FUTURE HYPE

THE MYTHS *of* TECHNOLOGY CHANGE

BOB SEIDENSTICKER

An Excerpt From

Future Hype:
The Myths of Technology Change

by Bob Seidensticker
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Preface

We are as gods and might as well get good at it.
—Stewart Brand, opening sentence
of the *Whole Earth Catalog* (1968)

Most people feel certain that the pace of technological change increases exponentially. They think that the Internet and personal computers are only the most prominent of the many innovations that surge around us and that new ones arrive ever faster. They're certain that never before has the social impact of technological change been as profound or as pervasive as it is today.

But they are wrong.

The Internet isn't that big a deal. Neither is the PC. Abandon all technology and live in the woods for a week and see if it's your laptop you miss most. In fact, the technologies most important to us are the older ones—the car and telephone, electricity and concrete, textiles and agriculture, to name just a few. The popular perception of modern technology is inflated and out of step with reality. We overestimate the importance of new and exciting inventions, and we underestimate those we've grown up with. Change is not increasing exponentially. In fact, technology has disoriented and delighted for centuries. This book will attempt to recalibrate your thinking by looking at how technological change really happens.

Please don't misunderstand—I'm excited about the future possibilities of technology. And, of course, it *is* changing, and this change is often stressful: its impact and potential are so great that an accurate view is impressive enough—we needn't exaggerate. Let's overhaul our perception of technology change. We'll tear it down and build a stronger, more accurate model in its place.

This book is divided into two parts. In part I, I look at how and why we see technology incorrectly. I explore its downsides, how it bites back, its surprising fragility, and its unpredictability; I also review some tools and insights that will ease our sometimes tense relationship to it. I analyze and debunk nine "High-Tech Myths," fashionable but deceptive explanations for how technology works today. Once we begin to chisel away at the errors, a new and more accurate way of seeing technological change begins to emerge from the debris.

In part II, I look at the constancy of change in a broad range of areas—popular culture, health and safety, fear and anxiety, personal technologies, business; in all of these, history gives us repeated examples that make our experiences today seem unexceptional. This survey, illustrated with stories from thousands of years of human innovation, should lay to rest the notion that technology change is unique to our day. I draw most of my examples from the United States, not to ignore the importance of innovation in the rest of the world, but to focus the book. Nevertheless, the lessons here should be applicable to understanding technology change in other countries.

Just as a doctor who misdiagnoses a disease will provide the wrong treatment, our response to technology will be ineffective if we incorrectly perceive how it impacts society. Swept along by overexcitement with the new, we don't accurately see its promises or its weaknesses. My hope is that *Future Hype* will lead you to the clear vision needed to understand its true impact.

What could a clearer view provide? Knowing that technology doesn't always deliver on promises, government and schools could be more rational and even skeptical before adopting it. Businesses might be sharper judges of technology and avoid the bandwagon effect. Worldwide, almost three *trillion* dollars are spent each year on information technology alone. A large fraction of that is wasted, but which fraction?

The view I offer is ultimately empowering—technology should answer to *us.* Readers who may not be encouraged by the cheery "and if you think it's changing fast now, just wait a few years!" will find here a breath of optimism. Learn how technology is *really* changing—and discover that it's much less scary than you've been told.

If people see technology more clearly, we would have a shrewder citizenry that would demand practical and constructive, rather than expedient or convenient, decisions from their politicians. They would be more able to analyze and discuss the relevant technology issues of the day—from the digital divide, to government support for space and other science programs, to national defense, to the value of computers in schools—and weigh more knowledgeably the pros and cons of what is being offered.

It's clear that many people care a lot about these issues. A recent National Science Foundation poll shows 92 percent of us moderately or very interested in new inventions and technologies. In one survey of the top news stories of the twentieth century—stories that included such fundamental events as the fall of the Berlin Wall, the start of World War II, and women's suffrage—fully 16 percent were about technology. Better-educated consumers would feel more confident about judging the value of a new product for themselves rather than relying on hype and would demand that it prove its value. They would know when the emperor had no clothes.

