

# 1 Unwrapping the Gift

## 1.1 The Ubiquity of Computers and the Rapid Pace of Change

*Everything that can be invented has been invented.* – Charles H. Duell, Director of the U.S. Patent Office, 1899

In 1804 information, people, and goods moved no faster than a horse – and this limitation on speed had not changed in thousands of years. In 1997, millions of people worldwide went to the World Wide Web to watch a robot cart called Sojourner roll across the surface of Mars.

Have you used a computer today?

Computers are not just PCs and Macs that sit on desks in homes and offices. Microprocessors are now in hundreds of millions of appliances and devices. They are built into microwave ovens, bread-baking machines, automobile ignition and braking systems, telephones, cameras, medical instruments, and a large number of other machines we use regularly.

When we speak of computers in this book, we include the PCs and mainframes that run applications software, embedded chips that control machines, the growing variety of information, entertainment, and communications devices (like palm computers, DVD players, and game machines), and the “Net,” or “cyberspace.”

In 1994, on the 25<sup>th</sup> anniversary of the first moon landing, a television documentary reported that lunar landing module used by the Apollo astronauts had less computing power than a 1994 automobile.

The web is a younger than college freshmen today

In 2001 Americans spent more than 3.3 billion dollars buying products online, approximately ten times the 1997 total.

*Since the computer-on-a-chip was invented in 1971, the cost of computing has plunged 10 million-fold. That's like being able to buy a new Boeing 747 for the price of a large pizza.* – Michael Rothschild

## 1.2 Examining the Gift: An Introduction to Some Issues and Themes

### 1.2.1 Issues

Why do we use ATM's? We use them because they are convenient, but what are some of the negative aspects of ATM's?

- Unemployment
  - In 1983, 480,000 people worked as bank tellers, by 1993, there were only 301,000 tellers.
- Alienation and customer service
  - Instead of talking to a smiling person, we confront a machine
- Crime
  - People are robbed after withdrawing cash as ATMs.
- Loss of privacy
  - The record of a person's transactions at various ATMs can provide information about the person's whereabouts and activities.
- Errors
  - Numerous errors have been reported using ATMs.

So, are ATMs, on balance, a bad development? Probably not. Why? The example of ATMs suggests that many people do in fact value convenience very highly.

Other issues:

Privacy of communications (chap 3)

As new telecommunications technology and encryption methods make it possible to keep communications secret from others, how should our desire for efficiency and privacy be balanced with the need of law-enforcement agencies to intercept and monitor communications of suspected criminals?

Freedom of speech (chap 5)

How much freedom of speech do we have in cyberspace? How much should we have? How serious are the problems of pornography, dangerous material, and misinformation? How would censorship affect the Net? Does freedom of speech apply to spam?

Intellectual property (chap 6)

Many millions of dollars worth of music and software is illegally copied each year. Storage in digital form has made intellectual property (e.g. books, software, movies, and songs) easy to copy without permission of the copyright owner. What is the extent of this problem?

General social issues (chap 9)

How does the increasing use of computers and the Internet affect local community life? Will widespread use of computers increase the separation of rich and poor, creating a two-class society, the information “haves” and “have-nots”?

## **1.2.2 Themes**

### **OLD PROBLEMS IN A NEW CONTEXT**

Cyberspace has many of the problems, annoyances, and controversies of non-cyber life, among them crime, pornography, pedophilia, violent fiction and games, advertising, copyright infringement, gambling, and products that do not work right.

The root is not always the new technology, but can be human nature, ethics, politics, or other factors. We will often try to analyze how the new technology changes the context and the impact of old problems.

### **ADAPTING TO NEW TECHNOLOGY**

New technology makes new activities possible. Many new activities made possible by the new technology are so different from prior ways of doing things that we need a new set of “rules of the game” to guide people’s behavior and to specify what will be permitted and what will not.

The ease of communication with distant countries has profound social, economic, and political effects – some beneficial, some not.

## THE GLOBAL REACH OF THE NET

It makes crime fighting and law enforcement more difficult, because thefts and disruption of services can be accomplished from outside the victim's country.

## TRADE-OFFS AND CONTROVERSY

Increasing privacy and security often means reducing convenience; Privacy protection makes law enforcement more difficult. Access to vast amounts of information on the Web is accompanied by access to unpleasant, offensive, or inaccurate information.

Many of the issues are very controversial; censorship of the Internet, legislation for privacy protection, how strict copyright law should be, the impact of computers on quality of life.

## DIFFERENCES BETWEEN PERSONAL CHOICES, BUSINESS POLICIES, AND LAW

The criteria for making personal choices, for making policies for businesses and organizations, and for writing laws are fundamentally different.

Arguments for passing a law should be qualitatively different from reasons for adopting a personal or organizational policy. Arguments on the merits of the proposal – e.g. that it is a good idea, or is efficient, or is good for business, or is helpful to consumers – are not good arguments for a law.

Arguments for a law must show why the decision should be enforced against someone who does not agree that it is a good idea.

## NEGATIVE AND POSITIVE RIGHTS, OR LIBERTIES AND CLAIM-RIGHTS

There are two quite different kinds of rights.

