**Chapter 7: Evaluating and Controlling Technology**

* 1. **Information, Knowledge, and Judgment**
		1. **Evaluating Information on the Web**

**Expert information or the “wisdom of the crowd”?**

There is a daunting amount of information on the Web-and much of it is wrong such as outdated information and bad financial advice.

Search engines rank Web pages by popularity, not by an expert evaluation of their worth. Search engines give prominent display to content providers who pay them; libraries do not. Thus, Web site, individuals, and businesses continually try to dissect and outsmart ranking algorithms. A major newspaper trains its reporters to pack key phrases in their articles so that the newspaper’s articles rank high.

On social media sites, readers submit and vote on news stories, the phenomenon is called democratic journalism.

The huge quantity of junk, the inaccurate information, the posting by people of unknown expertise and motives, and the lack of editorial control on the Web are serious problems. Take blogs as an example. Millions of people write blogs. Some are excellent; some are atrocious. Bloggers are not trained, objective journalists.

**Example: Wikipedia**

Wikipedia is huge, free, participatory, noncommercial, ad-free, and written by volunteers. Because hundreds of millions of people-anyone at all-can write or edit articles, accuracy and quantity are impossible. Some articles are biased and one sided. Members of the staffs of political candidates have distorted the Wikipedia biographies of their candidates to make their bosses look better. Adding to that, anonymity of writers encourages dishonesty.

In spite of the errors, sloppiness, bad writing, and intentional distortions, most of Wikipedia is of high quality. Although anyone can write and edit articles, most people do not. Those who do are educated and have expertise in the subject they write about. Yes, people manage Wikipedia. They are not editors in the traditional sense, but they do exert some control. Even though so much of Wikipedia is excellent, we learn that someone might have wrecked the accuracy and objectivity of any individual article at any hour.

As the weakness of new innovations appears, creative people find solutions. Recognizing the problems that result from totally open, anonymous access to writing and editing articles, one of Wikipedia’s founders began a variant called Citizendium. It is a project that combines public participation with the gentle expert guidance. Writers and editors must register with their real names, and chief subject editors oversee specific subject areas. Thus, Citizendium can begin with what has already been created, then revise and correct as necessary.

**The “wisdom of the crowd”**

People ask all sorts of questions on Yahoo! Of course a lot of answers are ill informed. Many are biased, or full of opinion, not fact. The questioner designates the posted answer he/she deems the best. ex. “Are medicines safe to use past their expiration date?” Without the Web, if someone asked questions like those only to friends, the answers might be less varied and less useful.

Some health sites on the Web encourage the public to rate doctors, hospitals, and medical treatments. If millions of people participate, the results will be very useful. Others are extremely suspicious of the “wisdom of the crowd.”

The New York Tomes is a prime example of a respected newspaper, staffed by trained journalists, with an editorial board in charge. Yet one of its reporters fabricated many stories. Numerous other incidents of plagiarism, fabrication, and insufficient fact-checking have embarrassed newspapers and television networks in the past.

The problems of unreliable information are not new; the Web magnifies them. For Blogs, as for Wikipedia or health care sites, the critics argue that popularity and voting do not determine truth. That is correct, but there is no magic formula that tells us what is true and reliable on the Web or off the Web. We can read only blogs that we trust in.

Guides for evaluating Web sites and information on those site:

* Determine who sponsors the site.
* Reviewers, ratings, editors, experts, and other sources we trust.

**Vulnerable viewers**

The most important vulnerable viewers are children. Some critics of the Web worry most about the impact of inaccurate information on such vulnerable people. The fear of some seem to edge towards a belief that we should somehow prevent such information from appearing.

Basic social and legal forces help: freedom of speech, teachers and parents, competition, fraud and libel laws-and people who care, who volunteer to write, review, and correct online information.

**Responsibilities of site operators**

They should take reasonable care to ensure that the information they provide is accurate. If the site covers a topic for which mistakes can have significant risks and includes a large amount of user-supplied content, the site should have a mechanism to review content and filter out or remove dangerous material.

