PART II

Technology

In Chapter 2, we survey how media technology has evolved from the creation of print to the evolution of the internet. We highlight the distinctive features of each new technology and how they might have enabled significant social change. We also consider how social forces helped shape these technologies in unexpected ways.

We begin with technology in large part because technological innovations have enabled the significant transformation of the media industry in recent years. With the digitization of media and the maturing of the internet, boundaries among different media forms have blurred, new media forms have emerged, and fresh questions about what this all means are plentiful. Ironically, one of the best ways to make sense of our rapidly changing media technologies is to look back at the evolution and impact of earlier technologies.

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CHAPTER

2 The Evolution of Media Technology

From printed paper to digital screens, technology underlies all systems of mediated communication. To understand how media work, we need to consider these technologies and their significance. In this chapter, after briefly reviewing the history of media technology, we examine some of the scholarly approaches to understanding technology and then use some of these ideas to explore the evolution of media technologies from print up through the internet. As we will see, technology matters in making each medium unique. However, each technology is influenced by a variety of social forces, including how the media industry elects to deploy it, whether and how users choose to adopt or adapt it, and whether and how governments opt to regulate it. Together, all of these elements—which are components of the media model from Chapter 1—make up technology's story.

Learning Objectives

After studying this chapter, you will be able to

- LO 2.1: Pinpoint significant developments in the history of media technology
- LO 2.2: Identify variations of technological determinism
- LO 2.3: Describe the features of social constructionism
- LO 2.4: Document the tension between technological determinism and social constructionism as new media technologies emerged from print through television
- LO 2.5: Describe the birth, growth, and characteristics of the internet

The History of Media Technology

One way to tell the story of media is through the history of its technology (Brigs and Burke 2009; Kovarik 2016). For most of human history, communication was conducted face-to-face. Then, centuries of one-of-a-kind creations followed, including artwork on cave walls, carvings in stone, impressions on clay tablets, and marks on bamboo or papyrus. Along the way, humans invented numbers and written language. But it was not until the invention of paper in China around the year 100 and printing, 500 years later, that communication using a medium began to be reproducible. By about 800, book printing began, using a single, carved wooden block to reproduce each page. For the first time, technology enabled the preservation and distribution of human thought to many others through the creation of duplicate copies. We had become a "world on paper" (Olson 1994).

Over time, the printing process was improved, but for 1,000 years print *was* media technology (see Figure 2.1). However, 19th-century industrialization drastically increased the pace of technological innovation, bringing the telegraph, camera, telephone, phonograph, radio, and motion pictures in rapid succession. The world of media technology became much more diverse. In the 20th century, these media—along with television and the internet—were refined and developed into the commercial industries we know today, utterly transforming communication worldwide. Technology in the 21st century has enabled new social transformations by integrating digital multimedia platforms into all aspects of our lives and by making media-creating technology more accessible to ordinary users.

Figure 2.1 Timeline of Select Media Developments

Year	Media-Related Advancement
100	Papermaking is developed in China
600	Printing using carved blocks of wood begins in China
800	First books are printed in China, using a single wood block for an entire page of text
1000	Movable clay type—with one piece of type for each character—used in China
1200	Movable metal type developed in Korea
1450	Modern, hand-operated printing press with movable type is developed in Germany
1600	First newspapers appear in Germany, France, and Belgium
1700	1702 London's *Daily Courant* becomes the first English-language daily newspaper
1800	1833 First low-cost "penny press" newspaper, the *New York Sun,* appears
	1837 Electric telegraph is patented
	1839 Early photographic camera for commercial sale is introduced
1850	1876 Telephone is patented
	1878 First practical sound recorder and player is patented
	1879 Electric light is patented
	1894 Motion pictures are invented and the first short films are shown to the public
	1895 Radio messages are first transmitted
1900	1920 Regularly scheduled radio broadcasting begins in Pittsburgh
	1927 *The Jazz Singer* is the first feature-length film with synchronized speech
	1928 Electronic television is first demonstrated
	1937 First digital computer is created from telephone parts
	1941 First commercial television is broadcast
	1946 Mainframe computer is invented
	1948 Early cable television captures and retransmits via wires local broadcast programs in areas with weak signals
	1949 Network television broadcasting begins in the United States
1950	1957 First communications satellite, *Sputnik*, is launched by USSR
	1961 Modern cable TV begins when a San Diego cable operator imports television broadcast signals from Los Angeles for distribution to subscribers

	1969 First nodes of the internet created as part of a Pentagon program
	1970 Videocassette recorder (VCR) appears; cheaper and popular by mid-decade
	1971 Microprocessor, essential for computer advancement, is invented
	1972 First video game console that connects to a TV is introduced
	1975 First microcomputer is marketed
	Fiber-optics transmission begins
	HBO is first to transmit programming to cable TV systems via satellite
	1982 Audio compact disk (CD) is introduced
	1990 World Wide Web (WWW) is released as simple user interface for a variety of data types
	1994 Commercial short message service (SMS), or "texting," begins in Finland
	Cyber stations (radio stations on the internet) first appear
	BellSouth introduces first multipurpose "smartphone"
	1997 Digital video disks (DVD) are introduced
	1997 First consumer WiFi service released
	1998 Digital TV broadcasting begins; in 2009 FCC makes digital signal mandatory
	Rio becomes the first popular MP3 player
	1999 Netflix launches DVD-by-mail subscription service; adds streaming in 2007
	Digital video recorders (DVR) are introduced
2000	2001 Satellite-based digital radio services grow with the launch of XM radio
	2002 Friendster social networking site launched; Facebook (2004) follows
	2003 Skype "over-the-top" internet telephone network is introduced
	2004 Flickr photo sharing site is launched
	Podcasts become more popular when made easier to find and download
	2005 YouTube video site is founded
	2006 First e-book reader is introduced
	Twitter microblogging service is founded
	2007 Hulu launched to stream commercial television programs and movies on demand
	2008 Roku, digital media player set-top box, simplifies internet streaming television
2010	2010 Apple's iPad helps spark revival in the dormant tablet computer market
	Instagram appears, helping make photo sharing wildly popular
	2011 Snapchat introduced, offering increased privacy via self-destructing messaging
	2015 Sling popularizes live TV streaming; others follow
	2016 Virtual reality enters the mainstream with Oculus Rift gear
	2018 Smart speakers—voice-activated digital assistants that serve as hubs for home automation—gain in popularity with Amazon's Echo (2015), Google's Home (2016), and Apple's Homepod (2018)

Sources: Crowley and Heyer (1991); Jost (1994); MIT Technology Review (2002–2017); Rogers (1986); Shedden (2010); and media accounts.

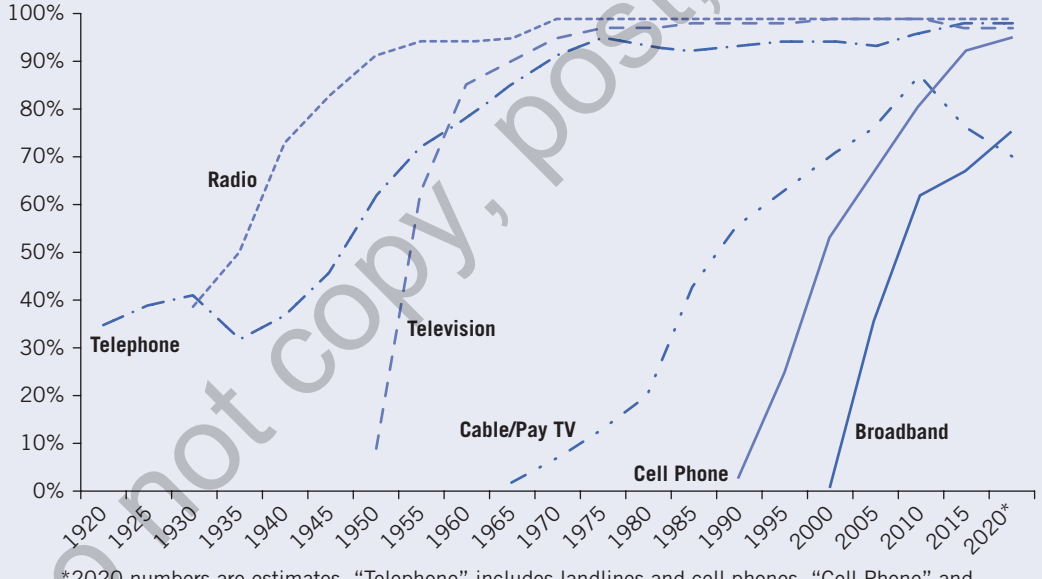
Given the inescapabilty of media and their significance in our lives, it's easy to forget that most forms of media technology simply didn't exist or were not widely available 100 years ago. Figure 2.2 shows adoption rates for select media technologies in the United States over the last century. Clearly, our media/society is a relatively recent development.

Figure 2.2 highlights another interesting fact about media: New technologies usually don't displace older technologies. Radio didn't destroy print; television didn't kill radio; and the internet has not put an end to television. Instead, media technologies tend to accumulate, contributing to the pervasiveness of media in our lives today.

How can we best understand this growing array of technology? How might it be affecting us? And why might this be important? Scholars have long debated such questions. There have been two general approaches to understanding the role of technology in society. The first, often referred to as "technological determinism," suggests that *technology* itself causes change, and often in unintended ways. The

Figure 2.2 U.S. Adoption Rates for Select Media Technology, 1920–2020

Much of the media technology we use today didn't exist a century ago. For the most part, older media have survived the introduction of newer media, resulting in a diverse and complex media environment.



*2020 numbers are estimates. "Telephone" includes landlines and cell phones. "Cell Phone" and "Broadband" refer to percentage of adults with access; other categories are household adoption rates. "Cable/Pay TV" includes cable, satellite, and fiber-optic access.

Sources: Adapted from the National Center for Health Statistics (2017); Pew Research Center (2017a, 2017b); U.S. Census Bureau (1999, 2012); U.S. Energy Information Administration (2017).

second, often referred to as "social constructionism" (or "social determinism" or "social constructivism") emphasizes that technology is made up of inanimate objects, and ultimately *people* decide how to use (or not use) technology. But even though debates about technology are often presented as a stark contrast between these two approaches, things are never quite so simple. In reality, nearly all scholars fall somewhere in between the extremes of pure technological determinism and social constructionism. We retain these well-known and usefully descriptive labels to identify general approaches to understanding technology. However, we consider them to be the opposite poles of a continuum rather than two mutually exclusive approaches. Technological determinists put more emphasis on the role of technology; social constructionists emphasize human agency. But nearly all scholars acknowledge a relationship between the social dimension of technology and their material components. The real debates are about the nature of this relationship and the degree to which technology or human action should be seen as the driving focus of change.