Over three decades ago, *Future Shock* by Alvin Toffler created a sensation by portraying technology spinning out of society's control. *Future*

Hype approaches the same topic but reaches a very different conclusion: that the popular view of technological change is wrong and the future won't be so shocking.

> *We live in a society exquisitely dependent on science and technology, in which hardly anyone knows anything about science and technology.*
>
> —Carl Sagan

Introduction:
Leveling the Exponential Curve

The further backward you look, the further forward you can see.
—Winston Churchill

THE GAME OF CHESS DATES back to India fourteen hundred years ago. Legend says that the local ruler was so delighted by the game that he offered its inventor the reward of his choice. The inventor's request was defined by the game board itself: a single grain of rice for the first chess square, two for the next, four for the next, and so on, doubling with each square through all sixty-four. Unaccustomed to this kind of sequence, the ruler granted this seemingly trivial request. Little did he realize that the rice begins to be measured in cups by square fourteen, sacks by square twenty, and tons by square twenty-six. The total comes to about three hundred billion tons—more rice than has been harvested in the history of humanity.

Like the king in the chess story, most of us are inexperienced in this kind of exponential increase. Let's look at a present day example. In 1971, Intel introduced the 4004, its first microprocessor, with a performance of 0.06 MIPS (million instructions per second). Intel's Pentium Pro was introduced in 1995 with 300 MIPS, a five-thousand-fold performance increase in twenty-four years—about one doubling every two years. A car making the same speed increase would now have a top speed of about Mach 700. Give it another twenty-four years at the same rate of increase, and its top speed would exceed the speed of light.

Moore's Law, named after Intel cofounder Gordon Moore, predicts this exponential rise in computer performance: every two years, microprocessor speed doubles. Again. This law has been startlingly accurate for three decades, and the progress it predicts is expected to continue, at least for the near future. Because there is no precedent for this rapid performance improvement, we tend to view computers and their rapid change with wonder.

My own career of twenty-five years as a digital hardware designer and a programmer and software architect has been tied to Moore's Law. Ever since my high school years in the 1970s, I've been immersed in computer technology and have been an energetic cheerleader for technology in general. I was in awe of the change it brought about and was delighted to be a small part of that change. Change was exciting. And it was all around us—I grew up with the space program and jumbo jets, nuclear power and skyscrapers, *Future Shock* and *Megatrends*. Exponential change seemed to be everywhere we looked.

To make sure we're all clear what exponential change looks like, figure 1 shows the differences between *no change*, *linear change*, and *exponential change*. The vertical axis is unlabeled—it could represent transistors in microprocessors, dollars for compound interest, the number of bacteria grown in a petri dish, or the grains of rice in the chess story. While they may start out slowly, exponential curves eventually snowball.

As I gained experience, I came to realize that change for its own sake wasn't as desirable for the software user as the software developer imagined. Users wanted new software to answer to bottom-line demands. Who would have guessed? Coolness alone was no longer enough—users demanded that software pull its weight, as they would for any other purchase.

They were right, of course. New software must provide sufficient additional benefits to outweigh the cost and aggravation of adopting it.

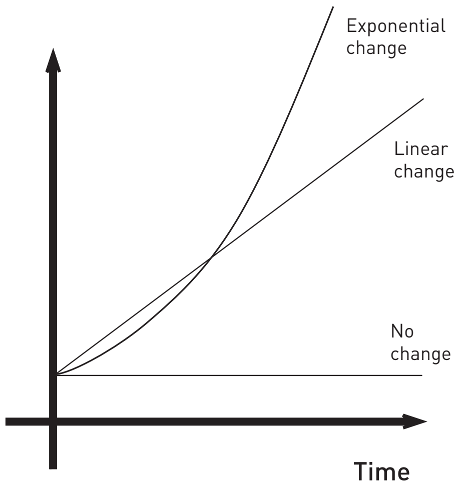

Figure 1. Exponential change contrasted with linear change and no change. The exponential curve doubles every time period. It might double every day if measuring bacteria growth or every decade if measuring number of miles of railroad track.