*Negative rights*, or liberties, are rights to act peacefully without interference. The only obligation they impose on others is not to prevent you from acting. They include the right to life (in the sense that no one may kill you), the right to be free from assault, the right to use your property, the right to use your labor, skills, and mind to create goods and services and to trade with other people in voluntary exchanges.

*Positive rights*, (claim-right) impose an obligation on some people to provide certain things for others. A positive right to a job means that someone must hire you regardless of whether they voluntarily choose to, or that it is right, or obligatory, for the government to set up job programs for people who are out of work.

Access to the Internet, as a claim-right, could require such things as taxes on our telephone bills to provide subsidized access for poor people.

Negative rights and positive rights often conflict.

### **1.3 Appreciating the Benefits**

#### **1.3.1 The World Wide Web, Games, Crime Fighting, and More**

Computer games are hardly life-saving, awe-inspiring wonders that profoundly advance the human condition. But they sure are fun. Entertainment and fun are valuable aspects of a happy life. The

demand for computer games spurred development and improvement of many technologies, such as real-time graphics and joysticks, that have many other uses.

## COMMUNICATION AND THE WORLD WIDE WEB

*New York to London is only five miles further than New York to Newark via satellite.* – Nicholas Negroponte

E-Mail and the World Wide Web are probably the two computer applications most widely used by both technical and nontechnical people. Electronic mail has many advantages of telephone calls without the disadvantages. Americans sent approximately 1.4 billion e-mail messages per day in 2000. A common reason cited by older people for buying a computer is to keep in touch with grandchildren by e-mail.

Computers and the Internet and World Wide Web make the collection, searching, analysis, storage, access, and distribution of large amounts of information much easier, cheaper, and faster than before.

The Web is so widely and commonly used now that we sometimes forget how new and extraordinary it is. The Web was established in Europe in 1990 to enable high-energy physicists to share pictures and text with colleagues and other countries. Among the earliest businesses on the Web were United Parcel Service and Federal Express that allowed customers to check the status of the packages they sent. As the Web became a tool for electronic commerce and ordinary users, it grew at an astonishing rate. In 1998, there were 320 million Web pages. By 2001, there were three billion.

Individuals, organizations, and businesses provide an amazing amount of information for free. A Pew survey estimated that 60 million Americans sought health information on the Internet in 2000. The improved productivity generated by use of the Web, from processing forms to routing trucks, was expected to save the economy \$100-230 billion between 2001 and 2005.

Tax software helps us fill out our tax forms without depending on (and paying) an expert.

The Web helps us not only to find material of interest to us, but also to make available to the world whatever information we want to provide. A small business' Web site advertises to potential new customers anywhere in the world. Musicians sell their music directly to the public without a contract with a major record company. Peer-to-peer technology provides easy transfer of files by large numbers of strangers over the Internet without any centralized system of Web server.

The impact of the communication and information provided by the Web is more dramatic in remote or less developed areas of the world, villagers in Nepal sell handicrafts worldwide via a Website based in Seattle. Sales have boomed, more villagers have regular work, dying local arts are reviving, and some villagers can now afford to send their children to school.

## AUTOMOBILES AND TRUCKS

The 1991 space shuttle had a one-megahertz computer onboard. Some luxury 2001 automobiles had 100-megahertz computers.

Anti-lock braking systems (ABS) use sensors and computers to control the pressure on the brakes to prevent skids. The ABS is more expert than human drivers at safely stopping a car.

“Hybrid” cars, like Honda’s Insight and Toyota’s Prius, use computers to alternate between burning gasoline and using battery power, reducing energy use and pollution.

A fleet of Buicks with special equipment developed by General Motors and the University of California drove themselves only 12 feet apart in a test on a San Diego freeway.

A closer goal is a warning system that alerts a driver, or even takes over the steering, when the computer determines that the driver is veering off the road or into an obstacle. Such a system could prevent many of the three million accidents that occur every year in the U.S. involving a single car and a sleepy or intoxicated driver.

## EDUCATION AND TRAINING

There has been educational software almost since there have been personal computers. Many courses and some complete college programs are offered entirely on the Web.

Speech recognition is a useful tool in many educational training programs.

## CRIME FIGHTING

The automated Regional Justice Information System (ARJIS) is an example of the use of computer networks and databases to aid crime fighting. It is used to identify suspects, clear suspects, track and identify trends and patterns of crime, and generate reports.

Insurance fraud is detected by using computers to find patients and doctors who file multiple claims.

Matching of fingerprints and photographs of suspects can now be done by computer. The Automated Fingerprint Identification System (AFIS) can process millions of prints in twenty minutes. In one state, the system helped solve about 200 crimes in its first two years of operation.

### **1.3.2 Health and Medicine**

Computers are used in virtually all phases of medicine, from research to the operating room to maintaining patient records.

## MEDICAL DEVICES

Physicians use machines such as CT (computer-aided tomography) scanners and MRI (magnetic resonance imaging) machines for medical imaging.

Microprocessors control a variety of medical instruments. One million Americans wear heart pacemakers.