Technological Determinism

Technological determinism is an approach that identifies technology, or technological developments, as the central causal element in processes of social change. In other words, scholars who lean toward technological determinism emphasize the "overwhelming and inevitable" effects of technologies on users, organizations, and societies (Lievrouw and Livingstone 2006:21). This applies to all forms of technology, most of which have nothing to do with media. From this perspective, technology produces change, albeit often through a series of intermediary steps. For example, the invention of the automobile might be said to lead to a reduction in food prices because the automobile "reduced the demand for horses, which reduced the demand for feed grain, which increased the land available for planting edible grains," making food less expensive (Fischer 1992:8).

As we will see, critics argue that there is no human agency in this type of analysis. Pure technological determinism suggests that technological properties demand certain results and that actual people do not use technologies so much as people are used by them. In this view, society is transformed according to a technical, rather than a human, agenda. Critics contend this cannot be true. Technology is composed of inanimate objects; it is humans who cause things to happen by the choices they make and the actions they take.

However, this crude form of technological determinism is often an accusation leveled by critics more than a position advocated by scholars. In recent years, some scholars have adopted the language of "materiality" in arguing that the physical aspects of media technology matter in complicated ways (Gillespie, Boczkowski, and Foot 2014). In using this language, they hope to distinguish their approach from the simplistic caricature of technological determinism as well as social constructionism.

Lievrouw (2014:25) cautions that "[m]ateriality itself is a complex, multidimensional idea, and open to a variety of interpretations, emphases, and disciplinary

assumptions." There are many different meanings and uses of the term *materiality*, often making it difficult to pinpoint a single definition that would be acceptable to everyone using the term (Sterne 2014). Still, whether you call it a form of technological determinism or an emphasis on materiality, there is no doubt that the physical aspects of technology are of interest to contemporary scholars and to anyone who wants to understand the media.

Media's Materiality

It may seem odd to suggest that the inanimate objects making up technology can *cause* anything. But scholars who focus on the material influence of technology usually mean something more nuanced.

The obvious forms of materiality are the tangible objects and "things" that are involved in media communication—keyboards, screens, phones, paper, and the like. But materiality also includes things that we often forget have a physical foundation (Allen-Robertson 2015; Pinch 2008). Data are not objects, but they exist on hard drives and servers. If there was no material component to data, there would be no limit to the amount of data you could store on a computer hard drive. A change in materiality—the storage capacity of computers—has contributed to a change in how computers can be used. The internet is another example. Despite the popular metaphor, the internet is not an amorphous "cloud." Instead, data packets are transmitted along copper or fiber-optic cables to be displayed on our screens. As Blum (2012:9–10) reminds us, the internet is made of pulses of light "produced by powerful lasers contained in steel boxes housed (predominantly) in unmarked buildings. The lasers exist. The boxes exist. The buildings exist. The Internet exists—it has a physical reality, an essential infrastructure." All of these material elements are necessary and help shape how we experience the internet.

More directly, all media technology has "material" elements that help determine how it can be used. Each medium has its own technological capabilities and limitations that affect the delivery of words, sound, pictures, and video (see Figure 2.3). For instance, while many assumed that e-book technology would mostly be adopted by younger Americans, it was quite popular among older Americans. This reason for this was because of how this new technology could be used. While older Americans who struggled with their eyesight had for decades been limited to those few most popular books that were also printed in large type, for the first time e-book technology allowed readers to read nearly any book they want in nearly any size font that suited them, which reopened up a whole new world of books for some passionate older readers.

In this example, different technologies do not "cause" books to contain different content. However, because of their capacities and limitations, these different reading technologies enable different people to engage with them. In the same vein one could add that e-book technology allows someone to easily bring more books while traveling, while at the same time, print books can be displayed in a home as a conversation starter in a way that e-books cannot. So this is one way technology matters; it offers opportunities and places limitations on what a

Figure 2.3 Select Characteristics of Different Media

The technological capacities and limitations of each medium set the parameters for their use. However, the internet is, in effect, a generic platform that enables the delivery of all forms of media while adding unique, interactive capabilities.

	Text?	Sound?	Picture?	Video?	Live?	Interactive?[a]
Print	Yes	No	Yes	No	No	No
Radio	No[b]	Yes	No	No	Yes	No[c]
Film	No[b]	Yes	Yes	Yes	No	No
Television	No[b]	Yes	Yes	Yes	Yes	No
Sound recording	No[b]	Yes	No	No	No	No
Internet	Yes	Yes	Yes	Yes	Yes	Yes

Notes:

[a]We are using "interactive" here to mean a medium that enables easy, two-way communication between producer and user.

[b]Although digital radio, film, television (video), and sound recordings can show text on a screen, they are not primarily textual media.

[c]Two-way communication is possible using radio technology, but most modern radio sets do not allow for this.

medium can be used for and makes some types of media more suitable for some purposes than others. In this way, each medium can be said to influence its users.

"Autonomous Technology" and "Technological Momentum"

Technology matters in other ways, too. Scholars in science and technology studies (STS) have long noted that technology can "take on a life of its own," even though people create and use it. For example, Langdon Winner (1977:15) used the term *autonomous technology* as "a general label for all conceptions and observations to the effect that technology is somehow out of control by human agency." Winner argued that political, economic, social, and cultural conditions shape the creation of technology and are embodied in technological artifacts and processes. However, Winner contended that technology is so vast and complex that it has unintended consequences that users and society as a whole often cannot control. He portrays technology as a potentially Frankenstein-like creation that can seem bewildering and unmanageable, especially in periods of rapid technological change. Today, the unknown implications of robotics equipped with increasingly sophisticated artificial intelligence and machine learning (where computers adapt without needing to be explicitly programmed by humans) is perhaps the most extreme and best-known example of

potentially autonomous technology. In the world of media, the growing dependence on algorithms that humans create but often don't fully understand (which we discuss later) might also be seen as an example of "autonomous technology."

Similarly, Thomas Hughes's (1983) idea of *technological momentum* suggests that a technology's influence changes over time. When a technology is new, Hughes argues, humans have agency over the ways in which it is developed, deployed, and used. New technologies are still in flux and full of possibilities, as creators and users negotiate how the technology will be used. As time passes, though, a technology becomes established, routinized, and institutionalized, making it more difficult to contest or change. This can be because of investment costs, habit, or inertia, but once a technology is established, a culture develops around it, and it can gain a permanency that is difficult for people to alter or change. An example would be the electrical outlets that we plug all of our devices into, which are different around the world, and for as long as we have electrical outlets they will likely always be different around the world. While different regions of the world all making the decision to adopt different (locally standardized) prongs for electrical outlets happened at a time when global travel was less frequent, we are now stuck with our current system of different outlets and various adapters, as no region of the world is going to change all of their outlets and appliances to make life for tourists just slightly more convenient.

Both concepts from Winner and Hughes are examples of ways to think about how technology can exert some autonomous influence over actors in society (a notion associated with technological determinism) while acknowledging the agency of humans in creating technology (an idea compatible with social constructionism). Understanding technology in such ways accepts the push-pull interaction between the material (nonhuman) and the social (human) as an essential dynamic of technological systems.

Medium Theory

Media scholars and commentators have long been concerned about technology's possible negative impact on society. As early as the 1920s, there was worry that newly introduced media technologies—film and broadcasting—might have some inherent power to influence susceptible audiences. During the two world wars, for example, governments on both sides used radio and newsreel propaganda effectively, enhancing concerns about the impact to which these media technologies could be put. Later, television would be blamed for making people stupid, earning it nicknames such as the "idiot box" or the "boob tube." More recently, as we will see, the internet and smartphone technology have been criticized for possibly "ruining" an entire generation with their addictive properties. To varying degrees, all these critiques presented technology as overtaking society and diminishing human agency.

But such concern never constituted the bulk of media scholarship. "Autonomous technology" and "technological momentum," for example, are both ideas that come from science and technology studies, not media studies specifically. Historically, most media scholars have focused on media industries, the content they produce, and the users that consume it rather than on technology.

(We examine all of these topics later in the book.) Most media scholars have long argued that technology was essentially "neutral." Its effects depended on the media industries that implemented it and on the "active" audiences who used media technology and interpreted media messages (Buckingham 1993; Williams 1974).

The notable exception to this is work known as "medium theory" or sometimes "media ecology" to emphasize media environments (Meyrowitz 1985; Scolari 2012; Strate 2017). Medium theorists see media as more than conduits for the transmission of messages; they argue that the very nature of the medium can be the key to its social impact. From this perspective, media technologies can be powerful social forces, affecting how we perceive and understand the world.

All medium theorists take seriously the potential impact of technology, but they differ in the degree to which they acknowledge the influence of social factors. Some analysts can be called technological determinists, whereas others more clearly emphasize the balanced interaction of various social forces with technological developments. They also differ in their assessment of the social changes prompted by new technologies. Some analysts have chronicled the dire effects of new technology, whereas others have optimistically embraced new developments.

McLuhan's Optimism

The best-known variant of medium theory was the so-called Toronto School. Initiated by political economist Harold Innis (1894–1952) and popularized by literary scholar Marshall McLuhan (1911–1980), this work was carried out mostly by literary and cultural critics rather than social scientists. Initially, Innis was interested in the effect of macro-level technologies on entire societies, such as the difference between cultures with oral versus written traditions. McLuhan, on the other hand, focused on the media's influence on how individuals perceived and thought about the world.

McLuhan can be thought of as both a technological determinist and an enthusiast for the potential of the new media technology of his time, television. McLuhan (1964) argued that, if we are interested in understanding the influence of media, then we should focus our attention on the ways each new medium disrupts tradition and reshapes social life. The real message, for McLuhan, was not the formal content of media but the ways the media themselves extend our senses and alter our social world. McLuhan was quite insistent about this position, colorfully arguing that "the 'content' of a medium is like the juicy piece of meat carried by the burglar to distract the watchdog of the mind" (p. 32). What changes people, he argues, is not media content but the experience of the medium itself. Thus, McLuhan is best known for his succinct assertion that "the medium is the message" (McLuhan and Fiore 1967). If he were alive today, it's not hard to imagine McLuhan writing, for example, about how smartphones have altered our social interactions, regardless of what content we are accessing with them.