This is also true for other consumer products. The consumer might think: I like that digital camera, but it uses a new type of memory card. Will it become a standard or an unsupported dead end, like so many other products? Should I make MP3 copies of my favorite songs or keep them on CD? Is HDTV (High-Definition TV) really here, or is the current hype another false alarm? In general, is the latest hot product something that will last, or is it just a fad? The early adopters are quick to make this leap, but the chasm must be narrowed considerably for the majority of us. Change for its own sake wasn't as delightful as I'd thought, and I came to see things more from the user's perspective.

The high failure rate of new products challenges the inevitability of exponential change. A bigger challenge came as I studied high-tech products from the past, looking for precedents against which to compare my own projects. I wondered, why were these old products successful? and how could I apply what I learned to my own work? As I learned more about the history of technology, I was surprised to find examples that the exponential model could not explain. I gradually realized that there was a different way—a more accurate way—to look at such change.

The exponential model as a universal explanation for and predictor of technological change is at best an approximation and at worst a delusion. We can sustain it only by selecting just the right examples and ignoring all the rest. Technology does not always continuously improve. For example, commercial airplane speeds increased steadily for a while but halted when airlines realized that expensive supersonic travel didn't make business sense. Highway speed limits increased steadily but also hit a ceiling. Record heights for skyscrapers increased rapidly during the first third of the twentieth century but have increased only moderately since then. Use of nuclear power has peaked, and manned space exploration halted after we reached the moon.

Specific areas of technology advance at different rates and come to the fore at different times. Cathedral building emerged during the 1200s while other technologies languished. Printing underwent dramatic change in the late 1400s, then surged again in the early 1800s as mechanized presses provided cheap books and magazines. Steam power and mills had their heyday; later, it was electricity and electrical devices. There are dozens of examples of a specific technology surging forward and then maturing and fading back into the commonplace.

Perhaps the most venerable use of the exponential model has been to represent world population growth, but even here it's an imperfect metaphor. In the 1960s and '70s, experts warned that the world's population was growing exponentially, and crowding would quickly get worse. Famine was just around the corner. Though dramatic, the model was inaccurate: world population growth is slowing and is expected to peak midcentury, and the populations of dozens of countries are already *falling* in population (not counting immigration).

Despite the common perception, the impact of technology on society today is comparatively gentle. To see a truly serious example of the collision of technology and society, look at Britain during the Industrial Revolution almost two centuries ago. In 1811, armed gangs of Luddites smashed the textile machines that displaced their handmade crafts. Several years and over ten thousand men were required to put down the rebellion. The unrest spread to the Continent, where the word "sabotage" was coined—from the French word *sabot,* the wooden shoes used by workers to smash or jam machines. In the space of a generation, independent work on farms had given way to long six-day weeks in noisy and dangerous factories. Our own technological growing pains seem minor by comparison.

It's easy to focus on the recent at the expense of the old, but doing so can lead to a distorted view of our current situation. New products loom disproportionately large, often simply because they're new. The image of previous generations of Americans living quiet, static lives is fiction; they dealt with disruptions caused by technological innovations every bit as challenging and exciting as our own: the telegraph and electricity, the car and railroad, anesthesia and vaccines, concrete and steel, newspapers and mail. And if we go even further back, we see the fundamental developments on which society is based: agriculture, metallurgy, the beginnings of engineering, writing, textiles, transportation, timekeeping, basic tools and weapons, and so on. Are today's products really so amazing compared to those on which they were built? Too often we mistake a new technology for an important one.

Part of the problem is a narrow definition of *technology.* Obviously, the Internet, computer, and cell phone fit into this category. These are in the news and in our awareness. But this book will use a very broad definition of technology, including these new technologies as well as older and less glamorous ones mentioned above. Metallurgy, textiles, and all the rest were high tech at one point, they are still important to society, and examples from these older technologies will be liberally used in this book to illustrate that today's issues have, in fact, been around for a long time.

