ONE

Introduction

1.1 A Brief History of Computers and the Internet

At the beginning of a study of computer ethics we need to have some understanding of how computing has developed in society. In one sense, computers have been around for a long time, and in another, they are a fairly recent phenomenon. Historically, the first computers were simply fingers and toes – digital computers in the literal sense. They were simple tools used for counting. As calculation became more complex, other tools began to be used to leverage the calculating load. This technology developed along the lines of sticks and stones, then the abacus about 1000 BCE in China, and finally the machines produced during the period of formal mechanics.

Like the railroad, mechanical computers were invented in the United Kingdom. The inventor of the first mechanical computer was Charles Babbage (1791–1871). In the early 1820s he began work on a model of a machine he called the Difference Engine. The purpose of this machine was to calculate numbers for use in mathematical tables. In the early 1830s he turned his attention to work on a programmable Analytical Engine, which was intended to use punched cards. This machine, like the Difference Engine, never went into production. Part of the problem was Babbage's continual rethinking of his plans for the engines. The other part of the problem was the lack of available tools that would produce materials of the tolerance that he required. Though Babbage was never able to finish it, the Analytical Engine may be regarded as a prototype for the modern electronic computer.[1]

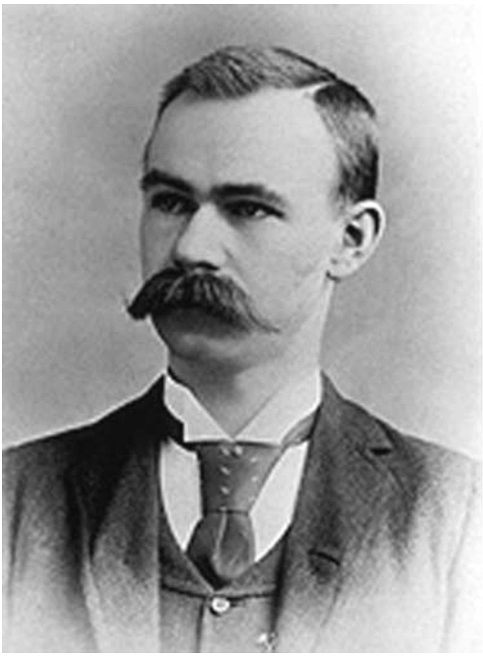

Figure 1.1. Herman Hollerith

George Boole (1815–1864) was a contemporary of Babbage. He was Professor of Mathematics at Queen's College (now University College Cork), in Cork City, Ireland. He formulated what today we call Boolean logic or Boolean algebra. It utilizes three basic operators: AND, OR, and NOT. Although Boole was not an inventor of any computing hardware, the logic that bears his name facilitates much of the computing that goes on today. It is by the use of his logic that search engines, for example, are able to do their work.

Herman Hollerith was another nineteenth century inventor who, unlike Charles Babbage, actually did use punched cards in computing. He designed a machine for the 1890 U.S. Census that, through a combination of the use of electricity and information punched into cards, greatly increased the speed with which census data could be tabulated. He later left the Census Bureau and founded a private company that eventually evolved to become IBM.[2]

The MARK series of computers at Harvard University was developed by Howard Aiken and Grace Hopper (the latter was known, because of her extraordinary achievements, as "Amazing Grace"). The MARK I, built in 1944, was a much different machine than the computers of today. It was fifty-five feet long and eight feet high, weighed five tons, and contained five hundred miles of wire. Despite its size, it was slow in processing speed, requiring three to five seconds to perform a multiplication operation. The Mark I was used by the Navy for gunnery and ballistic calculations. Grace Hopper, the first woman to become a Rear Admiral in the U.S. Navy, was a mathematician who developed validation software for the COBOL language. It was her idea that programs could be written in a human-type language rather than in machine code. She is also known for a remark in the Mark II log that she was "debugging" the computer because a moth had been found in it. She was awarded the first "Man of the Year" award by the Data Processing Management Association. Howard Aiken headed the team that worked on the Mark series. He published many articles on electronics and switching theory and went on to found Aiken Industries. He would seem to be a better scientist than prognosticator, since in 1947 he said, "Only six electronic digital computers would be required to satisfy the computing needs of the entire United States."[3]

The first electronic computer, ENIAC (an acronym for "Electronic Numerical Integrator and Computer"), began operating at the University of Pennsylvania in 1946. It was invented by John W. Mauchly and J. Presper Eckert. It used an external type of programming made up of cables and switches. There are still programmers working today who once used this type of "wiring board" to program their computers. Although it is apparently a myth that ENIAC dimmed the lights throughout Philadelphia when it was turned on, it did make use of a total of 18,000 vacuum tubes.[4] Computer hardware has progressed over the years from vacuum tubes to transistors to integrated circuits to microprocessors or microchips. These advances have made possible tremendous increases in speed of operation and in reduction of size. This "smaller but faster" technology allowed for the development of personal computers in the 1970s and 1980s.

