TECHNOLOGY AND SOCIETY

Building Our Sociotechnical Future

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Introduction

Technology is a powerful component of the modern world. Without technology, many of the most significant feats of the twentieth century could not have been achieved such as sending people to the moon, erecting skyscrapers, damming enormous rivers, and destroying entire cities. But the most significant, though less often recognized, power of technology is its permeation of so many aspects of our everyday lives. We use technology to house, clothe, feed, entertain, and transport ourselves. It is a crucial component of our work, play, education, communication, child rearing, travel, and even reproduction. Technologies have even become a central part of our identity; when we differentiate our world from that of a hundred years ago, or even ten years ago, one of the most striking differences is the technologies we use and the way they shape our daily lives.

We have embraced technologies because of the wonders we have accomplished with them and the promise that they will continue to unlock new possibilities. Technologies have helped us to eradicate diseases, communicate with friends around the world, and even eliminate bad breath. New technologies are often equated with progress itself in large part because they can help us to do things that were not previously possible and solve problems that have plagued humanity for centuries.

Nevertheless, technological development has not been an unqualified blessing. Technologies frequently have negative social and environmental side effects; can enable a (desirable or undesirable) shift of power from one group to another; or can be ''misused'' and have destructive consequences. The effects and implications of some technologies were perceived as disturbing as soon as they were developed—like the atomic bombs dropped on Hiroshima and Nagasaki. Other technologies manifested problems more slowly—like the damage done to the environment that has accumulated over the past few hundred years from chemical pesticides and fertilizers.

The negative effects of technology present us with a formidable challenge. It seems obvious that technologies will be indispensable in solving current problems and ensuring a better future, and yet we have to acknowledge that deploying technology is likely to create new problems and constraints. The challenge of taking advantage of the benefits of technology while minimizing the negative consequences of doing so is one that faces all of us, because all of us make decisions that shape or direct the development and use of technologies. For instance, venture capitalists and government officials decide which areas of science and engineering to fund with their budgets. Corporate executives choose the types of products to bring to market. Engineers shape the specific design and applications of technologies. Marketers decide how technologies are presented to the public. Regulators develop systems to help ensure that industries develop products that are safe and efficient. Advocates working with Non-Government

Organizations (NGOs) encourage the development of alternative technologies corporations may have overlooked; they voice concerns about technologies they believe governments should regulate. And finally, every individual decides whether, where, when, and how they will use new technologies at home, in public places, and at work.

Often these decisions are difficult, must resolve competing values, and require some negotiation. In some cases, the negative effects of a particular technology have been reluctantly accepted as necessary in order to reap its benefits—like the yearly death toll on our highway transportation systems. In a few cases the potential disruptive effects of particular technologies have convinced some countries to ban or restrict their use—like prohibiting CFCs as propellants, not allowing thalidomide to be prescribed to women who are or could become pregnant, and using politics (and sometimes war) to prevent other countries from developing nuclear capabilities. In yet other cases, controversies persist as to how a particular technology should be integrated into society—like the unresolved debates about nuclear power, stem cell research, and file-sharing.

These debates are not simply about how to best limit injuries and deaths that could be caused by new technologies. Those are difficult and important questions, but they do not address all the possible implications. Debates about technology are discussions about how it should and should not shape the fabric of tomorrow's society. Technologies do not entirely determine what the world will be like in the future, but they structure our lives, our capabilities, and our relationships with other people. The implementation and use of new devices and techniques create new possibilities while simultaneously making other avenues more difficult. Thus, even if a technology is non-controversial, decisions about how to develop it, and when and how to use it, can make a significant difference for future economic, political, and social well-being. Because of the significant implications of technological decisions, they should not be taken lightly.

This book is designed to inform and enlighten decisions about technology. It is based on the idea that to direct technology in the most beneficial ways, we need to know more than science and engineering traditionally offer—we need an understanding of how devices, techniques, people, institutions, goals, and values are intertwined. This more complex understanding of the world can empower those who design, fund, market, distribute, regulate, use, and dispose of or recycle technology to build a better future. Making informed decisions about technology is not simply a process of maximizing benefits and minimizing problems; it requires careful reflection on the values that are at stake and thoughtful deliberation about the best strategies to realize those values.

The readings in this volume provide conceptual tools, theories, case studies, and a multitude of ideas for thinking about the relationships between technology, society, and values. They present the views of lawyers, engineers, philosophers, sociologists, anthropologists, economists, politicians, science fiction writers, journalists, and others who reflect on the ways in which technologies are conceived, created, and integral to society and how social, economic and cultural forces and conditions shape and are

shaped by technology. Together these readings present an interdisciplinary approach to technology studies while providing access to a wide array of specialized expertise.