Sometimes the prevailing view of reality is an oversimplification. For example, small children are often taught that "All ocean creatures are fish." Though incomplete, it's a step in the right direction. When the children are a little older, we might teach them that all ocean creatures are fish—except whales and dolphins. When they are older still, we teach them that all ocean creatures are fish except marine mammals (like whales and dolphins), crustaceans (like crabs and lobsters), bivalves (like oysters and scallops), cephalopods (like nautilus and squid), and so on.

We frequently hear that the nature and rate of change in today's technologies are unprecedented. But like the fish simplification for children, this tells far less than the whole story; it helps explain some of what we see, but is inaccurate—and dangerously so. Leave behind the children's version of technology change, and explore how it is really affecting society and how it will impact us in the future.

> *We live in a technology-dense world. . . . We are terrifyingly naked without knowing elementary things about how [technologies] work.*
>
> —John Lienhard, *The Engines of Our Ingenuity* (2000)

1 The Birthday-Present Syndrome

THE WRAPPING PAPER FLIES as Junior tears into his present from Grandma. It's the toy he's been hoping for, and he's delighted. All other possessions are forgotten as he begins to play with his new toy that will, in its turn, be ignored in favor of the next new thing.

When it comes to technology, most of us are like that kid with his birthday present—we are interested in the cool toy of the moment, and older technologies are only noticed in their absence. The result is that we don't see technology clearly; we don't soberly weigh today's new developments against the technologies we already have. The value of today's technology is inflated, and some revaluation is needed to restore a balance.

This chapter is an exercise in seeing more clearly the birthday-present syndrome, a seemingly permanent feature of our culture. It will also explore our uncomfortable coexistence with machines throughout the centuries. Society's relationship with technology is like a romance in which each person sees attractive traits in the other, but with familiarity comes some unpleasant surprises. Maybe she chews with her mouth open or has disagreeable political opinions. Maybe he's a slob or has antiquated views of a woman's role in society. Similarly, a technology is never pure and innocent, incorruptible in every one of its applications. We find bad traits along with the good; we adopt a technology hoping we will be pleased with the balance.

Good surprises can be difficult as well. We want to off-load tasks to machines, but egos can get bruised in the process. Does this new ability encroach on humanity? Are we reduced in value somehow by the success of our machines? Expect more of these kinds of questions as computers are increasingly able to do things that require thought; let us not forget, however, that this friction between society and technology has been around for a long time.

Technology Good and Bad

Humankind is either on its way to the stars
or hurtling out of a high-rise window to the street
and mumbling, "So far, so good."
—Edward Tenner,
Why Things Bite Back (1996)

An ancient Chinese story tells of a farmer who owns a famous racehorse. One day, the horse runs away. His friends commiserate with him, but the farmer replies, "This isn't necessarily a bad thing." Soon, his horse returns and brings another fine-looking horse. His friends congratulate him, but the farmer observes, "This isn't necessarily a good thing." Later, the farmer's son is thrown while trying to tame the new horse. He breaks his leg, which leaves him lame. The farmer's friends offer condolences, but he responds, "This isn't necessarily a bad thing." Sure enough, war breaks out and the son's lameness prevents him from being conscripted. Though many neighbors' sons are killed in the fighting, the farmer's son is spared. Sometimes it's hard to tell what's a good thing and what's a bad thing.

But perhaps we can be certain in some cases. For example, we can all agree that the insecticide DDT is bad. The landmark book *Silent Spring*, by Rachel Carson (1962), made DDT's environmental crimes common knowledge. And yet DDT's discoverer won a Nobel Prize for his work in 1948, just six years after its properties were understood, and DDT was credited with saving five million lives by 1950. In the 1950s and '60s, DDT cut malaria in India to fifteen thousand cases per year, down from one hundred *million*. Given this remarkable progress, worldwide eradication of malaria seemed a strong possibility. Despite a growing understanding of the problems of resistance, environmental damage, and impact on human health, abandoning this insecticide was not the obvious course. Malaria kills millions of people per year even today, and DDT is still used in countries holding almost half of the world's population, including China, India, and Mexico. So, what's the moral? Is DDT a killer or a lifesaver? We could ask the same about antibiotics and vaccines—they mercifully saved lives and yet threatened widespread famine by encouraging dramatic overpopulation.