In an early work, *The Gutenberg Galaxy*, McLuhan (1962) focused on the shift from oral to print societies, exploring the social implications of the 15th-century invention of the modern printing press by Johannes Gutenberg. He argued

that new media technologies rework the balance of our senses, isolating and highlighting certain senses at the expense of others. Print, from this perspective, intensified the visual—we use our eyes to read—and separated it from other senses, in particular, sound.

In another work, *Understanding Media: The Extensions of Man*, McLuhan (1964) turned to the shift from print to electronic media, especially television. In it, he argued that, by delivering both images and sound, electronic media could help reconnect the senses that had been fragmented by print's exclusive focus on the visual, thereby bringing us back to a kind of preprint state of harmony. Further, McLuhan argued, by allowing us to see images and hear sounds from distant places instantaneously, electronic media are a global extension of our senses. "[W]e have extended our central nervous system itself in a global embrace, abolishing both space and time" (p. 19), he wrote. This perspective led him to optimistic predictions of the development of a new "global village"—a term he popularized—based on the wonders of communication technology.

In McLuhan's technological determinism, each medium was seen to shape our senses in such a way that certain social outcomes would be almost inevitable. Because the dominant media of an era are all-encompassing, McLuhan argued it is virtually impossible for people to see the ways technology influences them. Because McLuhan was generally an enthusiast for new technologies, this sort of stealth determinism did not alarm him. Instead, he saw electronic media as opening the door to new and more holistic ways of thinking.

Postman's Pessimism

Although McLuhan's vision of new technologies was an optimistic one, other analysts working in the tradition of technological determinism have cast a more skeptical eye on technology. For example, some critics—most notably Neil Postman (1931–2003)—argued that the rise of television was the central cause of the decline in the seriousness of public life. The underlying premise is that what we say is, in large part, the result of the form—or technology—we use to say it. According to this view, the substance of democracy—participation by an informed citizenry—was undermined by the rise of television. The properties of television encouraged, perhaps even dictated, particular ways of talking and thinking that were antithetical to serious debate and discussion. To envision an extreme version of this, think of the shouting matches on some cable news programming, or the "fluff" pieces or cute and silly videos that sometimes get included as "news." In the end, according to the title of Postman's best-known work, as a society infatuated with entertainment television that is no longer able to think seriously about social and political issues, we are *Amusing Ourselves to Death* (1985).

This kind of critique of the television age is often a nostalgic lament for the bygone days when print was the dominant form of media in American society. Following McLuhan, Postman (1985) argued that print-based societies changed how we think. But Postman saw literacy as encouraging rationality, seriousness, and coherence in both our ways of thinking and the content of public discourse.

Reading, Postman believed, creates a mind in which analytic thought, based on logic and clarity, is premium. Societies that rely on the printed word as the central means of both private and public communication, therefore, develop rational, serious populations, he argued. Postman identified 18th- and 19th-century America, which witnessed the birth and rise of U.S. democracy, as the most thoroughly print-based culture in history. Others have made similar arguments about the connection between print and rationality, suggesting that, for example, the development of the printing press played a key role in the rise of scientific thinking (Eisenstein 1979). Therefore, unlike McLuhan, Postman was concerned with the ways that, as a technology, television ostensibly replaced print and by extension caused the rational and logical print culture of America to be replaced by a culture obsessed with entertainment, triviality, and unconsidered emotional response.

While most of his focus was on television, Postman thought that the seriousness of print culture was already in decline before television's arrival because of other technologies, especially the telegraph and the photograph. The telegraph, according to Postman, challenged the world defined by print in three fundamental ways. First, because they could get information from faraway places, newspapers were full of stories that were largely irrelevant to their readers. News no longer had to have any relationship to its audience, nor did information have to be functional in any way—it just had to be "new." Second, because the telegraph made it easy to transmit so much information, little of which was relevant to the lives of readers, news no longer had any connection to action. People could not do anything about the things they read about in the paper. Information may have been abundant, but events were happening so far away and were so disconnected from people's lives that the news encouraged feelings of powerlessness. Third, in privileging speed and abundance of information, the telegraph sacrificed context. No longer did news have to be linked to any broader, historical framework. There was no need to connect one story to the next or one day's headlines to the next day's. The point was to keep the information flowing—to report the new things that happened—rather than to contextualize messages or events by linking them to prior messages or events. Quantity became more important than either quality or depth.

The photograph extended what Postman (1985) saw as a revolution in the ways we understand the world. Photos do not encourage logical argument or contextual knowledge. Instead, as Postman put it, "The point of photography is to isolate images from context, so as to make them visible in a different way" (p. 73). As the saying goes, a picture is worth 1,000 words. But Postman argued that, when we trade words for pictures, we lose something in the deal. The very meaning of information, of truth, is altered by a focus on the visual image of the photograph. Truth is no longer knowledge produced from logical thought, the kind of thinking that reading encourages. Instead, "seeing is believing."

If seeing is believing, then those who can skillfully manipulate what we see can also influence what we believe. A generation before Postman, historian Daniel Boorstin (1961) argued that the pervasiveness of visual images was changing the very meaning of "reality." Images have become so embedded in our consciousness, in this view, that it is becoming harder to discern the difference between image

and reality. It is not that we are losing our ability to think; it is that image-oriented pseudo-events blur the distinction between image and reality. *Pseudo-events* are events planned for the express purpose of producing dramatic images that can be disseminated or reported. In effect, they are events that have no independent existence; they take place only to be publicized. Pseudo-events can include press conferences, televised debates between political candidates, and photo opportunities—all staged to produce dramatic images. Pseudo-events, however, are neither true nor false. Think of the glamorous travel photos of an Instagram influencer, which are perfectly staged to present the more glamorous sides of life, leaving out the countless hours of unglamorous work required to capture the photos. For pseudo-events, appearance, not substance, is what matters. Indeed, pseudo-events may be more interesting than spontaneous happenings.

Postmodernist theorists suggested that contemporary society is increasingly characterized by this kind of "hyperreality," in which the boundary that used to separate reality from its representation has "imploded," leaving images with no real-world referents (Baudrillard 1988). One does not have to be a postmodernist, however, to see the significance of image making. Writing in the age of television—but still relevant today—Postman saw that, in a world dominated by visual media, fast-paced entertainment may have become the model for all of society.

There can be little doubt that critics such as Postman and Boorstin were correct about the significance of images and visual media in American society. However, the causal claims—that inherent properties of media technology are the key determining force—are much more difficult to accept. The problem with such technological determinism is that it ignores people, except perhaps as victims of an all-powerful medium. Even though it is rarely explicit, most critics of television write about *commercial television*, not simply television technology (Hoynes 1994). The claims that television, as a technology, must be about entertainment, attractive images, and rapid movement from one idea to the next are not some technological law of nature. They are the result of an industry—driven by people and market forces—in which the need to sell products and make profits has dominated (Croteau and Hoynes 2006). Similarly, today's internet has introduced a whole new level of engagement and entertainment, but these efforts are not inevitable; they are shaped by the commercial forces constantly seeking our attention (Wu 2016).

As should be clear now, there are a range of ideas that can loosely be grouped under the umbrella of technological determinism. What they have in common is a focus on the role technology plays in influencing individuals and society more broadly. This emphasis contrasts with the focus social constructionism brings to the role of human agency and social forces.

Social Constructionism

As the name suggests, social constructionism emphasizes the social construction of technology, focusing on the role of active human agents in ultimately

determining how technology is developed and used. These analyses usually acknowledge that technology matters, but they theorize technology and social forces as interdependent and mutually influential. Social forces—such as cultural norms, economic pressures, and legal regulations—fundamentally shape the ways in which technologies are designed and developed. In addition, ordinary users influence how these technologies are ultimately used and, often, whether these technologies succeed or fail.

Social constructionism is part of the broader sociological perspective that sees all of social reality as socially constructed (Berger and Luckmann 1966). Specifically, social reality is produced in three steps:

1. People create society through ongoing processes of physical and mental activity.
2. Over time, these creations come to seem objectively real, separate from human activity.
3. People internalize the norms and values of their culture, thereby being influenced by their own creation.

So we are influenced by the things we create in part because we forget that we created them; they seem "normal," "natural," and perhaps inevitable to us. However, because we collectively create social reality, we can always change it.

This basic argument for the social construction of reality underlies the constructionist approach to media technology. Humans create technology, and even though it sometimes appears technology has a life of its own, in fact, we ultimately have the power to alter how we use it—a fundamental difference from technological determinism. This essential insight has long animated a range of work that highlights the social construction of technology, both in and outside of media (Bijker, Hughes, and Pinch 2012; MacKenzie and Wajcman 1999). Social constructionists in media studies proper include "British media studies" or the "Birmingham School" of cultural studies, developed around the work of Raymond Williams (1974), Stuart Hall (1980, 1997), Richard Hoggart (1957), and their colleagues at the Centre for Contemporary Cultural Studies at the University of Birmingham between the 1960s and its closure in 2002. Among other things, these researchers highlighted the important role of "active audiences" in interpreting and making use of media.

For example, Raymond Williams (1974:9) opens a classic work by noting, "It is often said that television has altered our world." Williams then proceeds to dismantle this argument—which he says is technological determinism—by pointing out the interrelationship between technologies and the preexisting cultural values and practices in a society. Thus, he notes, television in the United States and the United Kingdom first emerged as two very different things because of what he considered to be the contrasting social values of the two societies. The more individualized values of U.S. society, Williams argued, led to taking this new technology and turning it into a privately owned commercial television industry with entertaining

content that attracted audiences whose viewership could be sold to advertisers. Meanwhile, comparatively collectivist British social values were embodied in the British Broadcasting Corporation (BBC), owned and funded by citizens, which took the same new technology and used it to focus on public service. In this way, technology did not inevitably lead to a single model for television; cultural values defined how technology would be used, which would then reinforce those values.

Social constructionists argue that users matter, too. For example, one variant of a constructionist approach, domestication theory, suggests that ordinary users "appropriate" technology of all sorts, bringing it into their homes and daily lives (Bakardjieva 2005, 2011; Silverstone and Hirsch 1992). In doing so they are consumers who both connect to the outside world of commerce while asserting their own identities through their consumption and use of technologies. Often, users end up changing technology by adapting it in novel ways, and these actions end up influencing the developers of future technologies.

Having sketched out the differing ways technological determinists and social constructionists view technology, we move now to see how such dynamics played out during the emergence of various media technologies. In our overview, we attend to the material reality of technology (from the technological determinism end of the continuum) but highlight examples of how human agency shaped technology (from social constructionism). As outlined in Chapter 1, our sociological approach embraces the tension between media technology and the people who create, regulate, and use it. It is part of the push-pull dynamic we highlight throughout this book.

