what end human vanity must lead, the ways and means of good and evil.

The two ought not be exclusive, yet we consider them as such, to the point where we structure our educational institutions so as to separate them as completely as possible. And in this dichotomy between wisdom and knowledge, we are repeating our past mistakes by siding ever more firmly with the latter. This would come as no surprise to the ancient philosophers. Knowledge, as Genesis tell us in the myth of the Fall, offers temptations that wisdom cannot match, and that men and women cannot resist: the quick-fix temptations of flash and dazzle over the hard-won truths of pause and think.

Is it possible to combine the wisdom of art with the knowledge of science? Can we temper pride in our considerable accomplishments with a mature and thoughtful examination of where they are taking us? At the zenith of

the Age of Technology, this is the dilemma we face. Our choice is to confront it head on, or to be returned to an age of hunters and gatherers, and not as a matter of choice.

Posing these questions is not advocating a return to that state, as the questioner at the genetic engineering debate implied. On the contrary, it acknowledges our great opportunity in having access to this storehouse of knowledge, and our responsibility to come to grips with the challenge that knowledge carries. If one subscribes to the assumption, common since the Enlightenment, that mankind can progress, that we can learn from past mistakes and reform and improve our behavior, then it is clear that we are facing in the most critical way the point where we must combine wisdom with knowledge. The question implicit in our enormous fund of knowledge is not whether we must abandon it to revert to some pre-industrial state, but whether we can learn to apply it with maturity and discrimination.

To believe that we can accomplish as much is to indulge in the most unbridled optimism; it is to have a faith in human capacity that is hardly justified by history. Yet to believe the contrary is to accept slow strangulation by the poisonous by-products of our technological race into the future. I repeat the question that the metaphor begs: In this technological race, what are we speeding towards? And why must we go so fast? To extend the metaphor to its logical conclusion assumes that there waits for us a finish line, and that our unquestioned pursuit of technology is getting us there sooner than later. A grim thought, indeed, and surely worth calling into question.

*"You see." [the White Knight] went on without a pause, "it's as well to be provided for everything. That's the reason the horse has all those anklets around his feet."*

*"But what are they for?" Alice asked, in a tone of great curiosity.*

*"To guard against the bites of sharks," the Knight replied. "It's my own invention."*

— Lewis Carroll, *Through the Looking Glass*

Like my father, Lewis Carroll was quite the inventor of systems and contraptions, some quite valuable, many less so: a chess set for travelers, a system for determining the divisibility of a number by 17 and 19. As Carroll's gentle self-caricature, the White Knight invented more outlandish plans: a trellis for one's hair; a pudding of blotting paper, sealing wax and gunpowder; a plan to "keep the Menai Bridge from rust/By boiling it in wine."

Carroll's White Knight is no monster, working away in a dark laboratory, but a kind-hearted, well-intentioned dreamer who could not understand the implications of his inventions. His kindness to Alice and his civilized and humane demeanor make clear that he possesses the wisdom that would lead to an appropriate technology; what he lacks is the knowledge.

Today's scientists find themselves in exactly the opposite position: They possess the knowledge that the Knight assuredly lacked, but lack the humanism that motivated the Knight's every move. Their great chance — *our* great chance — lies in the difference between Carroll's time and our own. To a far greater degree than the White Knight and his real-life contemporaries, today's scientists and their societies have the means to possess both knowledge and wisdom.

I think again of Neil Armstrong, alighting from the Apollo spacecraft, delivering his famous message. Whatever the merits (or lack thereof) of the race to the moon, Armstrong had the decency not to proclaim himself and his country as winner, but to acknowledge his debt — *our* debt — to the billions of all races and nations who preceded him.

We are in great need of inventors like Lewis Carroll, who can appreciate the enormous value of their work, while maintaining a sufficiently universal perspective to understand the insignificance of that work in the larger realm of being. We are in great need of scientists who possess and employ both wisdom and knowledge, who carry

Neil Armstrong's generosity and spirit to its next logical step. And we are in greatest need of men and women who see themselves not as technology's subjects or consumers but as active participants in the processes of technological decision-making. These men and women do not separate effects from cause, but consider beforehand the possible results of the processes they initiate, and resist the natural, human impulse towards impatience with nature's timeless and deliberate workings. They see themselves as responsible to the whole as much as to its parts; they see their work not as that of an individual striving toward recognition but as part of a larger and ongoing effort to sustain the psychological and physical conditions under which we live. Like conscientious parents, they see their role as one of educating themselves and their descendants in the never-ending search for the middle ground, between what we are capable of doing and what is good for us to do.

For all his tinkering, my father (who with his shock of white hair came to resemble Tenniel's illustration of the White Knight) understood this balance in his own way. Like many Americans, he was an inventor and a dreamer, fascinated with confronting and subduing his environment. Like many Americans, he recognized that same environment's precious and irreplaceable nature, and his role as participant rather than overlord. At both doors of his cabin — the same cabin heated by his indecipherable system — he posted Rules for Visitors, still hanging. Rule Number One: "Do Not Kill Snakes — This Means You."

On that last day at the Rough River cabin, I came to acknowledge his wisdom, with help, I concede, from a fifth of bourbon. Thanks to my father's foresight, I drank watching the birds and the snakes that live in the treetops. Atop his wacky, Rube Goldberg boiler he built a cabin of steel, pieced together with solid welds and anchored to a hunk of limestone that likely hasn't moved for the past several millenia. The cabin deck projects into the treetops of century-old beeches; planked with durable redwood, it

will project into those trees for years after his sons' and grandsons' passing. Below the cabin the creek runs clear, testimony to my father's scrupulous efforts to prevent upstream erosion. Eyeing the treetops or walking the ravine, a visitor encounters plenty of snakes, testimony to the efficacy of Rule Number One.

The key to this building's longevity and its harmony with its surroundings lies in its simplicity of design and the suitability of the materials from which it is made. The key to its beauty lay in my father's head, in that side of him that saw, and respected, the immense wealth and beauty of the world as it is given to us, to live among rather than atop. □