Kranzberg's First Law helps to clarify this situation: technology is neither good nor bad—nor is it neutral. At the risk of spoiling its Zen-like nature, let me propose an interpretation: a technology isn't inherently good or bad, but it *will* have an impact, which is why it's not neutral. Almost every applied technology has impact, and that impact will have a good side and a bad side. When you think of transportation technologies, for example, do you think of how they enable a delightful vacation or get the family back together during the holidays—or do you think of traffic jams and pollution? Are books a source of wisdom and spirituality or a way to distribute pornography and hate? Do you applaud medical technology for curing plagues or deplore transportation technology for spreading them? Does encrypted e-mail keep honest people safe from criminals or criminals safe from the police? Are plastics durable conveniences or everlasting pollutants? Counterfeiting comes with money, obscene phone calls come with the telephone, spam comes with e-mail, and pornography comes with the Internet. Every law creates an outlaw.

Opposites create each other. You can't have an up without a down, a magnetic North Pole without a South Pole, or a yin without its opposite yang. Providing a technology for a good use opens the door for the bad. Werner von Braun observed, "Science does not have a moral dimension. It is like a knife. If you give it to a surgeon or a murderer, each will use it differently." The same could be said for applications of technology.

The dilemma of finding and maximizing technology's gifts while minimizing its harm is especially important today, but it has plagued society for centuries. Today we worry about junk on the Internet; yesterday we worried about junk on TV (and before that, junk through radio and film and books and newspapers). Today we worry about terrorists using bioengineering techniques to make new diseases; yesterday we worried about the telegraph and railroad being used to conduct the Civil War. Today, computer pioneer Bill Joy has argued that because of the downsides of possible accidents, we should deliberately avoid certain areas of research; yesterday Leonardo da Vinci destroyed plans for devices like the submarine, anticipating their use as weapons.

Man Versus Machine Contests

Now the man that invented the steam drill
He thought he was mighty fine.
But John Henry drove fifteen feet
The steam drill only made nine.
—"John Henry" (folk song)

One particular kind of social friction caused by technology occurs when machines perform tasks that have traditionally been done by human beings. This is like a junior employee taking over the menial parts of your job—it's okay at first, but where will it end? Will it eventually cost you your job? Society has long been uneasy with machines encroaching on human turf, not just because of job loss, but also because of a vague loss of dignity. Could machines get uppity and forget their place?

The most direct example of this friction is the one-on-one turf battle—may the best man (or machine) win. Consider the story of John Henry. Though subsequently mythologized, he was a real person who worked on the Big Bend railroad tunnel in West Virginia in 1870. As a steel driver, he hammered long drills into the rock face to make holes for explosives. A mechanical drill had recently replaced steel drivers at other tunnels, and the drill manufacturer wanted it used on this project. Would it perform any better than men on the type of rock at Big Bend? To find out, a contest was proposed that pitted John Henry, the team's best driver, against the steam drill. John Henry defeated the steam drill but died in the process, thus celebrating the heroism of humanity while foreshadowing the ultimate futility of the man versus machine contest for physical tasks.

Perhaps the most prominent recent man versus machine contest was the defeat of chess grandmaster Gary Kasparov by IBM's Deep Blue computer. A computer as world chess champion had been "ten years away" since the 1950s, but not until 1997 did those ten years finally pass. After the Deep Blue victory, the press reported much soul-searching, as if humanity had been dealt a major blow. However, the fact that Deep Blue didn't celebrate its victory—and couldn't—underscores that it is a world-class chess player but nothing more. The original 1949 paper outlining the basics of computer chess noted that if human opponents didn't like how their game was progressing, they could always pull the plug.

To better understand the gulf that computers must still cross to be comparable to a human, imagine pitting a computer against a child rather than a chess champion. The computer's goal would be to match the child's understanding of the world. Some questions could test simple facts about the world (the sky is blue, water is wet, chairs are often made of wood), and others could examine common sense (What happens if you hit a pot with a spoon? What kinds of chairs burn? Can you stand on a table?). The ultimate test of this sort is the Turing Test, proposed by British mathematician Alan Turing in 1950, in which an observer communicates with two unseen entities, a computer and a human being. If the observer can't tell the difference, the computer has fooled the observer and passed the test. Present computer technology is a long way from passing this test, one far harder than a chess match.