**Manipulation of images**

Celine Dion sings a duet with Elvis Presley; many more impossible events result from digital manipulation of photographs and videos. People can use technology for deception and fraud. The ease with which we can modify digital images and videos raises ethical and social issues about deception.

Ex. A company developed an animation system that modifies video images of a real person to produce a new video in which the person is speaking whatever words the user of the system provides.

Ex. During the conflict between Israel and Lebanon in 2006, a freelance news photographer who had worked for Reuters news agency for many years, admitted to digitally adding and darkening smoke in photos to make damage caused by rockets look worse.

Press Photographers Association has a policy that considers any alteration of a photo’s editorial content to be a breach of ethical standards.

Some editors realize that a reputation for manipulating photos and video, like any form of deception, makes all one’s work suspect. The ethical issues are not new, but now many more people face them because image manipulation has become so easy. The public must become more aware of the possibility of fakery and must develop a reasonable skepticism.

* + 1. **Writing, Thinking, and Deciding**

Computers make activities easier, but displaced some skills that were important before.

Ex. The spelling checker is a software were a computer can check the spelling of all the words in a document in less time than it takes a person to find the first one.

Ex. Desktop publishing and Web page design tools lead many people to concentrate on layout, fonts, and graphics at the expense of thoughtful writing, correct grammar, word usage, and information- the parts that still require hard mental effort. The convenience of using a computer can encourage mental laziness.

Ex. A newspaper editor in Pakistan received a letter to the editor by e-mail and inserted it into the newspaper without reading beyond the title. The letter was an attack on the prophet Muhammad. Angry Muslims set fires in the newspaper office. Back when newspaper content was still being Typeset, such an accident would not have been unlikely.

Technology destroyed memory and oral skill and obscured the distinction between wisdom and knowledge. Better skills replace some old ones. Although most of us no longer develop strong memorization skill, this skill has not been lost to those who need it, such as an actor in a one-person play that lasts for 2 hours.

We need to resist the temptation to emphasize data rather than analysis, facts rather than understanding and evaluation. We need to distinguish between cutting and pasting from Web sites and real research and writing.

**Abdicating responsibility**

People are often willing to let computers do their thinking for them. Businesses make decisions about loan and insurance-policy approvals with the help of software that analyzes risks. They sometimes make bad decisions because of ignorance of the kinds of errors that limitations of the system can cause.

Sometimes, reliance on a computer system rather than human judgment becomes “institutionalized,” in the sense that an organization’s management and the legal system can exert strong pressure on individual professionals or employees to do what the computer says.

Computer programs advice doctors on treatment for patients. It is critical to remember that, in such complex fields as medicine, the computer systems might provide valuable information and ideas but might not be good enough to substitute for an experienced professional judgment.

* + 1. **Computer Models**

**Evaluating Models**

Computer generated predictions based on mathematical models of subjects with important social impact frequently appear in the news. A mathematical model is a collection of data and equations describing, or simulating, characteristics and behavior of the thing studied.

Models allow us to simulate and investigate the possible effects of different designs, scenarios, and policies. They have obvious social and economic benefits:

* They enable us to consider alternatives and make better decisions, reducing waste, cost, and risk.
* They enable us to project trends and plan better for the future.

Some Problems studied with computer models are:

* Population growth.
* The cost of a proposed government program
* The effect of second hand smoke
* The threat of global warming

Models are simplifications. Model airplanes generally do not have an engine, and the wing flaps might not move. Similarly, mathematical models do not include equations for every factor that could influence the outcome. They often include equations that are simplified because correct ones are unknown or too complicated. For example, we ignore the effect of wind in the equation. In mathematical models it is time rather than physical size that often differs from reality.

Models vary enormously in quality. Some are worthless, others are very reliable. It is the professional and ethical responsibility of those who design and develop models for public issues to honestly and accurately describe the results, assumptions, and limitations of their models.

