

A GIFT OF FIRE

*Social, Legal, and Ethical Issues
for Computing Technology*

Fifth Edition



 Pearson

SARA BAASE
TIMOTHY M. HENRY

A Gift of Fire

Social, Legal, and Ethical Issues for Computing Technology

Fifth Edition

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Cover Photo: imagedepotpro/Getty


Composition/Full-Service Project Management: iEnergizer Aptara[®], Ltd.

Full-Service Project Management: Deepthi Mohan, iEnergizer Aptara[®], Ltd.

Cover Printer: Lake Side Communications, Inc.

Printer/Binder: Lake Side Communications, Inc.

Typeface: Times LT Pro 11/13

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Library of Congress Cataloging-in-Publication Data

Names: Baase, Sara, author. | Henry, Timothy M., author.

Title: A gift of fire : social, legal, and ethical issues for computing technology / Sara Baase, San Diego State University, Timothy M. Henry.

Description: Fifth edition. | Includes index.

Identifiers: LCCN 2016058670 | ISBN 9780134615271 (alk. paper) | ISBN 0134615271 (alk. paper)

Subjects: LCSH: Computers—Social aspects. | Computers—Moral and ethical aspects. | Computers—Legal and Constitutional aspects. | Internet—Social aspects. | Internet—Moral and ethical aspects. | Internet—Legal and Constitutional aspects.

Classification: LCC QA76.9.C66 B3 2018 | DDC 303.48/34—dc23 LC record available at <https://lccn.loc.gov/2016058670>

ISBN 10: 0-13-461527-1

ISBN 13: 978-0-13-461527-1

To Keith, now and always

S. B.

To Tita, for her unconditional support

T. M. H.

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Preface

This book has two intended audiences: students preparing for careers in computer science (and related fields) and students in other fields who want to learn about issues that arise from digital technology, the Internet, and other aspects of cyberspace. The book has no technical prerequisites. Instructors can use it at various levels, in both introductory and advanced courses about computing or technology.

Scope of This Book

Many universities offer courses with titles such as “Ethical Issues in Computing” or “Computers and Society.” Some focus primarily on professional ethics for computer professionals. Others address a wide range of social issues. The bulky subtitle and the table of contents of this book indicate its scope. We also include historical background to put some of today’s issues in context and perspective.










Students (in computer and information technology majors and in other majors) will face a wide variety of issues in this book as members of a complex technological society, in both their professional and personal lives. We believe it is important for students to see and understand the implications and impacts of the technology.


The last chapter focuses on ethical issues for computer professionals. The basic ethical principles are not different from ethical principles in other professions or other aspects of life: honesty, responsibility, and fairness. However, within any one profession, special kinds of problems arise. Thus, we discuss professional ethical guidelines and case scenarios specific to computing professions and we include two of the main codes of ethics and professional practices for computer professionals in an Appendix. We placed the professional ethics chapter last because we believe students will find it more interesting and useful after they have as background the incidents, issues, and controversies in the earlier chapters.

Each of the chapters in this book could easily be expanded to a whole book. We had to leave out many interesting topics and examples, so we placed some of these topics in exercises and hope these will spark further reading and debate.

Changes for the Fifth Edition

For this fifth edition, we updated the whole book, removed outdated material, added many new topics and examples, and reorganized several topics. New material appears throughout. We mention here some major changes, completely new sections and topics, and some that we extensively revised.

- This edition has more than 75 new exercises.
- **Chapter 1**  has a new section on self-driving cars (a topic that appears again in later chapters). In this chapter, we introduce the Internet of Things, another topic that reappears in later chapters.
- New, expanded, or extensively revised topics in **Chapter 2**  include implanting tracking chips in people, national ID systems, extensive government surveillance programs made public by leaked NSA documents, new surveillance technologies, blocking online ads and ethical controversies about doing so, and the European Union's "right to be forgotten." We reorganized **Section 2.3**  and added more Fourth Amendment issues and significant court decisions about searching cellphones and tracking people by tracking their phones.
- In **Chapter 3** , we expanded the section on how companies handle objectionable content, added recent controversial examples of leaks of sensitive material, and expanded the discussion of net neutrality.
- In **Chapter 4** , we expanded discussion of exemptions to the DMCA, added copyright cases in several countries related to news excerpts, added the court decision and arguments in the lawsuit against Google for copying millions of books, and updated and added several patent cases.
- We extensively reorganized and updated **Chapter 5** . We added a case study (the Target breach). Other new sections cover hacking methods and why the digital world, including the Internet of Things, is so vulnerable. The new section on security includes, among other topics, what cybersecurity professionals do, responsible disclosure of vulnerabilities, the role of users in security, and the controversies over impenetrable encryption and backdoors for law enforcement. The chapter has many new examples throughout.
- **Chapter 6**  has a large new section on the sharing economy and gig work.
- **Chapter 7**  has new sections on hurdles to expanding Internet access in poor and developing countries and on various issues about control of our devices and data. We added new examples and more discussion of biased and distorted information in cyberspace.
- In **Chapter 8** , we updated the section on voting systems, added a section with a new case study (the **HealthCare.gov** website), added issues about software controls in cars, and added a discussion of the accidental bombing of a Doctors Without Borders hospital.