Acting Like a Human

That this toil of pure intelligence . . .
can possibly be performed by an unconscious machine
is a proposition which is received with incredulity.
—Columbia University president,
commenting on the adding machine (circa 1820)

Sometimes machines are deliberately designed to mimic how human beings work; a better approach is usually to discard those constraints and create a design that takes advantage of what machines do best. The history of printing gives us a good example. By the early 1800s, steam presses printing thousands of pages per hour were advancing the printing revolution Gutenberg began in 1455. The slow process of typesetting, however, remained a bottleneck. Even after text could be composed on a typewriter by the 1870s, each tiny metal character of type still had to be hand placed by skilled typesetters for printing. Not unlike programmers in the 1980s and '90s, fast typesetters could move between jobs at will and demand excellent wages. The best typesetters were celebrities and races became popular, attracting large audiences as if they were sporting events. Some competitors could set five thousand characters of justified and corrected text in an hour—better than one character per second. This was a tough job for machines to duplicate. Should they mimic the steps humans used or try a machine-specific approach?

By the 1880s, first generation mechanical typesetters were in use. Mark Twain was interested in this new technology and invested in the Paige typesetter, backing it against its primary competitor, the Mergenthaler Linotype machine. The Paige was faster and had more capabilities. However, the complicated machine contained eighteen thousand parts and weighed three tons, making it more expensive and less reliable. As the market battle wore on, Twain put more and more money into the project, but it eventually failed in 1894, largely because the machine deliberately mimicked how human typesetters worked instead of taking advantage of the unique ways machines can operate. For example, the Paige machine re-sorted the type from completed print jobs back into bins to be reused. This impressive ability made it compatible with the manual process but very complex as well. The Linotype neatly cut the Gordian knot by simply melting old type and recasting it. After investing a quarter of a million dollars in the project, Twain was bankrupt. He spent the next four years lecturing to repay his debts. (Twain's conclusion: never invest when you can't afford to and never invest when you *can.*)

As with typesetting machines, airplanes also flirted with animal inspiration in their early years. Flapping-wing airplane failures, however, soon yielded to propeller-driven successes. Airplanes don't fly like birds, and submarines don't swim like fish. Wagons roll rather than walk, and a recorded voice isn't replayed through an artificial mouth. A washing machine doesn't use a washboard, and a dishwasher moves the water and not the dishes. Asking whether a computer can think or wonder is like asking whether a car can trot or gallop—a computer has its own way of operating, which may be quite different from the human approach. The most efficient machines usually don't mimic how humans or animals work.

We can approach the question of thinking another way: Does a tree falling in a forest with no one to hear it make a sound? That depends on how *sound* is defined. Similarly, whether a computer duplicating a particular human skill is thinking or not depends on how *think* is defined. You could say that a computer chess champion doesn't think because it doesn't operate the way people do; or you could say that it thinks in its own way because it obviously gets the job done. To take another example, ELIZA was a famous 1965 computer program that played the role of a psychiatrist. It was so convincing that some users earnestly poured out their problems to the imagined intelligence, even though replicating ELIZA is simple enough to be assigned as homework in a college artificial intelligence course. Marvin Minsky considered artificial intelligence "making machines do things that would be considered intelligent if done by people."

Is the Turing Test still the ultimate test of cognition? Or is mimicking a human irrelevant as long as the computer gets the job done? In the movie *2001,* we see the computer HAL pass a second-generation Turing Test: not only is he convincingly human in conversation, he also becomes paranoid and homicidal. Perhaps acting like a human isn't such a worthy goal after all.