From Print to Television

The Print Medium

The introduction of the printing press had a substantial impact on human history. Building on earlier technology, in the mid-1400s, Johannes Gutenberg demonstrated a practicable way to print by converting a winepress into the first modern printing press with movable metal type. Although the technology had evolved, media content changed little at first. Given the power of the Catholic Church in Europe at the time, the Bible was the book most often produced by early printers. Thus, as was true for later changes, social forces other than technology determined how a new medium was used.

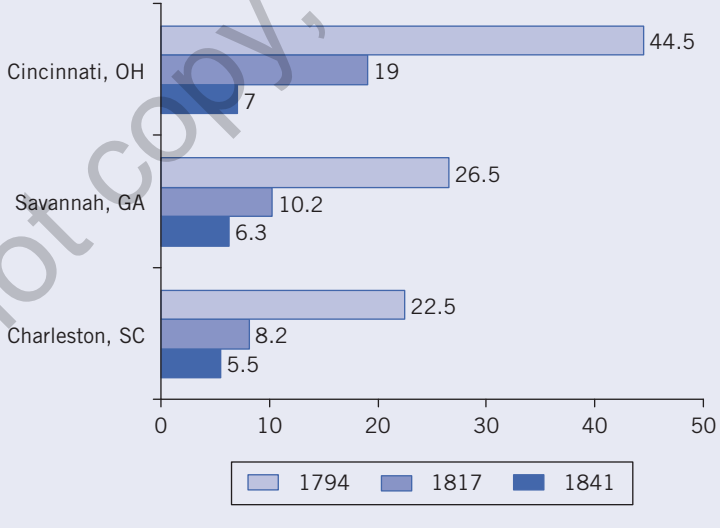
But printing technology also contributed to—or at least facilitated—social change that was unanticipated (Eisenstein 1979). Prior to printing, books had to be copied by hand, making them expensive, rare, and available only to a small number of scholars, primarily clergy. Printing—and the corresponding growth in literacy—helped democratize learning by making books more affordable and widely available. The Protestant Reformation that began with Martin Luther in 1517 was fueled, in part, by the ability of literate believers to now read the Bible for themselves, sometimes calling into question the Catholic Church's interpretation and authority. Over time, printing accelerated the pace of innovation in philosophy, science, the arts, politics, and other fields by helping spread information and ideas throughout

and across cultures. Rather than be dependent upon a mentor, it was now more possible for people to read and learn on their own, perhaps contributing to the rise of individualism in Western society, too. More broadly, print fundamentally changed how human societies operated. Oral traditions in storytelling and history were eventually supplanted by written texts. Arguably, as medium theorists contend, thinking changed as a result. Written texts required a disciplined approach to communication that favored linear sequencing of thoughts and reasoned arguments, which became hallmarks of these philosophical and scientific traditions.

At the founding of the United States, print media—in the form of books, newspapers, and pamphlets—was still the only means for reaching a wide audience. However, distribution was limited and slow because of the need for physical delivery of print material (unlike later electronic media). Both routine and extraordinary information, from holiday greetings to news of the outbreak of war, traveled only as fast and as far as a horse, train, or ship could carry it: a slow speed difficult to imagine today. It routinely took four to eight weeks for information to travel from Europe to the United States. Even communication between distances that we now perceive to be quite short—from New York to Washington, for example—were slowed by the need for messages to travel physically between the two locations. As late as the 1840s, it still took several days for news to travel from one city to the next (see Figure 2.4). One consequence of this limitation is that most publications tended to remain local, resulting in a highly fragmented and isolated media landscape.

Figure 2.4 Time (in Days) Required for News to Travel from New York to Select Cities, 1794–1841

In the era of print media, news could only travel as fast as people could physically carry it.



Source: Pred (1973).

The Telegraph

Although it is not a mass medium, the telegraph was an advance in communications technology that had major implications for other media. The invention of the telegraph in the 1840s allowed for near instantaneous communication over long distances, so long as they had been wired together. For the first time, there was a separation between physical transportation and long-distance communication. The telegraph did not reach a large audience, but it did speed up the spread of information through newspapers. Reporters could send news stories instantaneously over a long distance to newspapers that would then print and distribute the story locally. News not only spread faster and further this way, but wire services also began producing content that was used in multiple markets. These wire service stories helped unify—and critics would say homogenize—what had previously been a highly fragmented and localized news culture.

Print media had been highly decentralized, with local printers setting up shop in most communities. In contrast, the material nature of the telegraph—with single lines spread across thousands of miles—lent itself to more centralized control. In short order, companies competed until telegraph ownership became highly concentrated. By the 1870s, Western Union was the owner of the only nationwide telegraph network, and it carried Associated Press (AP) stories exclusively. Using this monopoly position, Western Union worked closely with the Republican Party to promote its agenda and candidates, arguably winning the election for President Rutherford B. Hayes in 1876. For example, Western Union provided Hayes with the telegrams of his rivals, allowing his campaign to be one step ahead of the opposition (Blondheim 1994; Wu 2011). This is an example of technology leading to an unintended social change. Rutherford B. Hayes may have never been president without the invention of the telegraph (technological determinism), but the telegraph didn't *cause* his victory. Instead, it was political allies who used the technology in this way (social constructionism).

The telegraph also foreshadowed several issues associated with emerging media technologies, including the increased speed of communication, the dangers of centralized control of technology, how control of technology can help shape which content is available, and how the integration of technology produced more unified—perhaps homogenized—content. All of these issues would reappear with later technologies.

The Telephone

The telephone is also not a mass medium, but it influenced other media in ways that are still felt today. In 1876, Alexander Graham Bell was issued a patent for the invention of the telephone, which opened the way for more widely accessible, personal, long-distance communication. But telephone technology went through considerable evolution as users experimented with different ways of employing it,

companies competed in how to deploy it, and the government eventually moved to regulate it—all of which shaped the evolution of the modern telephone (Fischer 1992; Wu 2011).

When the telephone was invented, Western Union hoped to use it as a new tool to make sending and receiving telegraphs more convenient. To send a long-distance telegraph message, customers would simply make a local phone call to the Western Union office. For a variety of reasons, including challenges to their patents, this never happened. Western Union agreed to drop out of the phone business as long as the newly created Bell Telephone Company agreed to stay out of the telegraph business. From that point on, Bell—later to become known as American Telephone and Telegraph (AT&T)—became the dominant phone company. For two decades, it held the key patents that enabled it to operate as a monopoly, providing profitable service mainly to businesses and wealthy clientele in major cities. By 1893, about two-thirds of the nation's telephones were in businesses, while residential service was quite limited (Fischer 1992:42)

In the mid-1890s, though, Bell's key patents expired, introducing a brief era of competition during which telephones were transformed from a luxury business service to a widespread and common utility. In just a few years, thousands of "independents" sprang up, ranging from innovative businesses using the latest technology to very basic community operations operating as nonprofit cooperatives. About 3,000 of these were for-profit businesses, and by 1902, fully half of communities with a population of 4,000 or more had at least two competing, independent phone companies. In addition, another 6,000 shareholder-subscriber "mutuals" were created to provide low-cost community access (Fischer 1992:43–4).

In some rural areas, where commercial service was unavailable or was too expensive, farmers even set up lines along existing barbed wire fences, providing unsophisticated but very low-cost phone service. These "farmer lines" had no privacy; they operated as a giant party line to which anyone in the community who was connected could listen. Users would sometimes organize telephone parties on a specific day and time, during which local musicians performed and storytellers entertained. Other time slots might be reserved for sharing the weather forecast and regional news. Using the technology in ways that were never intended, farmers were essentially "broadcasting" years before real radio broadcasting technology existed (Wu 2011).

Telephone competition was short-lived, however, coming to an end in 1913. The independents fought among themselves for small markets, often failing or being taken over by Bell—now a division of AT&T. Bell aggressively drove out local competition, sometimes using the profits from its lucrative urban markets to engage in predatory pricing in smaller communities and rural areas. At the national level, AT&T also took over Western Union, gaining unmatched access to the "long lines" that connected cities. By moving to take over both local and national communications, AT&T consolidated its control over the entire industry.

As AT&T's monopoly status became clearer, government antitrust regulators began investigating. In the end, AT&T asked to be regulated in exchange for continuing to hold its monopoly. In the Kingsbury Commitment of 1913, it agreed to operate based on rates set by the government, to sell off Western Union, to stop acquiring any more independents, and to permit the remaining independents to connect to its long-distance services. For the guaranteed revenue stream that came with such a monopoly, AT&T promised to make access to high-quality standardized phone service available to everyone. The company became a public utility and later officially became a "common carrier," equally open to all users without discrimination. (We explore the idea of "common carriage" and implications for today's internet in Chapter 4 on regulation.)

Often known as "Ma Bell" or simply "the phone company," the AT&T monopoly was a universal presence in American life until its breakup in 1982. The company had four divisions:

- Bell companies provided local telephone service.
- AT&T Long Lines connected local communities for long-distance service.
- Western Electric manufactured communications hardware.
- Bell Labs conducted research and development.

Government regulations protected the monopoly by forbidding competition. Consequently, AT&T controlled everything from the home phone (which was typically rented from AT&T, not owned by the resident or business) to the local and long-distance wires and all of the switching equipment in between.

Because telephone lines reached almost everywhere by the mid-20th century, they served as important information conduits for other media. Radio and television broadcast networks used phone lines to relay their programming across the country, which were then aired by local broadcasters. Later, early dial-up modems and high-bandwidth Digital Subscriber Line (DSL) service used telephone wires to connect users to the internet, too.

With standardized equipment and centralized control, the quality of telephone service under the AT&T monopoly was generally quite good. Bell Labs also provided the government with valuable defense and security-related research. However, without competition, costs could be high, and innovation that did not serve the existing business model was often suppressed. For example, Bell Labs' scientists discovered magnetic tape recording and created a prototype answering machine in the 1930s. However, the inventions were shelved because company officials feared the public would avoid using the telephone if they knew their conversations could be recorded. Magnetic tape recording in the form of the audiocassette became available only in 1962—first from foreign companies. Bell also discovered and put on hold early versions of fiber optics, mobile phones, DSL, fax machines, and speaker phones, among others (Wu 2011).