- In **Chapter 9** , we added a discussion of the Volkswagen “defeat device” scandal and updated the scenarios.

This is an extremely fast-changing field. Clearly, some issues and examples in this book are so current that details will change before or soon after publication. We do not consider this to be a serious problem as specific examples illustrate the underlying issues and arguments. We encourage students to bring in current news reports about relevant issues to discuss in class. Finding so many ties between the course and current events adds to their interest in the class.

Controversies

This book presents controversies and alternative points of view: privacy vs. access to information, privacy vs. law enforcement, freedom of speech vs. control of content on the Net, pros and cons of offshoring jobs, market-based vs. regulatory solutions, and so on. Often the discussion in the book necessarily includes political, economic, social, and philosophical issues. We encourage students to explore the arguments on all sides and to be able to explain why they reject the ones they reject before they take a position. We believe this approach prepares them to tackle new controversies. They can figure out the consequences of various proposals, generate arguments for each side, and evaluate them. We encourage students to think in principles, rather than case by case, or at least to recognize similar principles in different cases, even if they choose to take different positions on them.

Our Points of View

Any writer on subjects such as those in this book has some personal opinions, positions, or biases. We believe strongly in the principles in the Bill of Rights. We also have a generally positive view of technology. Don Norman, a psychologist and technology enthusiast who writes on humanizing technology, observed that most people who have written books about technology “are opposed to it and write about how horrible it is.”* We are not among those people. We think that technology, in general, has been a major factor in bringing physical well-being, liberty, and opportunity to billions of people. That does not mean technology is without problems. Most of this book focuses on problems. We must recognize and study them so that we can reduce the negative effects and increase the positive ones.

*Quoted in Jeannette DeWyze, “When You Don’t Know How to Turn on Your Radio, Don Norman Is On Your Side,” *The San Diego Reader*, Dec. 1, 1994, p. 1.

For many topics, this book takes a problem-solving approach. We usually begin with a description of what is happening in a particular area, often including a little history. Next comes a discussion of why there are concerns and what the new problems are. Finally, we give some commentary or perspective and some current and potential solutions to the problems. Some people view problems and negative side effects of new technologies as indications of inherent badness in the technology. We see them as part of a natural process of change and development. You will see many examples of human ingenuity, some that create problems and some that solve them. Often solutions come from improved or new applications of technology.

At a workshop on Ethical and Professional Issues in Computing sponsored by the National Science Foundation, Keith Miller, one of the speakers, gave the following outline for discussing ethical issues (which he credited to a nun who had been one of his teachers, years ago): “What? So what? Now what?” That describes the organization of many sections of this book.

An early reviewer of this book objected to one of the quotations at the beginning of a section. He thought it was untrue. So, perhaps we should make it clear that we agree with many of the quotations—but not with all of them. We chose some to be provocative and to remind students of the variety of opinions on some of the issues.

We are computer scientists, not attorneys. We summarize the main points of many laws and legal cases and discuss arguments about them, but we do not give a comprehensive legal analysis. Many ordinary terms have specific meanings in laws, and often a difference of one word can change the impact of a provision of a law or of a court decision. Laws have exceptions and special cases. Any reader who needs

precise information about how a law applies in a particular case should consult an attorney or read the full text of laws, court decisions, and legal analysis.

Class Activities

The course I (SB) designed in the Computer Science Department at San Diego State University requires a book report, a term paper, and an oral presentation by each student. Students do several presentations, debates, and mock trials in class. The students are very enthusiastic about these activities. Many of the Class Discussion Exercises at the ends of the chapters are good for these purposes. Many others in the General Exercises sections are also good for lively class discussions.

We both consider it an extraordinary pleasure to teach this course. At the beginning of each semester, some students expect boredom or sermons. By the end, most say they have found it eye-opening and important. They have seen and appreciated new arguments, and they understand more about the risks of computer technology and their own responsibilities. Many students send us news reports about issues in the course long after the semester is over, sometimes after they have graduated and are working in the field.