The gap separating computers and human beings is one of appearance as well as intelligence. The computer as an anthropomorphic robot that travels on two legs, manipulates things with fingers, and has the same approximate shape as a human has a long history, predating the 1950s low-budget sci-fi movies. The *Wizard of Oz* novel series introduced the robot Tik-tok around 1910, and an early robot appeared in the movie *Metropolis* (1927). The word *robot* was introduced into English from a Czech play in 1921. Fascination with smart machines extends back at least to the automaton orchestra built for a Chinese emperor over two thousand years ago.

One of the most famous historical automatons was actually a deception. The chess-playing "Turk" was unveiled in 1770. It toured Europe and defeated most opponents, including Benjamin Franklin. Charles Babbage's bout with the Turk stimulated his interest in computing machines. The Turk continued playing for decades, and few suspected its secret: a chess master hidden inside that controlled the turban-wearing mannequin. Elektro, "the amazing Westinghouse Moto-Man," was a seven-foot-tall robot exhibited at the 1939 New York World's Fair. Also a deception, a hidden operator controlled Elektro's speech. In a decision that seems especially dated now, its creators thought that the ability to smoke a cigarette added to its humanness.

Robots' real success so far has been in factories where precision and repeatability are important and appearance and adaptability are not. Machines work best when we let them be themselves. Around the house, the science fiction robot remains a dream, and yet telephone answering machines, microwave ovens, and other appliances have already encroached on the turf of the home robot.

The Ever-Moving Goal

"A slow sort of country!" said the Queen.
"Now, here, *you see, it takes all the running* you *can do*
to keep in the same place. If you want to get somewhere else,
you must run at least twice as fast as that!"
—Lewis Carroll, *Through the Looking-Glass* (1871)

Ask a magician to reveal how a trick is done. If you aren't told that it's a professional secret, you'll probably hear, "Actually, you really don't want to know." Knowing the secret eliminates the mystery and ruins the fun. Is fire-walking a mysterious example of mind over matter, or is it simple physics—that charcoal doesn't conduct heat well, so quickly moving feet don't get burned? (And which answer makes the more interesting story?) Similarly, the idea of a machine able to beat a chess grandmaster was magical and exciting, at least until it was achieved. Now we see it simply as an impressive feat but one without any impact on daily life. After all, as we now know, a dedicated chess computer can *only* play chess.

When you're told how a feat of illusion works, magic is replaced by mechanics and the fun is gone. When a computer reaches a human intelligence metric, it seems to show human-like qualities—that is, until you look behind the curtain and see very nonhuman algorithms and hardware.

A future technology milestone (the ability to see or to understand speech, for example) is sometimes considered proof of some aspect of humanity. But technology bears the burden that once that milestone is reached, it becomes a parlor trick. This new capability may well be useful, but it's no threat to humanity. An "electronic brain" from the 1940s performing thousands of additions per second certainly achieved a superhuman feat, yet a computer performing billions of additions per second today is not even noteworthy. Construction equipment that is as capable as hundreds of workers? Boring. Enormous factories that shape massive metal beams or make chemicals in ways humans could never duplicate? Ho-hum. Robotic assembly-line workers? Ancient history. Chess champion of the world? We thought that would be impressive, but have changed our minds—sorry. That which is "human" is redefined as machines approach it, like the mechanical rabbit that is always just out of reach of the racing greyhounds. For technology, the race is like the Red Queen said: "It takes all the running you can do to keep in the same place."

Perhaps that's the most important difference between man and machine. Society changes and improves, setting new goals once old ones are reached. But machines do what they're designed to do and no more. At least for now, it takes man to invent the next machine.

Technological Myopia: Revisiting the Birthday-Present Syndrome

Anything that was in the world when you were born
is normal and natural.
Anything invented between when you were 15 and 35
is new and revolutionary and exciting,
and you'll probably get a career in it.
Anything invented after you're 35
is against the natural order of things.
—Douglas Adams

The world's first escalator was installed in Harrod's department store in London in 1889, and brandy and smelling salts were available to passengers made faint by the ordeal. It is hard for us to put ourselves in the places of people seeing for the first time, as adults, technologies that we have grown up with.