The book continually poses three important questions. First, how does technology constitute the world? The volume explores the variety of ways by which machines and techniques are embedded in society and thereby shape institutions, relationships, and values. This exploration provides a basic understanding of how technology and society are intertwined, an understanding that is essential to any attempt to shape the future. Second, what kind of future is desirable? The authors of many of the articles argue that certain values are of key importance to a just society and challenge the reader to consider which values are most dear and which are most defensible. Careful deliberation and discussion of values and goals is vital if we are to make wise decisions about our future. And third, how can technology be steered to achieve a better future? Only when the role of technology in society is understood can strategies be developed to get from here to there. This book identifies a number of ways in which others have had an important effect on our future through technological decision making.

The starting point for answering these questions is, as already indicated, with an understanding of the ways in which technology and society are inextricably intertwined. Just as technology influences the kind of society we have, society influences the kind of technologies that are developed. This means that one cannot understand either as separate. Indeed, technology and society are complex interconnected systems.

The book argues that technology should not be understood to be material objects alone. Technology neither exists nor has meaning without the human activities of which it is a part and similarly, many social practices would be impossible or incomprehensible without material objects. Thus, to understand the ways in which technology permeates and constitutes our everyday lives, we have to examine material objects together with the social practices and social relationships that make the material objects possible and useful. The book refers to these combinations as ''sociotechnical systems'' to emphasize the idea that material objects and social practices are inseparable.

Thinking in terms of sociotechnical systems instead of artifacts is not just an academic exercise. This approach provides a window into the ways in which technologies are intertwined with values. Technologies are developed, promoted, and used because people perceive that they will fulfill a certain need, accomplish a certain task, or achieve a certain goal within a given set of circumstances. Technologies are not simply chosen at random. People are motivated to integrate technologies into the fabric of society because they have certain values and they want to promote those values. Once created, sociotechnical systems can sometimes seem to take on a power of their own. They facilitate and constrain certain actions and thereby facilitate and constrain certain values. In other words, the intertwining of society and technology is not neutral; it is value-laden. Values shape the technologies we get and technologies subsequently have a significant effect on the values that are realized in a society. For example, some technologies facilitate democratic decision making; others reinforce race and gender

bias; yet others facilitate individual independence and autonomy and erode community cohesion. Whether these values are thought to be cultural, social, moral, political, or whatever, recognition of this aspect of technology has important implications for future technological development.

The processes by which technologies are created, imbued with values, and come to affect the world are far from simple. In order to effect change in such a system, one must understand the complexity of sociotechnical systems. Many actors and many kinds of uncertainty are at work in the development and functioning of sociotechnical systems. All of those who help shape technology—engineers, business people, policy-makers, and even users—are not just cobbling together artifacts and giving them meanings and uses, they are building the framework and social structure for the society in which humans live. There are many different kinds of complexity here. The task of developing technology requires that individuals work on small components of enormously large projects and therefore must coordinate their work with many different actors and make sometimes-risky decisions in endless iterations of designs and decision making. Users may see something in a technology that the engineers who designed it or marketers who advertise it never even considered. Politicians and government agencies make decisions about technology in extremely complex economic and political environments. Cultural norms including those with regard to race, class, and gender are at work in sociotechnical systems. Once we acknowledge that technology is a combination of things and people, i.e., that it is sociotechnical systems, and that sociotechnical systems affect and are affected by values, then it follows that those who contribute to the production and use of a sociotechnical system are not just building a 'thing'; they are building society and making value decisions that will affect society.

With this understanding in hand, we are better equipped to think constructively about the future and explore the issues and challenges that face us in the twenty-first century. Many aspects of the current world now pose daunting challenges. How are we to continue to improve upon health care and assure equal access? How can privacy be protected while at the same time achieving adequate security? How will globalization affect the lives of individuals around the world? An understanding of how technology and society are intertwined and how values are woven into this relationship is essential to making informed choices to meet these challenges.

This book does not provide any simple algorithms for solving the challenges of the future. Rather, the readings are put together with the idea that individuals and institutions need a particular kind of understanding of technology, society, and values in order to make informed choices. Politicians, business people, engineers, technology users, and concerned citizens are not only affected by technology, they also play an important role in shaping modern technology. By reflecting on the relationship between society and technology and carefully considering how values may be affected, individuals are better situated to advance the values they cherish. This book has been designed to frame discussions about the future and how technology might be managed to get us there.

Many who are interested in technology are motivated by the possibility of making the world a better place—for themselves and for others. While this book provides an understanding of the relationship between technology and society, the ultimate intent is not simply to inform, but to challenge readers and equip them to be agents of change in our sociotechnical future. This book offers encouragement and guidance for that quest. It offers a way of thinking about technology and society that can lead to better technologies, and a society better able to make decisions about the future.