Additional Sources


The notes at the ends of the chapters include sources for specific information in the text and, occasionally, additional information and comment. We sometimes put one endnote at or near the end of a paragraph with sources for the whole paragraph. In a few places, the endnote for a section is on the section heading. We have checked all the Web addresses, but files move, and inevitably some will not work. Usually, a search on the author and a phrase from the title of a document will locate it. Also, we found that a search on the title of an article will often lead to a free version in cases where the URL brings up a page requiring a subscription.

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Feedback

This book contains a large amount of information on a large variety of subjects. We have tried to be as accurate as possible, but, inevitably, there will be errors. We appreciate corrections. Please send them to timhenry@acm.org or GiftOfFire@sdsu.edu.

Acknowledgments

I am grateful to many people who provided assistance for this edition. I thank Charles Christopher, for a steady stream of excellent articles on legal issues; Ricardo Bilton of Digiday.com and Jessica Toonkel of Thomson Reuters, for asking me about the ethics of blocking online ads and thus bringing the topic to my attention; Jean Martinez-Nelson, for conversations on a variety of topics in the book and for encouragement; Julian Morris, for reading a section; Jack Revelle, for bringing topics and examples to my attention; Diane Rider, for the idea for [Figure 1.2](#) ; Carol Sanders, for her unexpected and challenging perspectives, for telling me about articles relevant to the book, for reading a chapter, and for her encouragement; Jack Sanders, for reading a chapter and for his analytical insights and thoughts on various topics; Vernor Vinge, for valuable discussions and for sending relevant articles; and various friends and neighbors who listened to me talk about self-driving cars, virtual pornography, and smartphone patents when they were expecting casual conversation over a shared meal.

This edition includes material from earlier editions, and I remain grateful to all who helped with those. I thank Michael Schneider and Judy Gersting for asking me to write a chapter in this area when the field was new and Jerry Westby for encouraging me to expand it to a book.

I thank the team at Pearson who worked on this book: Tracy Johnson for overseeing the project and for finding Tim Henry to work with me on this edition, Erin Ault for her excellent job managing the production process, Marta Samsel for finding photos and creating [Figure 1.2](#) , Kristy Alaura, and the others behind the scenes who handled the many tasks that must be done to produce a book.

Above all, I thank Keith Mayers for helping with research, reading chapters, being patient, running errands, finding things to do while I worked (building furniture this time), and still and always being my sweetheart.

S. B.

In addition to the many people Sara thanks above, I am very grateful to my wife, Tita Mejia, for her tremendous patience and support as I attempted to balance family and writing and for allowing me to take on this project with so many topics that are near and dear. Also, Frank Carrano for starting me on this path and to Sara for her mentoring, ideas, high standards, and patience.

T. M. H.

Chapter 1 Unwrapping the Gift

1.1 The Pace of Change

1.2 Change and Unexpected Developments

1.3 Themes

1.4 Ethics

Exercises

Prologue

Prometheus, according to Greek myth, brought us the gift of fire. It is an awesome gift. It gives us the power to heat our homes, cook our food, and run the machines that make our lives more comfortable, healthy, and enjoyable. It is also awesomely destructive, both by accident and by arson. The Chicago fire in 1871 left 100,000 people homeless. In 1990, the oil fields of Kuwait were intentionally set ablaze. Since the beginning of the 21st century, wildfires in the United States have destroyed millions of acres and thousands of homes. In spite of the risks, in spite of these disasters, few of us would choose to return the gift of fire and live without it. We have learned, gradually, how to use it productively, how to use it safely, and how to respond more effectively to disasters, be they natural, accidental, or intentional.

Computer technology is the most significant new technology since the beginning of the Industrial Revolution. It is awesome technology, with the power to save lives, to make us healthier, and to create large amounts of new wealth. It helps us explore space, communicate easily and cheaply, find information, create entertainment, and do thousands of other tasks. As with fire, this power creates powerful problems: potential loss of privacy, multimillion-dollar thefts, and breakdowns of large, complex systems (such as air traffic control, communications networks, and banking systems) on which we have come to depend. In this book, we describe some of the remarkable benefits of computer and communication technologies, the ways they change our lives, the problems associated with them, and the means for reducing the problems and coping with their effects.

1.1 The Pace of Change

In a way not seen since Gutenberg's printing press that ended the Dark Ages and ignited the Renaissance, the microchip is an epochal technology with unimaginably far-reaching economic, social, and political consequences.