Try to remember the first time you used various technologies. For example, I remember the first time I flew on a Boeing 747, the first time I used a microwave oven, and the first time I used a mainframe computer. Other firsts for me: using an ATM to get cash in another state; participating in a videoconference call; and using a computer, a cell phone, and a Web browser. I remember the first time I saw a CD-ROM as the prize inside a cereal box.

By contrast, I do *not* recall the first time I rode in a car, watched television, read a book, used an electrical appliance, or made a telephone call. By the time I was born, these technologies had become unremarkable parts of society.

My kids will have a different list of unremarkable technologies. They have grown up with compact discs, personal computers, videotape, and cellular phones. For them, listening to music from a CD is commonplace but from a vinyl record is remarkable; I remember when it was the reverse. Similarly, flying in a jet plane for me is commonplace, but in a propeller-driven plane is noteworthy; my parents remember when it was the reverse. My grandparents knew a time when driving in a car was exciting, but horse-drawn transportation was not.

Joel Birnbaum observed: "Only people born before a technology becomes pervasive think of it as a technology; all others consider it part of the environment." This technological myopia—the tendency to see the new out of proportion to its impact and to discount the old—helps explain the pervasive and distorted view of technology in our society today. For a similar viewpoint, consider Saul Steinberg's well-known "A View of the World from Ninth Avenue." This *New Yorker* cover from 1976 shows several carefully drawn New York City streets in the foreground, with detail quickly dropping off in the distance. Beyond the Hudson River is a featureless and unimportant landscape composed of the rest of the United States, the Pacific Ocean, and Asia. In a similar way, we clearly see the changes caused by the PC, the Internet, and other recent technology, but older technologies, such as the printing press, train, and telegraph, fade into the distance. (By the way, I use

"PC" to refer to *any* personal computer, not just the IBM-compatible kind.)

For a different perspective, let's suppose we learned to communicate with dolphins. We could eventually ask, "So, what's it like to be wet all the time?" The dolphin might wonder what we are talking about. We understand *wet* because we understand *dry.* A dolphin wouldn't notice wetness even though it is constantly wet—in fact, *because* it is constantly wet. Similarly, we are so immersed in our technology that trying to evaluate today's society from the vantage point of today is inherently difficult, like any type of self-analysis, and it's not surprising that the common perception is off the mark.

We not only dismiss older technologies, we've also become accustomed to some rather startling consequences, things that might shock an outsider. For example, there are more than forty thousand car-related deaths in the United States annually. This is seen as an important but unremarkable fact of modern life. By contrast, when an airplane crashes and kills forty people, it becomes front-page news. This is the expected and accepted contrasted with the unexpected and surprising. Only the new is news.

In the Monty Python movie *Life of Brian*, there is a debate among the revolutionaries about the impact of Roman rule on Palestine. It sounds similar to our own debate about the relative importance of old and new technology. Here is a version of that technology debate, in *Life-of-Brian* style.

BOSS: Technology today is so revolutionary! It makes what came before seem trivial. The Internet, the PC, cellular telephony—what technology from the past can hold a candle to this?

LACKEY 1: Uh . . . the printing press?

BOSS: Oh yeah. That is quite old, isn't it? Yes, that's certainly important.

LACKEY 2: And electricity.

BOSS: Yeah, OK. I'll grant you the printing press and electricity are two important old technologies.

LACKEY 3: And the telephone.

BOSS: Well, sure, obviously the telephone. I mean, that goes without saying, doesn't it? But apart from the printing press, electricity, and the telephone . . .

LACKEY 1: How about antibiotics and vaccines?

LACKEY 2: Agriculture and animal domestication.

LACKEY 1: Oh—railroads, cars, and airplanes.

LACKEY 3: And roads, dams, buildings, bridges—that sort of thing.

LACKEY 2: Uh—books, newspapers, mail delivery . . .

BOSS: All right, all right. But apart from the printing press, electricity, the telephone, and the foundations of medicine, agriculture, transportation, civil engineering, and communication, *what* has technology from the past ever done for us?

Anything that can be automatically done for you
can be automatically done to you.

—DAVID WYLAND's Law of Automation

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