

A COMPANION TO AMERICAN TECHNOLOGY

Edited by
Carroll Pursell

A Companion to American Technology

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Contents

Notes on Contributors	vii
Introduction <i>Carroll Pursell</i>	1
PART I BEGINNINGS	
1 Technology in Colonial North America <i>Robert B. Gordon</i>	9
2 The American Industrial Revolution <i>James C. Williams</i>	31
PART II SITES OF PRODUCTION	
3 The Technology of Production <i>Carroll Pursell</i>	55
4 Technology and Agriculture in Twentieth-Century America <i>Deborah Fitzgerald</i>	69
5 House and Home <i>Gail Cooper</i>	83
6 The City and Technology <i>Joel A. Tarr</i>	97
7 Technology and the Environment <i>Betsy Mendelsohn</i>	113
8 Government and Technology <i>Carroll Pursell</i>	132
9 Medicine and Technology <i>James M. Edmonson</i>	156
PART III SITES OF CONTEST	
10 The North American “Body–Machine” Complex <i>Chris Hables Gray</i>	179

11	Gender and Technology <i>Rebecca Herzig</i>	199
12	Labor and Technology <i>Arwen P. Mohun</i>	212
PART IV TECHNOLOGICAL SYSTEMS		
13	The Automotive Transportation System: Cars and Highways in Twentieth-Century America <i>Bruce E. Seely</i>	233
14	Airplanes <i>Roger E. Bilstein</i>	255
15	Technology in Space <i>Roger D. Launius</i>	275
16	Nuclear Technology <i>M. Joshua Silverman</i>	298
17	Television <i>Douglas Gomery</i>	321
18	Computers and the Internet: Braiding Irony, Paradox, and Possibility <i>Jeffrey R. Yost</i>	340
PART V PRODUCING AND READING TECHNOLOGICAL CULTURE		
19	The Profession of Engineering in America <i>Bruce Sinclair</i>	363
20	Popular Culture and Technology in the Twentieth Century <i>Molly W. Berger</i>	385
21	Art and Technology <i>Henry Adams</i>	406
22	Critics of Technology <i>David E. Nye</i>	429
	Index	453

Notes on Contributors

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Aviation and Aerospace Industry (2nd edition, 2001). The official NASA history *Stages to Space: A Technological History of the Apollo/Saturn Launch Vehicles* (1980), received the history award for 1979 from the American Institute of Aeronautics and Astronautics and was released in a second edition by the University of Florida Press in 2003. His latest book is *Testing Aircraft, Exploring Space: An Illustrated History of NACA and NASA* (2003). He is also the author of several dozen articles and book chapters.

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Robert B. Gordon is professor at Yale University in the departments of Geology and Geophysics and Mechanical Engineering, and

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Betsy Mendelsohn studies how law, science and technology have interacted to shape environmental quality in the United States. She is finishing a book about how Chicago managed surface water to meet its needs for clean water, drainage, sewerage, navigation, and secure property boundaries. Her next book describes how science and law interacted to resolve environmental conflicts during the period 1850–1940. She earned her history PhD from University of Chicago as a US Environmental Protection Agency graduate fellow. She is the co-chair of Envirotech, a special interest group of the Society for the History of Technology, and is a postdoctoral fellow in the history of environment and technology at the University of Virginia's School of Engineering and Applied Science, Department of Science, Technology and Society.

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James C. Williams is Professor Emeritus of History at de Anza College, was formerly the Treasurer of the Society for the History of Technology and is currently Vice President of the International Committee for the History of Technology. He is the author of *Energy and the Making of Modern California* (1997).

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Introduction

CARROLL PURSELL

Americans live lives saturated with technology. They are certainly not unique in that, but this is no reason not to accept responsibility for attempting to discover how that happened, what shape it takes, and what it means. This *Companion* is designed to give us a place to start on that voyage of self-discovery.