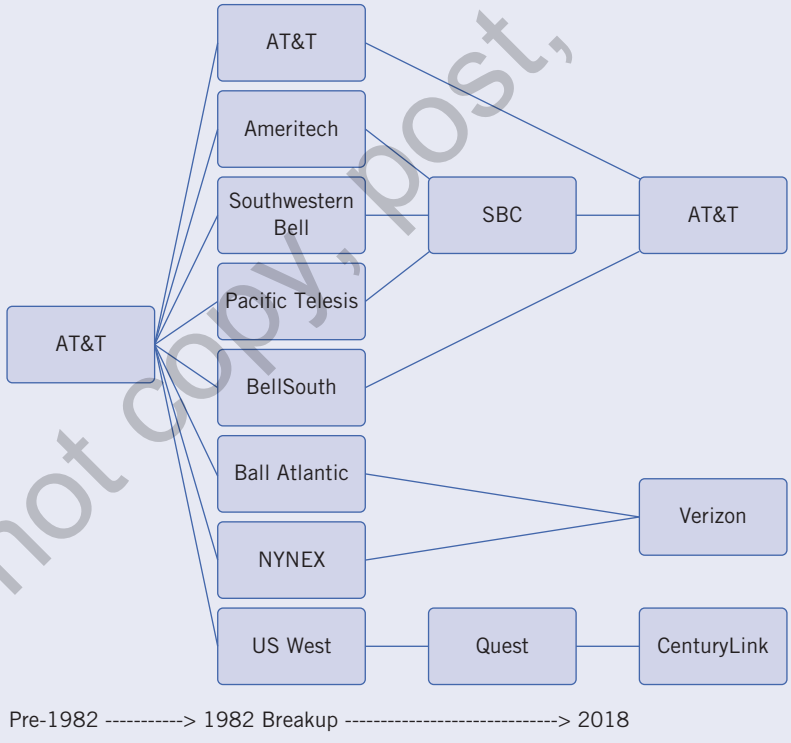
Over time, the political climate changed, and little by little, the AT&T monopoly was weakened. For example, building on a 1968 ruling, the Federal Communications Commission (FCC) mandated that what we now know as the

standard phone jack—the RJ11—be used on all equipment. Previously an AT&T technician had to attach a phone to the phone line. This technological standard, which allowed people to plug non-AT&T technology into their phone lines, sparked innovative third-party products, such as fax machines, cheaper telephones, and later, internet modems. In 1971, the FCC barred AT&T from entering data processing or online services, which enabled the growth of America Online (AOL), CompuServe, and other early innovative internet service providers (ISPs) (Wu 2011).

Most significantly, in 1982, a long-term antitrust suit was settled, and AT&T agreed to be broken up into eight separate "Baby Bell" entities that were required to accept connections from smaller competitors (see Figure 2.5). This

Figure 2.5 The Breakup and Reconsolidation of the Telephone Industry

Regulatory environments change, affecting the nature of communication technologies and industries. Long a state-sanctioned monopolgy, AT&T agreed to settle an antitrust lawsuit by being broken up into "Baby Bell" companies in 1982. Since then, though, the companies have significantly reconsolidated and are major players in today's media industry.



Source: The Master Switch. Wu (2011).

breakup unleashed enormous competition and innovation. Most notably, expensive long-distance services—which had long subsidized local service in sparsely populated areas—were now open to competition, bringing costs down sharply. As media and legal scholar Tim Wu (2011) notes,

> [T]he breakup of Bell laid the foundation for every important communications revolution since the 1980s onward. There was no way of knowing that thirty years on we would have an Internet, handheld computers, and social networking, but it is hard to imagine their coming when they did had the company that buried the answering machine remained intact. (P. 162)

But, again, this era of competition was short-lived. The pre-1982 AT&T has slowly reconsolidated over the past 40 years; the eight "Baby Bell" companies have become the "Big Three" telecom companies of today: AT&T, Verizon, and CenturyLink.

Telephone technology clearly changed the way we live. But the telephone's long and complicated history illustrates starkly how human agency ultimately determines the shape and direction of technological development and use. The regulatory environment, for example, fundamentally influenced the way telephone technology was created and deployed. Users, too, helped shape the way the technology was incorporated into daily life. In fact, in his classic social history of the telephone, sociologist Claude Fischer (1992) argues that we should not even ask what "impact" a technology has had on a particular society because this question implies from the outset that the technologies do something to us. Fischer (1992) contends,

> [W]hile a material change as fundamental as the telephone alters the conditions of daily life, it does not determine the basic character of that life. Instead, people turn new devices to various purposes, even ones that the producers could hardly have foreseen or desired. As much as people adapt their lives to the changed circumstances created by a new technology, they also adapt that technology to their lives. (P. 5)

Sound Recording

In 1878, Thomas Edison received a patent for the cylinder-based phonograph, which would lead to the first new mass medium since print. Edison referred to his invention as a "talking machine" and believed that "[t]he main utility of the phonograph [is] for the purpose of letter writing and other forms of dictation" to be used in conducting business correspondence (Katz 2012:13). However, other developers and users had different ideas about how to use this technology.

Within a decade, phonograph records featuring musical recordings were introduced, and as other forms of sound recording later proliferated, music became the

primary application of sound recording. At first, the standard phonograph record was the 78 rpm that could accommodate a three-minute recording on each side. In 1948, the long-playing (LP) 33 1/3 rpm record was launched and became the industry standard for more than 30 years. Magnetic tape became most popular in its easy-to-use cassette form, introduced in the 1960s, which enabled people to easily make their own recordings or assemble mix tapes for the first time. This technology made music more mobile, too, because tapes could be played in car stereos and on portable tape players such as Sony's Walkman, the cassette tape precursor of the iPod. In the early 1980s, sound recording became digital, and the compact disk (CD) emerged as the dominant recording format. By the 1990s, compressed digital file formats, such as MP3, allowed music to be speedily distributed via the internet and stored on tiny MP3 players and smartphones. Since 2011, digital music has made up the majority of music sales, outselling CDs and vinyl LPs. However, sales of specific music recordings have been displaced by subscriptions to streaming audio services, such as Spotify, Apple Music, and Amazon Music, which have accounted for the majority of digital music revenue since 2016 (International Federation of the Phonographic Industry 2017a).

Through its various incarnations, the technology behind sound recording enabled significant social change for listeners and musicians alike. Recordings made musical performances permanent, altering how musicians performed and how audiences listened. Prior to recordings, music was experienced exclusively in live performances, often in group settings. Professional music could be heard only in public spaces such as concert halls, clubs, and the like. Recordings meant that such music was now available to hear—and replay at will—in the privacy of the home and was often experienced alone, making it a much more intimate listening experience. Solitary listening was so new and startling that users had to be educated about the experience. One article noted that if the reader found a friend listening to recorded music alone, they would be forgiven for thinking "such an activity would be evidence of an unwell mind, whether caused by mental instability or substance abuse" (Katz 2012:16). Not to worry, though, the article continued, in the new age of recorded music, listening to music alone was perfectly normal behavior.

Because access to professionally created music was so limited before recordings were available, the "music industry" largely focused on selling instruments and sheet music for amateurs to play for family and friends at home. With recorded music now available, social gatherings didn't stop, but playing recorded music at such get-togethers became commonplace and sometimes controversial. Composer and conductor John Phillip Sousa gained fame from his early recordings of marching music (Eschner 2017). But he penned a wide-ranging essay in 1906 warning about recordings (and player pianos) as the "menace of mechanical music." Part of his concern involved the rights of copyright holders, but his apprehensions also included the worry that professionally recorded music would "substitute for human skill, intelligence and soul" that came from live performances (a technologically driven concern that only intensified in later years with the rise of sophisticated studio music production techniques that greatly

manipulated an artist's performance). He was alarmed, too, that, with the rise of recorded music, "it will be simply a question of time when the amateur disappears entirely" (Sousa 1906).

Recording technology helped change the music artists made, too. For example, one side of the early 10-inch 78 rpm record could only accommodate a three-minute recording, so musicians of all stripes changed how they wrote. Even classical composer Igor Stravinsky once reported, "I had arranged with a gramophone firm to make records of some of my music. This suggested the idea that I should compose something whose length should be determined by the capacity of the record" (Katz 2010:3). The result was 1925's "Serenade for Piano," written in four movements of roughly three minutes each to fit conveniently on two records. By the 1950s, the 78-rpm record was replaced by LPs, which could accommodate recordings of more than 20 minutes on each side. However, the three-minute standard for a recording lived on because they could be conveniently sold as low-cost 45-rpm "singles." As a result, nearly every pop song of the 1950s, 1960s, and beyond was roughly three minutes in length. After getting longer with album-oriented radio, pop songs have again gotten shorter with the switch to online streaming. With this recent technology, musicians are paid per song streamed, not per minute of music streamed, making an hour of listening more profitable if it is made up of a larger number of short songs rather than a few longer songs.

New recording technology also changed the experience of musicians over the years. Prior to recordings, live performances were the essence of being a professional musician. As the recording industry grew, however, studio recordings became the primary source of income for popular musicians. (The same was true for the new breed of "session players": highly skilled but largely unknown musicians who were hired to play on recordings.) By the mid-20th century, the most popular artists launched concert tours primarily as promotional vehicles for selling records. But elaborate studio recordings that used complicated production techniques, such as overdubbing many tracks of the same artist, enabled the creation of recordings that could never be played live. The Beatles, for example, famously stopped touring in part because the complex studio recordings they were making later in their career could not be performed on stage.

By the end of the century, though, new technology helped swing the pendulum back toward live performance. On the one hand, the sales of recorded music were undermined by musical "piracy" (via easily downloadable digital recordings) and streaming services (which generate lower revenue). Musicians, then, returned to relying on live performances to generate the bulk of their income. On the other hand, these live performances were sometimes now enhanced by new technologies. Synthesizers and sampling made the inclusion of complicated and prerecorded sounds in live performances easy. More controversially, lip-syncing became common. As early as the 1940s, some artists lip-synched to their recordings in brief filmed "soundies"—the music videos of the day—which could be played on coin-operated film jukeboxes. On television in the latter half of the 20th century, popular teen dance programs such as *American Bandstand* and *Soul Train*

featured musical acts lip-synching to their latest recordings. By the turn of the century, lip-synching to recorded music at "live" concerts became prevalent in the pop music industry as well. Well-known pop artists such as Beyoncé, Mariah Carey, Madonna, and Britney Spears all lip-synched on stage. The reasons for doing so varied: Vocals created in the studio through digital manipulation, most famously with Auto-Tune, could not be performed live; grueling touring schedules and outdoor performances in variable weather conditions stressed artists' vocal chords; and shows now often included athletic dance performances that made simultaneous singing difficult (Lubet 2017). Frequently, the result has been a mixture of live performance with prerecorded enhancements.