—Michael Rothschild¹

In 1804, Meriwether Lewis and William Clark set out on a two-and-a-half-year voyage to explore what is now the western United States. Many more years passed before their journals were published, and many later explorers did not know that Lewis and Clark had been there before them. In his book about the Lewis and Clark expedition, *Undaunted Courage*, Stephen Ambrose points out that information, people, and goods moved no faster than a horse—and this limitation had not changed in thousands of years.² In 1997, millions of people went to the World Wide Web to watch a robot cart called Sojourner roll across the surface of Mars. We chat with people thousands of miles away, instantly view Web pages from around the world, and tweet from airplanes flying more than 500 miles per hour.

Telephones, automobiles, airplanes, radio, household electrical appliances, and many other marvels we take for granted were invented in the late 19th and early 20th centuries. They led to profound changes in how we work and play, how we get information, how we communicate, and how we organize our family lives. Our entry into space was one of the most dramatic feats of technology in the 20th century. Sputnik, the first man-made satellite, launched in 1957 and Neil Armstrong walked on the moon in 1969. We still do not have personal spacecraft, vacation trips to the moon, or a large amount of commercial or research activity in space, and space tourism for the very rich is in an early stage. Space exploration has had little direct effect on our daily lives, but cars park themselves, and experimental cars drive themselves. Computer programs beat human experts at chess, *Jeopardy!*, and Go, and our smartphones answer our questions. Elderly people have robot companions. Texters send trillions of texts in a year; Facebook has more than 1.7 billion members; Twitter users tweet hundreds of millions of times a day; and these numbers will be out of date when you read them. A day without using an appliance or device containing a microchip is as rare as a day without turning on an electric light.

The first electronic computers were built in the 1940s. Scientists at Bell Laboratories invented the transistor—a basic component of microprocessors—in 1947. The first

hard-disk drive, made by IBM in 1956, weighed more than a ton and stored only five megabytes of data, less than the amount of space we use for one photo. Now, we can walk around with hundreds of hours of video in a pocket. A disk with a terabyte (one thousand gigabytes, or one trillion bytes) of storage—enough for 250 hours of high-definition video—is inexpensive. Indeed, the cost per bit of memory is now about one-billionth of the cost per bit on the first solid-state memory chip in 1970. There are trillions of gigabytes in cyberspace now. Researchers are developing methods to store digital data encoded in DNA molecules and in atomic-level memory chips. With the DNA technique, a million gigabits can potentially be stored in one cubic millimeter. Both methods are still experimental but have potential for reducing the cost, space, and power requirements of today's huge data centers.

The 1991 space shuttle had a 1-megahertz* computer onboard. Ten years later, some luxury automobiles had 100-megahertz computers. Speeds of several gigahertz are now common. When we, the authors of this book, started our careers, personal computers had not yet been invented. Computers were large machines in air-conditioned rooms and we typed computer programs onto punched cards. Our phones had dials, they all looked the same, and the phone company owned them. If we wanted to do research, we went to a library, where the library catalog filled racks of trays containing 3 × 5 index cards. Social-networking sites were neighborhood pizza places and bars. The point is not that we are old; it is the speed and magnitude of the changes. Few current college students remember a time before smartphones existed. The way you use computer systems and mobile and wearable devices, personally and professionally, will change substantially in two years, in five, and in ten, and almost unrecognizably over the course of your career. The ubiquity of computers, the rapid pace of change, and their myriad applications and impacts on daily life characterize the last few decades of the 20th century and the beginning of the 21st.

*This is a measure of processing speed. One megahertz is 1 million cycles per second; 1 gigahertz is 1 billion cycles per second. "Hertz" is named after the 19th-century physicist Heinrich Rudolf Hertz.

It is not just the technology that changes so fast. Social impacts and controversies morph constantly. With PCs and floppy disks came computer viruses and the beginnings of a huge challenge to the concept of copyright. With email came spam. With increased storage and speed came databases with details about our personal and financial lives. With the Web, Web browsers, and search engines came easy access by children to pornography, more threats to privacy, and more challenges to copyright. Online commerce brought bargains to consumers, opportunities to entrepreneurs, and identity theft and scams. The connection of infrastructure systems such as the electric grid to the Web brought risk of sabotage by foreign

governments. Mobile phones have had so many impacts that we discuss them in more detail later in this chapter and in [Chapter 2](#). With hindsight, it might seem odd that people worried so much about antisocial, anticomunity effects of computers and the early Internet. Now, with the popularity of social networking, texting, and sharing video, photos, and information, the Net is a very social place. In 2008, “experts” worried the Internet would collapse within two years because of the demands of online video. It did not. Privacy threats of concern several years ago seem minor compared to new ones. People worried about how intimidating computers and the Internet were; now toddlers operate apps on tablets and phones.