First let us deal with the problem of definition. Those of us who study technology for a living are often challenged to define what that is. In fact, no single definition has been imposed upon the authors because, in my opinion at least, no single definition is possible. This is not because defining technology is difficult – indeed, the problem is the opposite: it is all too easy. Such chestnuts as “applied science” or “the tools with which we make things” spring to mind, but are immediately seen as too partial to serve.

As Leo Marx has famously pointed out, the word itself is of fairly recent origin. For most of American history such phrases as the *mechanical*, the *practical* or *industrial arts* stood for the stock of tools we used and the knowledge of how to use them. *Technology*, as both a word and a concept, replaced these older terms, in Marx’s estimation, sometime between the two world wars. During the period roughly from 1880 to 1920, he claims, both the character and representation of “technology” changed dramatically, eliding the accustomed identification of the older terms with real and specific tools and processes.

These tools and processes were displaced by great systems of power and production, in railroads and chemical, electrical and other industries, which were “large-scale, complex, hierarchical, centralized.”¹ A telling case in point is the contrasting ways in which the Ford company represented its automobiles to the public. At the 1915 Pan-Pacific Exposition in San Francisco, Ford set up an actual assembly line so that viewers could see for themselves the miraculous way in which the Model T was produced. A quarter century later, at the New York World’s Fair of 1939–40, the emphasis had shifted from the artifact and how it was made to the *image* of the happy, fulfilled lifestyle which could be yours if you bought a Ford.

The cutting loose of the representation from the things themselves also marked an ideological shift from the Enlightenment notion of first defining the good life or the just society through rational argument and political debate, and then using particular tools to help create those ideals, to a modern urge to define that good life and just society in terms of technological progress. In other words, this new floating signifier *technology* became the end and not the means of our lives. All this is a powerful

reminder that what words we use, and what we mean by them, is critical to our political and social, as well as personal being.

A problem closely related to that of definition is the way in which I have chosen to organize this book as shown in the Table of Contents. *Beginnings* seems straightforward enough. Most of the chapters that follow concentrate on the twentieth century but Americans had technology long before then of course. Indeed, the idea that we somehow live in a “technological age” whereas previous generations did not is not only nonsense but profoundly ahistorical. One can argue in fact that since our use of technology is one of the major ways of separating us from other animals, humankind has always lived in a technological age. In discussing the Technology of Colonial North America, Robert Gordon begins with that of the indigenous Americans, moves through that of the Spanish settlers, before focusing on the more familiar stories of Northern European activities. For the 1800s, James Williams chronicles the changes of the “Long Century,” encompassing the Industrial Revolution in America and its spread across the continent, setting the stage for the so-called Second Industrial Revolution of the twentieth century.

Sites of Production seems somewhat less straightforward. Factories and farms; yes of course. Cities and the environment are where we expect to find factories and farms so they may be accepted as well. The home is more often thought of as a site of consumption than of production, though, of course, a great deal of consumption (of coal, steel, fertilizers, pesticides, petroleum and so forth) goes on in factories and on farms. How though do we justify government and medicine as topics of production? These last two tip us off that sites of production are also sites of contest.

The essay on Manufacturing Technology covers the familiar subjects of Armory Practice and Mass Production, but also shows the ways in which the latter influenced the way in which ships and houses came to be made. As Deborah Fitzgerald’s essay on Agriculture reveals, the ideal of the “Factory Farm” provided both a roadmap for agricultural change and a model of what the modern farm should look like. Gail Cooper’s essay on House and Home chronicles the way in which houses are networked into systems of utility, and the gradual integration of appliances into the home. The “house,” in other words, has become a part of technological systems from electrical grids to electric toasters. Cities are “home” to millions of people and, according to Joel Tarr, are shaped and serviced in much the same way as Cooper’s homes. From walking cities to “edge” cities, technology has played a critical role in the way urban geography and urban life have been formed, not always by design.