Vintage Images/Alamy Stock Photo

Photo 2.1 Prior to the invention of sound recordings, listeners could experience music only in live public settings, which is one reason why so many communities had bandstands in their local parks. With the phonograph, music listening could become more private and individualized.

Sound recordings have affected how we live our daily lives and impacted how musicians work. However, the application and evolution of recording technology certainly did not proceed in the way its inventor had envisioned. Users made choices that significantly altered the trajectory of sound recordings away from simple dictation for business purposes to much broader applications. The music industry helped shape how we experience popular music. On the whole, recorded music also did not destroy amateur musicianship, as some had feared. To the contrary, millions of people were able to use sound recordings to help themselves learn how to play their own instruments. Some experimented with new recording technologies, creating new forms of music such as when DJs "scratched" records in hip-hop performances. Many other amateurs are now able to record and edit their music on digital audio workstation (DAW) software like Pro Tools, Ableton Live, and CuBase, which used to be accessible only to professionals. These amateurs can also distribute their music on online platforms such as SoundCloud and YouTube, which offer greater potential audience reach—if not financial compensation—than could be dreamed of by prior generations of professional musicians.

Film and Video

Sound recordings enabled the permanent capture of what had previously been a fleeting auditory experience. Photography did the same for visual experiences. People could take photos of their loved ones to remember them in their absence. Historical events were captured for posterity. Soon, inventors created "moving pictures" through various devices that gave individual users the illusion of motion by peering into a box to see a series of photographs flicker past. Modern "movies" were born in 1895, when brothers Auguste and Louis Lumière first demonstrated

their cinematograph, which used film to project moving pictures onto a screen that could be viewed by an audience. Film technology eventually evolved to include the use of synchronized sound, color film stock, and digital technologies that have largely replaced film.

In their first decade, "movies" were brief, and more than 80 percent of them were about topical subjects such as news, travel, documentaries of everyday life, and sports (Starr 2004). In time, filmmakers shifted from using film technology to produce simple animated photographs to creating increasingly elaborate fictional stories. The nature of this evolution varied greatly, though, based on the social context within which it occurred.

For example, in the 1910s, a New York City-based "Film Trust," a cartel of 10 companies, controlled the U.S. film industry. The Trust had every important patent on motion picture technology and therefore kept out competition while dictating how the industry operated. The Trust set a price per foot of film that distributors would pay producers, a weekly price that exhibitors paid for the use of patented technology in projectors and so on. Movies were, in effect, a commodity sold by the foot. The arrangement kept prices low to ensure a steady audience and guarantee a healthy profit. This monopoly, though, greatly restricted creativity. It blocked most film imports and limited U.S. moviemaking to short (less than 20 minutes), uncontroversial, uncomplicated films, featuring unknown and low-paid actors (Wu 2011).

Meanwhile in Europe, most notably France, there was no film cartel, and feature-length films starring well-known actors quickly became the norm. The model eventually made its way to the United States after a couple of renegade "independent" distributors—who refused to join the New York-based Film Trust—began importing foreign film stock and producing their own films. Sued hundreds of times by the Film Trust, the independent film producers fled New York and filmed in other locations, including Cuba. But Los Angeles proved the most convenient location for their work because they could quickly and easily cross the Mexican border to avoid court injunctions and subpoenas. Thus, renegade outlaw filmmakers founded what eventually became the Hollywood movie industry (Wu 2011). (Over time, the Hollywood studio system became a new monopoly and the courts would intervene, a story we explore in Chapter 4.)

Film production exploded with the rise of independents. In 1914, more than 4,200 new films were reviewed in the industry press. U.S. filmmaking prospered and catered to a wide and diverse set of market niches across racial, ethnic, and political lines. World War I decimated the European film industry, opening the way for the domination of the U.S. industry there, too (Wu 2011). Movies became a central element of American leisure. By 1930, an astonishing 65 percent of Americans were attending movies at least once a week. (That figure would drop by half with the introduction of television in the 1950s and then hover around 10% or less from the mid-1960s to today [Pautz 2002].)

By the late 1970s, technological innovations radically changed how users interacted with films. Videocassette recorders (VCRs) allowed people to purchase or rent

movies to watch in their own homes, thereby privatizing the movie experience. Cheaper video cameras also enabled users to more easily film and show their own videos. In 1997, the digital video disk (DVD) was introduced, marking the shift of movies to digital formats. Digital cameras, smartphones, and related software made it easier still for the general public to record, edit, produce, and store their own videos, whereas websites such as YouTube and Vimeo offered platforms for the upload, storage, and exhibition of these amateur videos. With such sites and social media sharing, personal videos could now enter the public sphere. Meanwhile, a deep catalogue of commercial films was increasingly available through internet-based video-on-demand and streaming services, such as those provided by Netflix, Hulu, and Amazon.

Film technology changed how audiences—and later amateur filmmakers—related to movies and videos. But the development and application of this technology was shaped by the social forces surrounding it. Industry collusion in the form of the U.S. Film Trust limited how the technology could be used, whereas European filmmaking evolved differently. The action of renegade independents changed the U.S. film industry. Much later, users changed the nature of videos by taking advantage of new technology to record and share videos online. From recording embarrassing but amusing "fail" videos to documenting police shootings, smartphone videos and social media have added new complexity to the world of film/video creation and consumption.

Radio Broadcasting

Radio was developed over the first two decades of the 20th century. In contrast to a telegraph or telephone message sent via a wire to a particular person or destination, the unique feature of radio was that it used the electromagnetic spectrum to transmit audio signals that could be received by anyone with an inexpensive radio kit who was within range of the signal. Early amateur radio operators referred to this process as "broadcasting," taking the term from a farming technique in which seeds were "cast broadly"—that is, scattered widely—rather than planted in neat rows. For the first time, media producers no longer had to physically distribute their products (e.g., to newsstands, record stores, or movie theaters), nor did the public have to travel to these locations to have access to mass media, further enabling privatized and individualized media experiences. In addition, broadcasting introduced the possibility of live programming as well as "free" content.

Although early radio was essentially the same technology we know today, people knew radio by a different name and understood it as a very different form of communication than we do now. That's because the social forces that later shaped the direction of radio technology had not yet coalesced. Corporate consolidation of the radio industry had not yet occurred, the government had not yet regulated the use of the electromagnetic spectrum, and investors had not yet recognized the profitability of producing household radio receiving devices. What we now take for granted—a model of broadcasting music, news, and entertainment programming

usually supported by advertising—took two decades to evolve (Douglas 1987; McChesney 1994; Schiffer 1991; Wu 2011).

For the first 10 years after its invention, people called radio the *wireless* because its creator, Guglielmo Marconi, promoted it as a telegraph without wires. For Marconi, the wireless was an improvement of an existing point-to-point, two-way communication technology; it had nothing to do with broadcasting. Marconi hoped his wireless could serve as a substitute, or an upgrade, for long-distance communication by large commercial interests that relied on the telegraph, particularly newspapers and steamships. Individuals were not seen as users, and receive-only devices—what we call radios today—were still far off. In fact, the uncertainty in the future of wireless can be seen in its eventual name changes. The wireless became *radiotelegraphy*; then, when it began to transmit voice instead of Morse code, it became *radiotelephony* and finally just *radio* (Douglas 1987).

Despite its inventor's intentions, amateur radio operators quickly began experimenting with the technology. As amateurs learned how to use the new technology and how to construct their own transmitters and receivers, a radio subculture emerged in which sending and receiving long-distance communications became a popular hobby. As listeners tuned in at night, seeking transmissions from sites hundreds of miles away, it was amateurs who planted the seeds of the broadcast model and made the act of listening a leisure activity.

Because the airwaves have limited space and demand for their use was growing, amateurs came into conflict with commercial interests and the government. Each of them wanted to use radio technology in a different way, and a struggle over the control, definition, and proper use of radio ensued. Corporate interests sought private control of the airwaves to use them for profit. The U.S. Navy sought government control of the airwaves to use them for military and security purposes, particularly during wartime. Amateur radio enthusiasts, mostly young men and boys in the years between 1906 and 1920, saw the airwaves as a form of public property to be used by citizens to communicate with one another.

Both the U.S. Navy and the Marconi Company supported government regulation of the airwaves to organize and set limits on electromagnetic spectrum use. Douglas (1987) explains they agreed that "the amateurs had to be purged from the most desirable portion of the broadcast spectrum. They had to be transformed from an active to a passive audience, allowed to listen but not to 'talk'" (p. 233). The result was the Radio Act of 1912, which regulated the use of the airwaves by requiring all transmitting stations to be licensed by the federal government, thereby curtailing access for amateurs. So even before the notion of broadcasting had taken hold, the institutional structure of broadcasting was in place: centralized, licensed senders and large numbers of individual listeners.

Despite these restrictions, amateurs continued to operate radios in even larger numbers. Some made use of the shortwave frequencies that the government allocated for them, a few were granted government licenses to use the airwaves, and many more continued to operate without licenses. In 1917, when the United States declared war on Germany in World War I, the government ordered all

amateur radio operators to shut down and dismantle their equipment. The police closed down more than 800 operators in New York alone (Douglas 1987). At the same time, the Navy was in need of experienced radio operators, so it recruited amateurs who returned home after the war even more skilled in radio technology. By 1920, amateurs were experimenting with playing music and providing information over the air to other amateurs, who were encouraging their families and friends to listen along. Several amateur transmitters built up substantial audiences for their "programming," while the corporate radio industry continued to focus on point-to-point communication.

All of this changed when, in the hope of increasing sales of their radio equipment, a Pittsburgh department store ran a local newspaper advertisement for a musical program broadcast by amateur Frank Conrad. Shortly thereafter, Westinghouse, one of the major manufacturers of radio sets, began financing Conrad's station as a means of selling its radios. Radio manufacturers AT&T and General Electric, along with department stores, quickly jumped into the business of broadcasting by setting up stations to stimulate the sale of radio sets. They had realized that the market for the broadcast model of radio was much larger than for the point-to-point model, offering the possibility of greater profits.

Soon, owning a radio set and being able to listen to the programs became highly popular. In 1922, AT&T began selling access to the airwaves as Marconi had done for private communication. The commercial broadcast model, with programming financed by the sale of advertising, was established. Records are incomplete, but there were already more than 500 radio stations in 1923, and by the following year more than 2 million radio sets had been sold (Wu 2011:35).