ENIAC was an early form of digital computer. Digital means that data is represented as discrete units. Analog, on the other hand, means that data is represented as continuous quantity. An example of analog representation would be a timepiece with smoothly sweeping hour, minute,

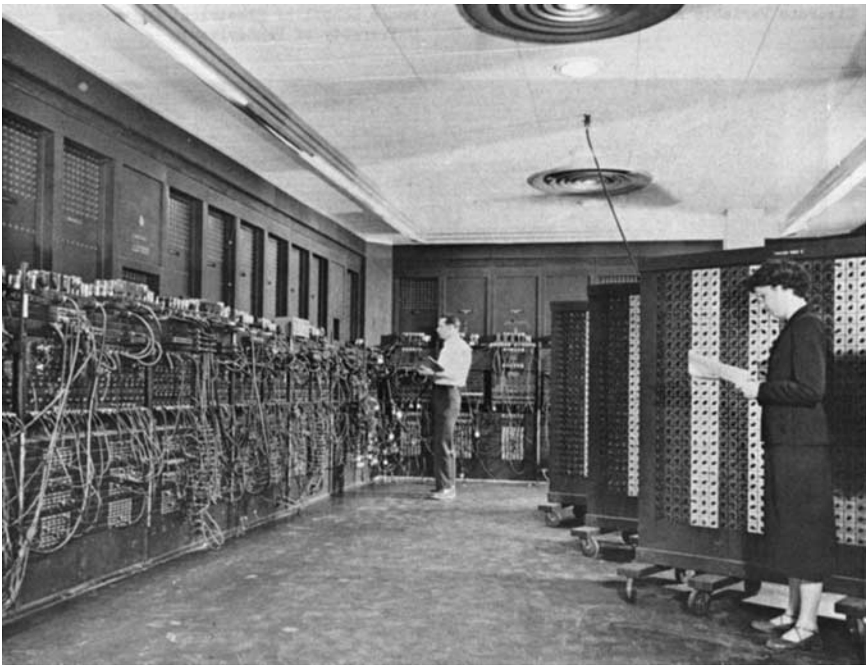

Figure 1.2. ENIAC (U.S. Army photo)

and second hands. An example of digital representation would be a timepiece with hours, minutes, and seconds that change by discrete numbers. It is interesting that these different representations make for a different "conception" of time. For instance, a person wearing an analog watch is likely to report the time as being "a quarter to eleven," whereas the wearer of a digital watch – because of the discrete digits that appear on the face of the watch – might say that the time was "ten forty-five."

An interesting hallmark in the development of interactive software occurred in 1963 when Joseph Weizenbaum, a Professor of Computer Science at the Massachusetts Institute of Technology (MIT), created a program called "Eliza." This program functioned like a Rogerian psychotherapist, basically reflecting a patient's comment back to the patient and getting the patient to develop it further. Weizenbaum once told me that he was amazed and appalled that some people were actually using this program as if it were really capable of achieving a psychotheraputic result. Weizenbaum is also famous for the following joke he loved to tell, emphasizing the divide between science and the humanities. It seems a college student was shopping in a supermarket located between the campuses of Harvard and MIT. He pulled his very full cart into a checkout lane that had a sign saying, “Eight items or less.” The cashier glanced at the overflowing cart, then at the sign, and finally at the student. Then with a pained expression the cashier asked, “Are you from Harvard and can’t count or from MIT and can’t read?”

A quantum leap in computing occurred with the development of communication between distant computers. The initial work on this type of communication was done in the late 1960s by a U.S. Defense Department agency known as the Advanced Research Projects Agency (ARPA). It constructed a computer network between contractors working for the Defense Department, which was known as the ARPANET. A major concern in the development of this network was to insure that if a node on the network were obliterated by an atomic attack, messages could be routed around this node so that communication with the rest of the network would not be disrupted. The ARPANET was followed in the 1970s by the development of the Internet, which was essentially a network of networks. The Internet made it possible for virtually an infinite number of servers to communicate with one another. Its development was enabled by the invention of the Transmission Control Protocol and the Internet Protocol, known by the acronym TCP/IP. These protocols were invented by Vinton Cerf and Robert Kahn. These TCP/IP protocols will be explained in detail in Chapter 19 in the context of the parasitic computing case. The most recent major development in worldwide computer communication was the Hypertext Transfer Protocol (http). It was invented in 1989 by Tim Berners-Lee while he was working at the European Particle Physics Laboratory in Switzerland. The http protocol facilitates exchange of hypertext documents by a browser with servers on the World Wide Web (www). The Web, although often thought of as synonymous with the Internet, is actually a subset of it.