The following questions help us determine the accuracy and usefulness of a model:

* How well do the modelers understand science or theory of the system they are studying?
* What are the assumptions and simplifications in the model?
* How closely do the results or predictions of the model correspond with results from real experience?

Among three models developed to predict the change in health care costs that would result if the U.S. adopted a Canadian style national health plan, the predictions varied by $279 billion. There are both political and technical reasons why models might not be accurate. Technical reasons are the following:

* We might not have complete knowledge of the system we are modeling.
* The data describing the current conditions or characteristics might be inaccurate.
* Computing power could be inadequate for the number of comparisons needed to model the full complexity of the system.
* It is difficult, if not impossible, to numerically qualify variables that represent human values and choices.

A life-cycle analysis attempts to consider the resource use and environmental effects of all aspects of the product, including manufacture, use, and disposal.

**Example: Modeling car crashes**

Car crash-analysis programs use a technique called the finite-element method. These programs superimpose a grid on the frame of a car, dividing the car into finite number of small pieces. The grid is entered into the program, along with the data describing the specifications of the materials making up each element. Engineers initialize data to represent a crash into a wall at a specified speed.

A real crash test can cost several hundred thousand dollars. The crash-analysis programs allow engineers to consider alternatives, for example, to vary the thickness of steel for selected components.

* How accurate and complete are the data? Force and acceleration are basic principles. There are good data on the density, elasticity, and other characteristics of materials used in the model.
* What simplifications do the programs make? The grid pattern is the most obvious. A car is smooth, not with made up of little blocks. However, current computers speeds allow updating the calculations on fine grids with small time intervals.
* How do the computed results compare to actual crash tests on real cars? Engineers perform a real test and a computed test and compare the results. The conclusion is that crash-analysis programs do an extremely good job.

Engineers who work with the crash-analysis programs do not believe that physical crashes will be or should be eliminated. The crash-analysis programs are excellent design tools that enable increase in safety with far less development cost. The physical crash test is confirmation.

Other uses of crash-analysis programs are:

* Predict damage to a hazardous waste container if dropped.
* Predict damage to an airplane windshield if hit by a bird.

**Example: Modeling climate**

Climate models calculate relevant variables for grid points and elements for specified time intervals. Equations simulate atmospheric pressure, temperature, incoming solar energy, wind speed, and moisture.

The models used in 1980s were limited; the model did not distinguish day and night and they made assumptions about methane that scientists later determined were incorrect, clouds represent a significant source of potential error in climate simulation, and computing power was insufficient to do the many calculations to simulate ocean behavior.

Current models are more detailed and complex. Increased computer power allows more runs of a model with different data assumptions. Increased computer speed allows the use of finer grids. Increased data collection and basic science research have been improving the understanding of the behavior. It is now reasonable that confidence in the models had increased.

The IPCC reports that many uncertainties remain: lack of full understanding of some of the effects of clouds, weaknesses in understanding variations in output from the sun, sources and behavior of methane, and other factors. That is, even the extremely powerful computers of today are not sufficient to achieve an ideal level of resolution and to include simulation of more processes that affect climate.

* 1. **Computers and Community**

Many people spend hours online instead of with their families. Some virtually eliminate direct contact with their families and other friends. Critics of the Internet worry that computers reduce face-to-face gathering and that the Web hurts local community vibrancy. Technology puts a much greater emphasis on the individual and downplays the importance of community.

Social scientists offer various theories about what makes a strong community. We join hobby clubs, religious congregations, Boy scouts and Girl scouts, unions, professional organizations, and others. Such memberships create informal personal and information networks that help solve social problems in a community. But participation in clubs has been declining. Critics of computers and the Internet blame them for this decline, bit social scientists point to a number of other factors: modern transportation and communications, changes in family patterns, and television.