The emergence of radio advertising was an important part of the clampdown on amateurs. Wu (2011:76–7) notes, "When revenues came from sale of radio sets, it was desirable to have as many people broadcasting as possible—nonprofits, churches, and other noncommercial entities. The more broadcasters, the more inducement for the consumer to buy a radio, and the more income for the industry." This revenue stream was limited, however; households needed only so many radios. In contrast, advertising was limitless, and "once advertisements were introduced, radio became a zero-sum game for the attention of listeners. Each station wanted the largest possible audience listening to *its* programming and *its* advertisements." In that scenario, amateur competition was a threat to profits and needed to be eliminated.

These developments were highly controversial and certainly were not inevitable. At first, even radio manufacturers worried about the emergence of radio advertising. The head of publicity for Westinghouse argued, "Direct advertising in radio broadcasting service [should] be absolutely prohibited" because "advertising would ruin the radio business, for nobody would stand for it." Then Secretary of Commerce—and later U.S. President—Herbert Hoover said of radio in 1922, "It is inconceivable that we should allow so great a possibility for service, for news, for entertainment, for education, and for vital commercial purposes to be drowned in advertising chatter" (Wu 2011:74). But in a few short years, that's exactly what occurred,

Photo 2.2 It took a number of years for the new medium of radio to evolve into what we know it as today. Beginning as the "wireless," radio was first conceived of as a telegraph without wires that could improve one-to-one communication. Amateur radio enthusiasts adopted the technology to send and receive long-distance messages as a hobby. Only later did radio become primarily a way to broadcast music, news, and talk.

and by 1931, Henry Lafount, the commissioner of the Federal Radio Commission (FRC, the precursor to the Federal Communications Commission [FCC]) would write, "Commercialism is the heart of the broadcasting industry in the United States" (Wu 2011:82).

Radio continued to evolve, of course. For example, because of its limited range, early radio had been an inherently local medium. That changed when AT&T used its exclusive access to long-distance phone lines to establish the first nationwide radio broadcast network. With this model, centralized programming was sent over the lines to be simultaneously broadcast in local markets. With a much larger audience and more advertising revenue, the company could afford to produce high-quality programs with nationally known talent against which local broadcasters could not compete. But AT&T's short-lived dominance was challenged on patent grounds by the Radio Corporation of America (RCA), which had been formed out of the American Marconi Company. Eventually, through a series of court and binding arbitration agreements, AT&T agreed to leave the radio business if RCA agreed not to challenge AT&T's long-distance operations. RCA gave its resulting network a new name: the National Broadcasting Corporation (NBC) (Wu 2011:78).

The emerging group of major broadcasters encouraged the FRC to get rid of competing local stations to create "clear channels" for their large stations and networks, arguing that their better equipment and higher-quality programming better served the public. The FRC agreed, and the age of plentiful, small-scale local radio largely came to an end. Later, innovation was throttled for years when the FCC, at the behest of the radio giants who feared more competition, delayed the introduction of FM radio broadcasting, which enabled signals to be sent further, more clearly, and with less power. In these cases, too, a technology's application, and innovations in that technology, were shaped by the power of corporate and government players.

The route to radio broadcasting of music, news, and serials, all surrounded by ads, was not the straightforward result of some technological imperative. In fact, one of radio's great technological capacities—its ability to both send and receive messages—was largely abandoned in the final model, relegated to shortwave frequencies. By including factors beyond technology in our understanding of radio, we can see that what we often take for granted as radio's natural order of things is in fact the result of a complicated social process involving commercial interests,

amateur users, and government regulators. Moreover, we can see that things could have turned out differently. Basic wireless technology might have been applied or further developed in a different direction, leading to different social consequences.

We don't need to rely on pure speculation to imagine these alternatives. In other countries, radio played a different role than in the United States. In some countries, radio served as a more distinct form of public service communication, aimed at raising the standard of political discourse. Sometimes such top-down communication was abused, as when Nazi propaganda minister Joseph Goebbels called radio "the spiritual weapon of the totalitarian state" and argued, "Above all, it is necessary to clearly centralize all radio activities" (Wu 2011:303, 385). In other countries, listeners have much more widespread access to the airwaves, which are not used to sell products with the same zeal as in the United States. Instead, in several countries, including England, Australia, Argentina, and Uruguay, a portion of the airwaves has been earmarked for "community radio" (Gordon 2008; Hintz 2011; Rennie 2006).

The evolution of radio, and the variations in how it has been adopted, again illustrates the fact that we cannot understand a new medium simply by looking at its technological component because this ignores the social processes that ultimately shaped its use.

Television

As an over-the-air (OTA) broadcast medium, television combines the ability of film to record and display moving images and sound with the ability of radio to broadcast live. Until the 1930s, most television sets were mechanical devices that created an image by scanning a location using a spinning disk with holes in it. The image was transmitted to a user's receiver, which used another spinning disk to display the crude moving picture. Television became practical only in its electronic form, which used cathode ray tubes to produce a better-quality image by sweeping an electron beam across a phosphorescent screen.

The deployment of early television technology might have threatened the dominance of radio. However, after successfully eliminating amateur radio competition, the major radio companies effectively delayed and destroyed potential television competitors, too. NBC's owner, RCA, argued to the FCC in the 1930s that "[o]nly an experienced and responsible organization such as the Radio Corporation of America, should be granted licenses to broadcast material, for only such organizations can be depended upon to uphold high ideals of service" (Wu 2011:144). The FCC agreed and sharply limited the television stations that could broadcast until the 1940s, effectively locking out any amateur or fledgling competition. This gave RCA time to catch up in developing—and in some cases stealing—new technology. It also scared away potential investors from competing technology ventures, driving inventors and innovators into bankruptcy. This left only the large radio corporations with enough capital to enter the electronic television field.

As a result, the few companies that dominated radio became the same players who dominated network television: NBC and ABC evolved from RCA's radio business, and CBS television was spun off from CBS radio. (A fourth, short-lived, Dumont network was owned by a manufacturer of television equipment.) As a result, there was almost no innovation in programming; early television was essentially radio with pictures. The three major networks simply began shifting their radio programs—and advertisers—to the new television medium.

Building on radio's success, manufacturers and broadcasters marketed television as another form of privatized entertainment that would bring the family together to enjoy public amusement without having to leave home. They succeeded wildly (harming movie box office revenue in the process). In the span of less than 10 years, between 1946 and 1955, television sets made their way into 65 percent of American households and were in 90 percent of households by 1960 (Spigel 1992). In relatively short order, television became a major part of American life. After a half century of analog broadcasting, manufacturers and broadcasters successfully lobbied the U.S. government to order all television stations to convert to digital signals in 2009. This marked yet another medium making the shift to the universal digital format. Digital programming could easily be transmitted over the air, via cable, via fiber optics, or through internet streaming to a wide range of devices, not just television sets.

Television and Daily Life

In its remarkable rise to prominence, the television industry both accommodated already existing family practices and tried to mold these practices (Spigel 1992). In this era, white middle-class women were perceived as having a great deal of "free time" during the day for leisure or relaxation while also attending to housework. Therefore, producers directed most early television programming at women viewers, whom they considered to be the largest and most accessible audience. Although broadcasters had largely repackaged radio programs for television at first, they soon learned that the different technologies facilitated different sorts of audiences. Radio could provide entertainment while women worked because, as a purely aural medium, listening did not interfere with other activities. However, as a visual medium, it was more difficult to market television as something women could enjoy at the same time as they were doing housework. Leaders of the television industry were concerned that the new medium might not fit into women's lives and therefore might be underused or ignored altogether.

One 1952 effort to overcome this hurdle came from manufacturers who developed a TV-Stove, an appliance that allowed women to watch television while they cooked. By designing an apparatus that accommodated existing cultural practices and traditions, the television industry hoped to attract loyal viewers. The TV-Stove demonstrates that cultural practices can shape the development of media technology. It also shows how user preferences can be more powerful than technological innovation: The TV-Stove was a market failure.

Ad*Access On-Line Project - Ad #TV0699, John W. Hartman Center for Sales, Advertising & Marketing History, Duke University, David M. Rubenstein Rare Book & Manuscript Library, http://library.duke.edu/digitalcollections/adaccess/

Atari Mania

Photo 2.3 Both early television and computer manufacturers tried to sell new technologies as ways to enhance existing social relations. In time, both of them would enable significant change in the routines of daily life.

Television broadcasters were more successful by designing the content of programming to accommodate the practices of 1950s middle-class women. Producers designed the "soap opera" (named after the soap manufacturers who often sponsored them) and the variety show as programming that would not interfere with women doing housework. Soap operas contained little action but a great deal of verbal explanation and often repeated the same themes. Viewers could listen from an adjacent room or could miss episodes without losing track of plot developments. Variety shows moved from one act to the next, making it easy for viewers to enjoy them, even if they watched only parts of the program. This, too, was ideal for women working around the house.

The television industry also tried to reshape family routines to be compatible with television viewing. As Spigel (1992) puts it, "Not merely content to fit its programming into the viewer's rhythms of reception, the network aggressively sought to change those rhythms by making the activity of television viewing into a new daily habit" (p. 85). For example, promoters billed NBC's *Today Show* as the TV equivalent of the morning newspaper. In addition, the networks routinized their schedules, previewed upcoming programs, and linked program times to the household activities of women and children, all of which encouraged viewers to adapt their daily routine to the television schedule.

In the end, broadcast television became the centerpiece of U.S. consumer culture, influencing and disrupting American traditions, practices, and buying habits. Still, television was not a predetermined entity; cultural practices shaped its early development and uses, just as the medium in turn influenced these practices.

Cable Television

Just like radio, broadcast—or OTA—television relies on the airwaves to send its signal. Due to limitations in bandwidth, the number of broadcast stations in any market is limited, and the audience must be within range of the broadcast signal. Beginning in the late 1940s, amateur operators in remote areas where broadcast signals didn't reach properly began to put up huge antennas to catch the weak signal and resend TV content via wires to local paying customers. Known then as Community Antenna Television (CATV), this was the birth of cable television (Wu 2011).

The early cable markets were tiny, and because the practice merely expanded the audience for existing programs, broadcasters were not particularly concerned. Over time, though, cable operations expanded. Cable companies moved into larger communities and eventually began to use microwave towers (which were the first practical alternative to phone lines for long-distance communication signals) to import programs from far away that would otherwise not be available over the air in the local market. Since the local audience now might be watching programs that originated elsewhere in the country, this threatened to undermine the broadcast business model. Broadcasters sued, claiming copyright infringement, but in 1968 the Supreme Court ruled in favor of cable operators. Broadcasters then turned to the FCC, which began using new regulations to bar cable from the largest markets and to otherwise strangle the industry. With cable expansion stopped, investment stopped.