A list of other highlights in hardware and software development in the last quarter of the twentieth century concludes this section:

1975 – The first personal computer (PC) appeared on the market. It was sold as a kit through *Popular Electronics* magazine. It enabled programming through the use of the BASIC language.

1976 – Steve Jobs and Steve Wozniak built the first Apple computer.

1976 – The Cray-1, the first supercomputer, was built by Cray Research.
1977 – Bill Gates and Paul Allen founded Microsoft.
1977 – PCs manufactured by Tandy and by Commodore appeared on the market.
1979 – VisiCalc was marketed, becoming the first electronic spreadsheet program.
1982 – The Compaq computer entered the marketplace.
1983 – IBM produced its own spreadsheet program, Lotus 1–2–3.
1984 – Apple introduced the Macintosh computer.
1984 – The CD-ROM, making possible greater storage capacity, was produced by Sony and Philips.
1988 – Robert Morris, Jr., released the Internet Worm, contending that he meant it to expose security risks on the Internet.
1995 – The Java language was developed by Sun Microsystems.[5]

1.2 The Meaning of Ethics

Ethics is defined by *Webster's Third International Unabridged Dictionary of the English Language* as "the discipline dealing with what is good and bad or right and wrong or with moral duty and obligation." Ethics is a part of philosophy, not science. As John Horgan, noted science journalist and author, says: "Science tells us that there are limits to our knowledge. Relativity theory prohibits travel or communication faster than light. Quantum mechanics and chaos theory constrain our predictive ability. Evolutionary biology keeps reminding us that we are animals, designed by natural selection, not for discovering deep truths of nature, but for breeding. The most important barrier to future progress in science – and especially pure science – is its past success."[6] Philosophy, on the other hand, does not place limitations on our knowledge. It deals with questions of quality, not quantity. It is not so much concerned with measuring amounts of things as it is with understanding ideas and concepts. A more rigorous investigation of ethics will be undertaken in Chapter 3, but for now let us conclude by saying that the words "computer ethics“ do not denote the oxymoron spoken of in the Preface of this book. Rather, they symbolize the hope that dilemmas involving one of the world's most complex machines, the computer, can be analyzed with a systematic use of normative value theory. This investigation will not be an easy task. Heinz von Foerster, late Professor Emeritus of Biophysics and Electrical Engineering at the University of Illinois at Urbana-Champaign, has suggested the difficulty of such a study. He said: "The hard sciences are successful because they deal with the soft problems; the soft sciences are struggling because they deal with the hard problems."[7]

1.3 The Distinction between Law and Ethics

An assumption is often made that what is right is also what is legal and that what is legal is also what is right. However, it is possible for an act to be ethical but illegal, or, conversely, unethical but legal. An example of the former might be the case of objection to fighting in a war by a person who truly has a conscientious objection to participating in violent actions, but where that person's government has not provided for excusing such an individual from service. An example of the latter might be the case of a government sanctioning capital punishment when a majority of its citizens believe capital punishment to be an immoral means of punishment.

You will find that computing dilemmas will be analyzed in this textbook more from the standpoint of ethics than from the standpoint of law. I sometimes ask a professor of law to visit my computer ethics class and comment on computer ethics dilemmas. Of course the professor's comments tend to be legally based rather than philosophically based. While I do believe that law is very important and that our society could not survive without it, I always remind my students that – as indicated in the previous paragraph – ethics and law are not the same thing. It is true that often the law requires what ethics requires, but not always. It is also true that often ethics requires what the law requires, but not always. It is my belief that computer ethics dilemmas should be analyzed and solved on the basis of enduring ethical principles, even if there is an argument about which of these principles should enjoy priority. I do not believe that computer ethics dilemmas should be analyzed and solved primarily on the basis of legal precedents that change with time, shifting majorities, and revisions of law.