Discussions of social issues related to computers often focus on problems, and indeed, throughout this book we examine problems created or intensified by computer technologies. Recognizing the benefits is important too and is necessary for forming a reasonable, balanced view of the impact and value of the technology. Analyzing and evaluating the impact of new technologies can be difficult as some changes are obvious while others are more subtle. Even when benefits are obvious, the costs and side effects might not be, and vice versa. Both the technological advances brought about by computer technology and the extraordinary pace of development have dramatic, sometimes unsettling, impacts on people’s lives. To some, this is frightening and disruptive. They see these changes as dehumanizing, reducing the quality of life, or as threats to the status quo and their well-being. Others see challenging and exciting opportunities. To this group, the development of technology is a thrilling and inspiring example of human progress.

When we speak of computers in this book, we include mobile devices such as smartphones and tablets, desktop computers and mainframes, embedded chips that control machines and devices (from sewing machines to oil refineries to smart watches), entertainment systems (such as video recorders and game machines), and the “Net,” or “cyberspace.” Cyberspace is built on computers (e.g., Web servers), communication devices (wired and wireless), and storage media, but its real meaning is the vast web of communications and information that includes the Internet and more.

In the next section, we look at phenomena, often unplanned and spontaneous, that computer and communication technology made possible. Some deeply change how we interact with other people and what we can accomplish. In the rest of the chapter, we introduce themes that show up often, and we present an introduction to some ethical theories that can help guide our thinking about controversies throughout the rest of the book. The next seven chapters look at ethical, social, and legal issues primarily from the perspective of any person who lives and works in a modern computerized society and is interested in the impact of the technology. The final chapter takes the perspective of someone who works as a computer professional

who designs or programs computer systems or as a professional in any area who must make decisions and/or set policy about the use of computer systems. It explores the ethical responsibilities of the professional. The Software Engineering Code of Ethics and Professional Practice and the ACM Code of Ethics and Professional Conduct, in [Appendix A](#), provide guidelines for professionals.

1.2 Change and Unexpected Developments

No one would design a bridge or a large building today without using computers, but the Brooklyn Bridge, built in the 1870s and 1880s, is both a work of art and a marvelous feat of engineering. The builders of the Statue of Liberty, the Pyramids, the Roman aqueducts, magnificent cathedrals, and countless other complex structures did not wait for computers. People communicated over long distances by letters and then telephone. People socialized in person before social-networking sites. Yet, we can identify several phenomena resulting from computer and communication technology that are far different from what preceded them (in degree, if not entirely in kind), several areas where the impacts are dramatic, and many that were unanticipated. In this section, we consider a sampling of such phenomena. In [Section 1.2.1](#) , we look to the future and speculate about impacts of self-driving cars. Some of the other topics we consider are routine parts of our lives now but did not exist a generation or so ago. They illustrate the amazingly varied uses people find for new tools and technologies. Most of these developments have clear benefits; we include questions that raise concerns about potential problems.

It is precisely this unique human capacity to transcend the present, to live one's life by purposes stretching into the future—to live not at the mercy of the world, but as a builder and designer of that world—that is the distinction between human and animal behavior, or between the human being and the machine.

—Betty Friedan³

1.2.1 Self-Driving Vehicles

Social scientists have credited and blamed the automobile for huge changes in our environment and lifestyles: suburbs, pollution, freedom, family vacations, ending lives, and saving lives. Will self-driving cars have similarly broad impacts? We briefly run through some possible results and some ethical, legal, and social issues. Our purpose is not only to learn about self-driving cars but also to “warm up” our thinking about potential consequences of technology throughout this book.

Perhaps the biggest benefit of self-driving cars is that they will save lives. Currently, roughly 35,000 people die in vehicle crashes each year in the United States. Human error is a cause or *the* cause of roughly 95% of crashes. Undoubtedly, there will be some fatal crashes of self-driving cars because of unanticipated situations, software bugs, or design errors, but the total number is likely to be far lower than for human drivers.

It is likely that in many situations people will summon a car when needed from a service, perhaps provided by a joint venture between a car manufacturer and a car-sharing app. (Journalist Christopher Mims suggested a few names: Applegewagen, Tyft, and Goober.⁴) A trip in a self-driving car will be cheaper than a ride-sharing trip with a driver. An even less expensive car-pooling service might pick up other passengers nearby, especially at rush hour. Software can quickly determine which nearby customers are going to similar destinations, and the car-sharing service can screen members for safety when riding with strangers. How will self-driving-car services affect mass transit?