Several companies are developing devices to measure blood glucose through the skin. Anyone with diabetes will recognize the value of such devices: they eliminate the need to prick one's finger several times a day to take blood-glucose measurements.

Some hospitals use large robot pharmacist machines connected to the patient database. In its first few years, it filled 30 million prescriptions with no errors!!!

## PATIENT RECORDS

Hospitals and medical centers replaced many paper patient records with computerized records.

At a Harvard University hospital, the medical staff can get records from a computer system in about two seconds. Before the system was installed, it took an average of two hours.

Another hospital with computerized patient records found that patients were released from the hospital almost one day earlier and had bills averaging almost \$900 less than when they relied on paper records.

## DIAGNOSIS

Many computer-based systems aid doctors in diagnosing diseases.

A computer program predicts the results of biopsies from prostate cancer with 87% accuracy; doctors typically can predict the result with 35% accuracy.!!!

An ultrasound device uses computers to analyze echoes from sound waves bounced off a lump in a woman's breast. It can determine whether the lump is benign and could eliminate the need for 40% of surgical biopsies for breast cancer.

## TELEMEDICINE, OR LONG-DISTANCE MEDICINE

Many rural hospitals cannot afford to have a trained radiologist on staff. The X-rays can be transmitted by telephone lines instead of being physically carried by couriers.

The specialists can see and hear and participate in examination, eliminating the expense, time, and possible health risk of transporting the patient to the medical center.

Video and robotic devices and high-speed communication links are being developed for emergency situations. They can save the lives of soldiers wounded on battlefields far from expert surgeons.

### **1.3.3 Tools for Disabled People**

There are more than 1000 computer-based devices for the disabled.

People with poor eyesight can direct a computer display to use a large type size. For people who are blind, computers equipped with speech synthesizers read aloud what a sighted person sees on the screen.

A system made up of a bar-code reader, a database, and a speech synthesizer helps blind people keep track of objects in their home or work environment.

Researchers are developing a computer chip that will float on the retina of the eye and send visual signals to the brain, restoring some sight.

Computer chips have enormously improved hearing aids.

A person can use a wireless head mouse, a headset that detects movement of the head and moves the cursor accordingly on the screen.

Microprocessors are embedded in prosthetic devices, such as artificial arms and legs.

For some quadriplegics, a device about the size of a pacemaker, implanted in the chest, helps restore partial use of their hands.

People who formerly could not work now can. Many disabled people have formed and run their own businesses.

### **1.3.4 Automation**

An example is a sophisticated warehouse system built in 1987 by Ralphs supermarket chain with more than 100 stores. The warehouse is ten stories high. Products are stored on more than 50,000 pallets and retrieved by huge automated cranes. The cost of the system was recovered from the savings it brought about in just a few years.

A robotic milking machine milks cows at dairy farms while the farmhands sleep; more frequent milking boosted milk production.

Robots are used in environments that are hazardous to people.

### **1.3.5 Identification, Sensors, and Tracking Systems**

Technology for identifying people and products, from bar codes to smart cards, has been getting more sophisticated and finding new applications.

Smart cards are the size of credit cards, but they contain a microprocessor and memory. Hundreds of applications, including uses for financial transactions, health care, credit, and telephone calls, are being developed.

#### **SMART THINGS**

Sensors with tiny radio transmitters are finding all sorts of applications.

Sensors and microprocessors detect temperature, acceleration and stress in materials (such as airplane parts).

#### **FOILING POACHERS, FOLLOWING TURTLES**

Satellite technology and microprocessors enormously improve animal tracking.

Many people are familiar with the tracking devices that can be installed in a car to locate it if stolen.

Pets, prisoners, people with Alzheimer's disease, and children can wear, or have implanted under their skin, devices that locate them if they wander off.

New applications for identification, sensor, and tracking/locating technologies are popping up at an increasing rate. There are many planned and potential applications of tracking technologies that raise significant issues concerning privacy and freedom of movement.

### **1.3.6 Reducing Paper Use and Trash**

Electronic storage of text, and the ability to edit and update it, is reducing the need for paper in many businesses – and the amount of trash produced.

A department store chain reported saving \$1 million worth of paper per year by keeping sales reports on computer instead of paper.

The paper industry remains one of the highest emitters of toxic chemicals.

Most of us still want a paper copy of a document to read in a comfortable chair or when sprawled on the sofa or at the beach. As portable readers become more convenient and flexible, we could see a substantial decline in paper use.

### **1.3.7 Some Observations**

A bicycle rider who survives an accident might know that her helmet was an important factor, but she probably would not know that some detail of the design suggested by computer simulations prevented a worse injury.

For many of us, it would be hard to imagine living without computers. Yet, until very recently, we did.

The builders of the Statue of Liberty, the Pyramids, the Roman aqueducts, magnificent cathedrals, and countless other complex structures did not wait for computers.

Computers enable us to work faster and more accurately than before.

Efficiency is sometimes looked down upon, but that is a mistaken view. If a new drug is discovered 15 years earlier than it would have been without computers, hundreds or thousands of lives might be saved or improved in those 15 years.

Any task that can be done more efficiently frees some of our time and resources for other pursuits, be they work, community, cultural, or leisure activities.