In writing on the Environment, Betsy Mendelsohn includes under that term both wilderness and urban neighborhood air quality. Our own particular “environments” are ones in which we necessarily consume not only food but air and sensory perceptions. Work environments, whether the factory floor or the office cubicle, are places where we both consume and produce. Governments at all levels play a critical part in production: setting the rules, defining the playing field, offering incentives or disincentives. The most passionate libertarian walks the streets, flies in and out of airports, lives under the shadow of the law. In a democracy, governments are the chosen instruments with which we produce the conditions of our lives. As James

Edmonson points out, medical technology at the very least *reproduces* good health and well-being. The “mechanical fix,” he asserts, tends to be preferred to preventative medicine.

The Body, according to Chris Hables Gray, is “one of the main sites of technological innovation in America.” Whether or not that should be so, of course, is hotly debated. Technology moves the body about (cars, for example), decorates them, reshapes them, and makes them perform more to our liking. Tattoos, birth control pills, cloning, and penal implants can all cause an argument and, in some cases, perhaps sway an election. Even the very notion of gender, or at least its malleability, is controversial. Rebecca Herzog notes that so basic a technology as the water closet (more commonly called a toilet in the US) is gendered in ways that most people accept without thinking unless the line at the “ladies” room is impossibly long. It is one of those technological spaces which compel us to make the “right” decision about our own gender identification or risk not only the wrath of our colleagues but the majesty of the law. And finally, Arwen Mohun analyses the ways in which class is shaped by and determines technological choices. Matters of skill or unskill, for example, are deflected by notions of class and the extent and form of technological alienation are closely tied to class. It is ironic that in a country where *everyone* considers themselves “middle class,” historians have concentrated more on the relationship between machines and the working class than any other.

Sites of Contest itself becomes clear as a subheading only when we see the topics that have been subsumed under it. The body and gender are both, most scholars would argue, socially constructed and labor is, as always, very much about class which too is socially constructed. Originally an essay on race and technology was planned, but finally proved impossible to include. Race, too, we now understand is socially constructed. What most scholars mean by that term, I think, is that race, class, gender and the body (and other things as well, like sexuality and ethnicity) are categories that, while more or less agreed upon by societies in any particular time and place, lack the kind of essentialist quality that is so often attributed to them. All of these are contingent as well as contested, but they are also sites where meaning is produced.

Technological Systems seems to put us back on a more solid footing – we are talking about things, and in the case of this book the very most obvious, ubiquitous, and iconic things at that. Although not an American invention, the automobile is intimately connected not only to the nation’s economy but to its very self-conception. As Bruce Seely shows, the car along with the highway is an American totem of great power. Despite excited predictions that the airplane would replace the car as a mode of personal travel, Roger Bilstein shows that commercial and military applications quickly took precedent in aviation development. Rockets and space flight, on the other hand, grew largely out of the circumstances of America’s international rivalries, according to Roger Launius. M. Joshua Silverman emphasizes the dual nature of the promise and practice of nuclear technology: energy and medical treatments, for example, on the one hand, but toxic wastes and weapons of mass destruction, on the other. Douglas Gomery describes how television took a half century to materialize, but then became a major factor in the way Americans spend their time and understand their

world. Along with the car and television, the computer has a ubiquitous and totalizing influence on American life. Jeffrey Yost emphasizes the “ironic” nature of the complexities of the computer’s development.

Producing and Reading Technological Culture seems almost as unproblematic but hides a few complexities. It would be wrong, I think, to read it as meaning that engineers produce the culture and painters, let us say, or novelists, do the interpreting. Engineers stand ready and willing to interpret our technological culture (they do it all the time in fact), and cultural production is the very purpose of Hollywood and academic departments of humanities, of High Art and Popular Art.

Bruce Sinclair traces the practice and the public understanding of engineers from the manly heroes of the early twentieth century to the “nerds” and “geeks” of a century later. Dilbert is a sympathetic and competent engineer, but more anti-hero than hero; more “everyman” than elite. Molly Berger looks closely at the ways in which our popular culture figures both engineers and technology in general. She finds that while many “popular” expressions of culture would appear to express a bottom-up picture of technology, they are often commodities produced by particular people for particular purposes. The High Art of paintings, sculptures, photographs and the like, links the complications of defining technology with the equally slippery definitions of “art.” Henry Adams, in his essay, calls for a new art history which places art in not just a social context, but one of technological development as well. And finally, David Nye discusses the tradition of questioning our technology even as we elaborate it. Since the late eighteenth century, he shows – that is from the dawn of the industrial age – there have been individuals and groups which have asked the hard political, social, and moral questions of technology as a whole as well as its various components.