Studies found that some Internet users spend less time with family and friends. Later studies found opposite results. Users of computers and the Internet were “voracious consumers of information,” not just from online sources. They read newspapers, magazines, and books. A substantial number of e-mail users said e-mail brought them closer to their families. With the popularity of social-networking sites, cell phone conversations, instant messaging, sharing of photos and other material, the Web is a very social place.

“Addiction” to the Internet is a real problem for some people. A study of computer addicts found that many had other psychological problems. Without computers, computer addicts might be among the people who engage in other unwise or unhealthy behavior, such as excessive gambling, alcoholism, drug abuse, eating disorders… The Internet provides communities focused on special interests or problems for which a person might not find many contacts in his/her local community. Some people who are socially awkward communicate more because of e-mail than they would without it. Automated and online services reduce the opportunities for personal interaction with the local merchants and neighbors in the course of ordinary daily activities, but they free time that we can fill with activities shared with people we know well and associate with by choice.

Wal-Mart and E-Commerce versus Downtown and Community

Wal-Mart store draining business from downtown shops, resulting in the decline of the downtown community. Everyone wants the downtown stores to remain, but downtown stores have lost and still losing. This is described as an “involuntary transformation” that no consumer wanted. The fact that consumers want a particular service, store or product is irrelevant if not enough people is willing to buy it at prices that make the business viable. The downtown residents are not willing to pay what it costs to keep downtown stores in business. Therefore, change creates new options and causes some old options to disappear.

* 1. **The Digital Divine**

The term refers to the fact that some groups of people have access to and regularly use computer, information, and communications technology, while others do not.

* + 1. **Trends in Computer Access**

Once upon a time, everyone in the world had equal access to PCs and the Internet. They did not exist, and we all had none. As the technology began to spread and its value became clearer, people became more concerned about the gap in access.

Advocates of universal access to the Net argued that access might give some people such a large advantage over those without it that our society would divide sharply into the “information haves” and “information have-nots.” Many advocates saw access as an issue of social equity. Computer Professionals for Social Responsibility published that everyone in the country must have access to the Net; that hardware and software must be easy to use and fit the needs of all users, including the disabled. Advocates of universal access see access as a right-positive right-something that society must provide for everyone who cannot afford it themselves.

The early purchase finance improvements in design and production techniques bring prices down. Price of many consumer products follows this pattern. Ex. Telephone and televisions were originally luxuries of the rich; now almost everyone has them. Software innovations such as user interface, Web browsers, and search engines, made computer use more confortable. With lower prices and ease of use, ownership and access spread quickly.

Entrepreneurs provide options for people who want to use a product but cannot afford to buy it. Internet Cafes for example provide Net access for an hourly fee. Community centers offer classes in how to use computers.

The most important factors in shrinking the digital divide were the incredible decline in prices of computers and the increase in services that made the Web useful and attractive. As a result, we conclude that it is more accurate to think of people as “have” and “have-laters.”

* + 1. **The Global Divide and the Next Billion Users**

Most people in the world have never made a telephone call and have little or no access to books. This lack is due to: poverty, isolation, and sometimes, politics.

Nonprofit organizations and huge computer companies have ongoing projects to spread computer access to more people in developing countries. Some companies use the catchphrase “the next billion users” to describe the people their program address. One laptop per child is one goal.

* 1. **Evaluations of the Impact of Computer Technology**
		1. **The Neo-Luddite View of Computers, Technology, and Human Needs**

We might urgently try to prevent implementation of some applications and urgently advocate increased protection from risks and better solutions for problems, yet not consider the threats and risks as reasons for condemning the technology as a whole. On the other hand, there are people who see the benefits as few and overwhelmingly outweighed by the damage done.

The term Luddite describe for people who oppose technological progress.

Ex. In England people burned factories in efforts to stop the technologies and social changes that were eliminating their jobs.

**Luddite criticisms of computer technology**

Some of their criticisms are problems that also trouble people whose views of computers is generally positive. One of the differentiating characteristics of the new-Luddite is that they focus on these problems, seeing no solution, and concluding that computers are a terribly bad development for humans.