1.4 The Subjects of Ethics

By "subjects of ethics," I mean those persons to whom ethics applies. As might be concluded from a statement in the Preface of this book that it is people who are unethical and not computers, the subjects of ethics are basically individual human beings. Human beings are the subjects of ethics because they are free in their actions and therefore are responsible. To the extent that a person's actions or choices are constrained in some way, then to that same extent a person is not acting or choosing freely. Such persons are therefore limited in the responsibility that they have for their actions or choices. Thus, those actions or choices cannot be called fully ethical or unethical.

Besides individuals, moral or corporate persons may also be the subjects of ethics. What this means is that institutions and organizations must bear responsibility for their corporate activity just as individuals bear responsibility for their individual activity. Corporations may have a broader scope of activity that may not be as easy to isolate as the activity of individuals, but they bear the same degree of responsibility for the effects of their actions as do individuals.

Finally, we sometimes speak of "good" weather or "bad" weather, but we do not really mean this in a moral sense. Although we might colloquially "blame" Mother Nature for the state of the elements, there clearly is no choice or responsibility implied in our manner of speaking.

1.5 Computer Ethics as a Unique Kind of Ethics

A word of acknowledgment should be given at the start of this section to James H. Moor, a philosopher at Dartmouth College, for his groundbreaking article in 1985 on computer ethics.[8] In that article Moor spoke of computers as "logically malleable," in other words, as able to occasion all sorts of new possibilities for human action and hence also able to create "policy vacuums" (absence of policies for dealing with these new possibilities). He saw computer ethics as a way to analyze these policy vacuums and to formulate appropriate policies.

Since Moor's article, other questions have arisen concerning the field of computer ethics. A central question has been whether computer ethics is essentially different from other kinds of ethics. Traditional computer ethicists maintain that the principles of ethics are relatively constant, no matter to what areas of activity they might be applied. That is to say, the principles of medical ethics, legal ethics, and computer ethics are all the same. They do not differ from one professional field to another. Another way to put this is: theft is theft, no matter whether it is accomplished at the point of a gun or by means of a computer. Some computer ethicists, such as Deborah G. Johnson, suggest that new circumstances occasioned by the use of a computer make for new questions about how ethical principles are to be applied. For example, she points out that computers have brought about the creation of new kinds of things that have never existed before, such as microchips. As she says, "The activity of encoding ideas on silicon chips could not have been conceived of sixty years ago."[9] Undoubtedly, the unique features of computers and the way in which they operate have created new ethical problems. These problems, if not "new" in the sense of a new genus of problem, are at least new in the sense of a new species. This is true because of the change in the scope and scale of the "old" problem brought about by the way in which the computer operates. Consider the following problems as examples:

- Speed/reflex behavior

Computers have facilitated an increasingly speedy form of communication. An example where this speed can cause unique problems is the "flame" phenomenon. This occurs when a person immediately responds by e-mail to a posting, using an immoderate tone, which the person would not use if he or she had taken the time to write a traditional letter or had contacted the recipient in person or by phone.

- Storage/privacy

Massive numbers of files can be retained on a computer for indefinite periods of time. Once information is recorded in these files and shared with other computers at lightning rates of speed, information about people (whether accurate or inaccurate) can take on a life of its own and invade people's privacy in a way never before possible.

- Identity theft

It is possible, using a computer, literally to steal another person's identity. People who have been victims of such theft have found that a great amount of time and trouble is necessary to recover from it.

- Internationality

Computer transmissions do not stop at national boundaries. For example, material that is considered obscene (and perhaps illegal) in one country can be sent into that country from another country in which there is no such prohibition.

- Copying/stealing

In a few seconds with a few clicks of a mouse, images and text can be stolen using a computer. They can then be applied out of context, or without attribution to their true author.

- Perversion
  - Pornography: Pornographic sites exist that display material without regard to the age of the viewer and that can be disguised to avoid detection by pornography filters.
  - Gambling: Sites exist (some of which are located offshore) where one can remotely gamble for money, using a credit card. This gambling is usually done against computer programs rather than against human beings. These gambling sites may use unfair odds and may not pay off a player's winnings.
  - Stalking: Stalking with a computer involves unauthorized persistent surveillance. It is illustrated in the "Fingering" case in Chapter 15 of this book.
- Social issues
  - Gender: Computer science is still a male-dominated field. Research indicates that this is the result of social inequities.[10]
  - Race and social class: Consider these statistics from a 1998 study published by Henry Jay Becker of the University of California, Irvine. Only about 22% of children in families with annual incomes of less than $20,000 have access to a home computer, compared with 91% of children in families with incomes of more than $75,000.[11] Clearly, the rich have more access to computing