In fact none of these categories will withstand too close an inspection. It is an article of faith among historians that everything including the word “technology” and everything signified by it is contingent and contested. *Contingent* because, as historians, we insist that things change through time and the understanding of any one historical moment is not frozen in time but was something else before and became something else as time moved on. Not only did the means of travel change with the coming of the automobile, but the very idea and meaning of travel as well. It was one thing to be an “engineer” in the early nineteenth century, but quite another at the end of the twentieth. What it took to be manly – a concept long associated with the possession and use of technologies – in one period did not prove adequate in another.

All this is also *contested* because at any one time there were competing measures of masculinity and while one is usually hegemonic at any point in time, it is never universally accepted. The definition of the word *technology*, as we have seen, is still contested: it will not be obvious to everyone that *the body* deserves a place in a book such as this or that wearing glasses makes us cyborgs. One very important contest being fought out in our own time is whether the factory model of farming is either efficient or constructive of the kind of society in which we want to live. (And the Good Society, of course, is a concept that has always been fought over and redefined – while, it should be pointed out, the role of particular technologies in furthering or eroding one’s own idea of the Good Society is an important part of that debate.)

The history of technology, as a self-conscious academic field, is hardly a half-century old.² It came together during the post-*Sputnik* years when rapid technological change was devoutly desired to keep the Americans ahead of the Soviet Union. Both the economy and defense seemed to be based on Americans' ability to invent, engineer, and impose their technologies on themselves, their allies, and the nations of Africa and Asia, newly emerging from the often violent decay of the great European empires. Understanding what Americans had done right in the past seemed useful to shaping sound policies for the future.

A second critical context of the emergence of this new field was that it tended to take place in engineering schools. As a profession, engineers had always suffered from a belief that they were not sufficiently appreciated; that the American public at large, while basking in a technological modernity, did not recognize where and from whom this all came about. Not surprisingly many early historians of technology had some engineering background, either through training or practice. This meant that such scholars had a close and insiders' knowledge of the machines and tools they wrote about, but it also meant that they were sometimes inclined by training, practice, and employment to have a basically uncritical view of what it all meant. Progress was the measure of civilization, and technology was the engine of that progress.

Being centered in engineering colleges also meant that women were not often found in their ranks. Both the subject ("toys for boys") and the engineering departments which provided the employment for these scholars were not welcoming to women. This was importantly true also of the larger historical profession, and of academia as a whole, but the history of technology seemed particularly masculine. All this constituted a serious limitation on who would be likely to take up the subject, but also worked to limit what subjects were taken up at all.

Over the past half century, however, many of these limitations have been swept aside and new scholars as well as new topics have become a part of the shared enterprise of understanding the history of technology.³ This book is a snapshot in time of what we now know, and in what we are interested.

NOTES

- 1 Leo Marx, 'The Idea of Technology' and Postmodern Pessimism, " *Does Technology Drive History? The Dilemma of Technological Determinism*, eds Merritt Roe Smith and Leo Marx (Cambridge: MIT Press, 1994), p. 241. See also Lewis Mumford, 'Authoritarian and Democratic Technics,' *Technology and Culture*, 5 (Winter 1964), 18.
- 2 See Bruce E. Seely, 'SHOT, the History of Technology, and Engineering Education,' *Technology and Culture*, 36 (October 1995), 739-72 and John A. Staudenmaier, 'Rationality, Agency, Contingency: Recent Trends in the History of Technology,' *Reviews in American History*, 30 (March 2002), 168-81.
- 3 Carroll Pursell, 'Seeing the Invisible: New Perspectives in the History of Technology,' *Icon*, 1 (1995), 9-15.

PART I

BEGINNINGS