Some of the criticisms are:

* Computers cause massive unemployment.
* People use computers because they are there, not because they satisfy real needs.
* Computers cause social inequity.
* Computers cause social disintegration. They weaken communities and lead to isolation of people from each other.
* Computers separate humans from nature and destroy the environment.
* Computers benefit big business and big government most.
* Use of computers in schools thwarts development of social skills, human values, and intellectual skills in children.
* Computers do little or nothing to solve real human problems. Ex. In situations like families break up and when children are mistreated.

Counter arguments about criticism:

* Blaming computers for social inequity in the world ignores thousands of years of history.
* A computer in the classroom does not replace good parents in the home.
* Access to information and communication can assist in solving problems and is not likely to hurt.

To the Luddites, the computer is just the latest, but in many ways the worst, stage in the decline of what was good in human society. This view is made clearer by attitudes toward common devices most of us use daily. For example, “I find talking on the phone a physical pain, as well as mental anguish.” Another example, Some of us see modern medicine as a lifesaving for humanity; some Luddites point out that it gave us the population explosion.

There is a fundamental difference between the world views of supporters and opponents of technology. Supporters of technology see an upward trend in quality of life, beginning with people living at the mercy of nature with an empty glass that technology has been gradually filling. Neo-Luddites view the glass as originally full when people lived in small communities with little impact on nature; they see technology as draining the glass.

**Business, consumers, and work**

Luddites see the profit seeking goal of corporations as in fundamental conflict with the well-being of workers and the natural environment. To the Luddites, technology eliminates jobs to reduce the costs of production. The Luddites view combines a negative attitude toward business with a high estimation of the power of corporations to manipulate and control workers and consumers.

We can phone around town or look on the Web to find a store, movie theater, or restaurant that has what we want. Luddites and other critics of technology do not value these advantages highly. In their point of view, the advantages are merely making better other problems technology causes. For example, if there had been no railway to conquer distances, my child would never have left this native town and I should need no telephone to hear his voice.

**Does the technology create the need for itself?**

Luddites argue that technology causes production of things we do not need. This contrasts with the market-oriented view that sees consumer’s choices as determining which product, service, and business succeed of fail.

Those who emphasize the value of individual action and choice argue that needs are relative to goals, and goals are held by individuals. Anyone who does not feel a desire or need for one does not have to buy one. The Luddites, who believe buyers are manipulated by advertising, work pressure, or other forces beyond their control, reject this individual-oriented approach.

**Nature and human life styles**

Luddites argue that technology has made no improvement in life, or at best improvements of little importance. List of benefits from technology to Luddites include: speed, ease, and mass access. They argue that thousands of generations of humans got along without computers, suggesting that we could do just fine without them too.

* + 1. **Accomplishments of Technology**

Living and working conditions are getting worse, that we are running out of natural resources, that the environment is deteriorating, that we are less healthy, among others. A variety of scholars find these observations to be false. Hard data show that prices of food are down around the world, raw material are more abundant, and wages have been going up in rich and poor countries.

For example, prices of natural resources have declined over the past 100 years as a result of improvements in mining technologies. Technology and the Industrial Revolution have had a dramatic impact on life expectancy. Worldwide average life expectancy increased from 30 to 64.

Technology certainly is not the only factor in improving quality of life. Progress against disease, discomfort, and early death depends on the stability, freedom, and flexibility of political and economic systems as well.

**Who benefits most?**

Mander believes the answer to his question is multinational corporations and centralized corporate power. In capitalistic society, the benefits are allotted to the people who own machines. He said that small businesses will be better off if computers had not been invented, since they are essentially one more tool that large businesses can use better.

John Naisbitt’s view contrasts with Mander’s view. The Web and the value of information services help small businesses form and flourish.

Postman acknowledges that computers are very beneficial to disabled people. He sees convenient access to online information as a tremendous advantage for scholars and scientists. But he sees the main beneficiaries of computers as governments and big business. In his view, computers have little value to ordinary workers.

* 1. **Making Decisions About Technology**
		1. **Questions**

Determination of what are true needs depends on our choice of values.

Most people accept that people can choose to use a technology for good or ill. Some critics of technology disagree. In the view of some critics of computing technology, big corporations and governments make decisions about uses of the technology without sufficient input control by ordinary people.

Telemedicine: A Bad Application of Technology.

Telemedicine is a benefit of computer technology, but it also has some privacy and safety problems. Several states passed laws prohibiting the practice of telemedicine by doctors who are not licensed. The main argument they give for the laws is safety. Also, telemedicine could increase the influence of large, well-financed medical centers-to the detriment of local physicians in private practice.

* + 1. **The Difficulty of Prediction**

It is difficult to evaluate the consequences and future application of new technology. The PC was originally a tool for doing computation. No one except few visionaries imagined most of their current uses.

Although a technology does not drive human beings to adopt new practices, it shapes the space of possibilities in which they can act: people are drawn to technologies that expand the space of their actions and relationships.

The history of technology is full of wrong predictions:

* The telephone is so important, every city will need one.
* Computers in the future may weigh 1.5 tons.
* There is no reason for any individual to have a computer in their home.

Arguments made by Weizenbaum against speech recognition:

* The problem is so enormous that only the largest possible computers will ever be able to manage it. We can buy pocket-sized personal organizers that take spoken commands.
* Speech recognition machine is bound to be enormously expensive. Some computers come with simple speech-recognition software as a free bonus.
* What can it possibly be used for? We can search the Web from a cell phone by speaking what we want instead of typing. Voice-activated, hand free operation of cell phones, car stereos, and other appliances in automobiles eliminates some of the safety hazard of using these devices while driving.
* The military planned to control weapons by voice commands. Some argue that we should have the best possible weapons to defend ourselves. Other argue that, if wars are easier to fight, governments fight more of them.

His argument is important because:

* He was mistaken in his expectations about the costs and benefits.
* Should we decline to develop technologies that can be misused, or should we develop the tools because of their beneficial uses.
* His argument against the development of a technology because of its expected cost.

Example: a common objection to some new medical technologies is that they are so expensive that only the rich will be able to afford them. This shortsighted view can result in the denial of benefits to the whole population. We saw that, for many innovations, prices are high at first but quickly come down.

* + 1. **Intelligent Machines and Super intelligent Humans-Or the End of the Human Race?**

MIT robotics research suggests that by 2020 we might have wireless Internet interfaces that can be implanted in our heads.

**The technological singularity**

The term refers to the point at which AI or some combined human-machine intelligence advances so far that we cannot comprehend what lies on the other side. Some technologists see the human race transforming into an unrecognizable race of super intelligent, genetically engineered creatures within this century. Some see this as a welcome; others find it horrifying. Two estimates support this scenario:

* The estimate of the computing power of the human brain.
* Moore’s law.

One day, computer hardware will be about as powerful as a human brain. Those who criticize these ideas provide many reasons why it might not happen:

* Hardware progress might slow down.
* We might not be able to develop the necessary software in the next few decades.
* The estimates of the “hardware” computing power of the human brain might be drastically too low.
* Some philosophers argue that robots programmed with AI software cannot duplicate the full capability of the human mind.

**Responding to the threats of intelligent machines**

We cannot prepare for the aftermath of the singularity, but we can prepare for more gradual developments. Joy describes his worries about robotics, genetic engineering, and nanotechnology. He observes that these technologies will be more dangerous than technologies of the 20th century because they will be self-replicating and will not require rare and expensive raw material and huge factories.

Protection from machines:

* Space enthusiasts suggest creating colonies in space. If colonists take the current technologies with them, the threat goes too.
* Develop protection that can stop dangerous technologies from getting out of control. But we may not be able to develop shields in time, and if we do, they would as dangerous as the technologies they are supposed to protect us against.
* Relinquishment, by which we must limit development of the technologies that are too dangerous.