By the end of the 1960s, though, the Nixon administration championed deregulating cable to open up the industry while avoiding monopoly concerns by keeping the owners of the wires separate from the producers of programming. Cable enthusiasts argued that it could help solve the problem of limited bandwidth. New channels could be devoted to public service and be a noncommercial alternative to advertiser-driven broadcasting. In this vision, cable operators would be in control of a few of the channels, while the bulk of cable channels would be available for public interest programming or be made available for lease. Cable did expand, but it did so as a fully commercialized system with just a few local "public access" channels (Wu 2011).

Continuing the long-standing trend of privatizing public entertainment, in 1972 HBO launched its "Home Box Office" service, bringing commercial-free feature films and sporting events to television. It was among the first channels to rely primarily on subscribers paying a premium fee rather than on advertisers. In 1975, HBO innovated technologically when it began to use satellites to deliver its content rather than AT&T's long-distance lines or microwave towers. This caught the attention of Ted Turner, who, in 1976, created a "superstation" when

he bounced the data from his Atlanta broadcast station off of satellites down to local cable operators across the country. Using a similar technological approach in 1980, he launched the Cable News Network (CNN). Over the next decade, many others followed suit as new cable networks such as ESPN, MTV, Bravo, Showtime, BET, Discovery Channel, and Weather Channel—along with many that have since failed—were created. Television, long known for its limited and homogenous programming from three major broadcast networks, was transformed by the spectacular growth of cable. Broadcast television networks (now often actually delivered via cable) would continue to be in the business of delivering large mainstream audiences to advertisers, but cable-only TV channels now could survive by "narrow-casting," delivering niche audiences to specialized advertisers, and by enticing these audiences to pay a premium for content they valued (Wu 2011).

Cable technology overcame the limited number of stations that could be accommodated in OTA broadcasting. As a result, television's business model—as well as its social impact—changed. As we've seen, early mass media—newspapers and local radio—were fragmented by locality because technological limits meant most content was created and distributed locally. Later, radio and television networks created a more unified, mainstream, national culture. For example, when Elvis Presley performed on *The Ed Sullivan Show*, his appearance drew an astounding 83 percent of American TV households. (In comparison, in recent years, even the highly rated Super Bowl has reached less than half of U.S. households.) American viewers shared a more common television culture in that time, but that programming was typically bland, designed so as not to offend viewers or potential advertisers, and wildly unrepresentative of the nation as a whole. People of color and others outside of the mainstream, white middle class were largely invisible on television. Wu (2011:214) calls the programming from this period "unprecedented cultural homogeneity" from networks that "were probably the most powerful and centralized information system in human history."

Cable changed that through an economic model that enabled the viewer to access a larger volume and variety of programming. However, content aimed at smaller and sometimes more adventurous audiences reintroduced cultural fragmentation. This time, though, fragmentation was based on interest, taste, and—with news and commentary—political orientation rather than locality. But cable was still homogenous in a key way: With few exceptions, its business model is unapologetically commercial, whether catering to advertisers or appealing to subscribers. Early cable enthusiasts, who saw cable as a public service alternative to the commercial broadcast networks, never saw their vision realized. Instead, cable grew into powerful local monopolies that, critics argued, offered high-priced packages bloated with many rarely viewed channels. Cable operators argued that this package model subsidized smaller niche stations that otherwise could not survive on their own.

In recent years, cord-cutters began voting with their feet as they abandoned cable in droves, relying more on streaming services for television and video entertainment. Netflix, especially, was a pioneer in offering users low-cost access to content from a wide variety of producers. Once the lucrative nature of streaming

was evident, though, those producers sought to control both their own content and their own streaming platform. Increasingly, Netflix has focused on its own "original" programming, while producers like HBO, Disney, and NBC Universal all launched competing streaming platforms that spotlight their own content. For users, the result has been a fragmented and increasingly expensive landscape of streaming services.

Whether delivered via broadcast, cable, or streaming technology, commercial television became the centerpiece of U.S. consumer culture, influencing and disrupting American traditions, practices, and buying habits. Still, as we have seen, television was not a predetermined entity; cultural practices shaped its early development and uses, just as the medium in turn influenced these practices.

The Internet

In many ways, today's media landscape is dominated by the internet. As with earlier technologies, the internet has enabled social change and, in turn, has been influenced by a variety of social forces. Because we will be exploring many of these internet-related dynamics throughout the book, we limit our discussion here to an overview of narrow technology issues that distinguish the internet from other forms of media.

Creating the Internet

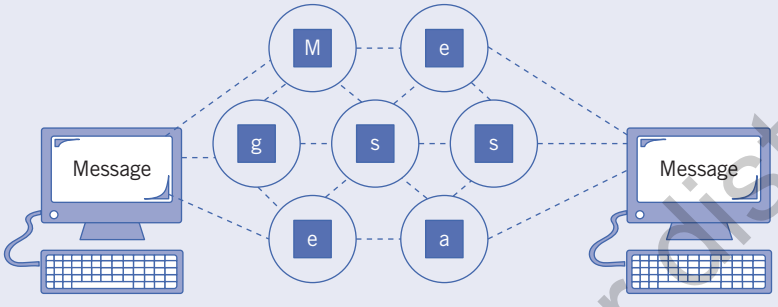
The internet is a vast network of interconnected computer networks whose underlying technology was developed over a half century (Abbate 1999; Hafner and Lyon 1996; Naughton 2000).

In 1958, in the midst of the Cold War and in response to the Soviet Union launching the first space satellite, *Sputnik,* the U.S. government created the Advanced Research Projects Agency (ARPA) within the Department of Defense to develop forward-looking technology with military applications. Two years later, one of the program's leaders, J. C. R. Licklider (1960), wrote, "The hope is that, in not too many years, human brains and computing machines will be coupled together very tightly, and that the resulting partnership will think as no human brain has ever thought and process data in a way not approached by the information-handling machines we know today" (p. 75).

By 1966, the group had launched ARPANET, a small network of government and university computers that pioneered the use of "packet switching" to break down messages into small data packets before sending them separately along different routes to be reassembled by the receiving computer (see Figure 2.6). Although this technology was seen as potentially enabling military communication to continue after a nuclear attack destroyed one or more nodes in the network, it instead became an essential element of the internet.

Figure 2.6 Internet Packet Switching

The internet's technology enables messages sent from one computer to be broken up into tiny data packets that are routed through whatever optimal pathway is available and then reassembled at the receiving computer. This promotes speedy transmission by avoiding bottlenecks or breakdowns in the vast network. It also helped establish the internet as a highly decentralized medium that was not easy to block or shut down.



By 1968—more than a half century ago—Licklider and his colleague Robert W. Taylor were presciently writing, "In a few years, men will be able to communicate more effectively through a machine than face to face." They envisioned that "interactive communities of geographically separated people" would create "distributed intelligence," available to tackle any task. These "on-line communities" would be "communities not of common location, but of common interest . . . interconnected by telecommunications channels." They hoped that "life will be happier for the on-line individual because the people with whom one interacts most strongly will be selected more by commonality of interests and goals than by accidents of proximity." They argued that access to such networks needed to be a right, not a privilege, so that everyone could benefit. They concluded, "[I]f the network idea should prove to do for education what a few have envisione[d], . . . surely the boon to humankind would be beyond measure" (Licklider and Taylor 1968:21–40).

ARPANET went online in 1969, at first linking just four universities. In the 1970s, researchers worked out the standard language and protocols that would be used by all computers wanting to connect to the network. By 1975, more than 50 university and government sites were networked, and the pace of growth increased. In 1983, ARPANET was split in two, resulting in MILNET, for military uses, and NSFNET—under the control of the National Science Foundation (NSF)—for civilian uses. Under NSF guidance, standardized communication protocols (Transmission Control Protocol/Internet Protocol [TCP/IP]) that regulate the size and flow rate of data packets were officially adopted, enabling any computer to connect to the growing internet. The NSF supported the national "backbone" of this network, free of charge.

Once the military uses of the internet were separated from civilian uses, government financial support came with relatively few strings attached. This enabled early developers to work without the pressures of commercial market forces while acting on their optimistic "technocratic belief in the progress of humans through technology" (Castells 2001:61; Kahn and Kellner 2004). Within this context, a subculture of computer enthusiasts (sometimes known as hackers) promoted principles such as sharing, openness, decentralization, and free access to computers (Jordan 2008; Levy 2010). Their efforts were the foundation for later "open source" and "free software" movements.

In its early years, using the internet was generally limited to engineers, computer scientists, and others who possessed the necessary specialized computer skills. That changed when Tim Berners-Lee, a British scientist at the European Laboratory for Particle Physics (known as CERN) in Switzerland created a user-friendly network interface and freely released it into the public domain. Launched in 1991, this "World Wide Web" created the familiar "www" at the beginning of web addresses and used hypertext to enable "point-and-click" navigation, making it much easier for people to use the internet's growing archive of resources. (This also marked the beginning of the widespread but erroneous belief that the "web" and the internet were one and the same.)

Also in 1991, the U.S. Congress passed the High Performance Computing and Communication Act, authored by then-U.S. Senator Al Gore, to substantially expand the publicly funded infrastructure that was becoming popularly known as the "information superhighway." Shortly thereafter, the NSF issued an "Acceptable Use Policy" for NSFNET, confirming that its services were provided to "support open research and education." The research arms of commercial firms could also use it but only "when engaged in open scholarly communication and research" (National Science Foundation 1992).

But as the potential of the internet to reach the wider general public became increasingly clear, businesses began operating their own private networks, and investors sought to use the internet for commercial purposes rather that public ones. Back in 1988, the NSF had already begun discussions about commercial access to the internet and sponsored a series of conferences on "The Commercialization and Privatization of the Internet." As media scholar Robert McChesney (1999) points out, "No one really had a firm sense . . . of what exactly, if anything, the privatization of the Internet would mean for individual users" (p. 130), and there was little public input into the process. Still, the transition happened quickly; by 1995, the NSF stopped funding NSFNET, and internet connectivity became the exclusive domain of private firms.

As the president of the Internet Society, a nonprofit group that helps maintain the technologies and applications that undergird the internet, noted, "The mechanics of the Internet are so widely distributed that for [the government] to try and exercise control is folly. Sure, they created the technology through their funding . . . but the baby has grown up and left home" (Quick 1998:B4).

The Internet Grows Up

Some researchers within the military's ARPANET program had viewed themselves as nonconformists challenging the confining structures of the military establishment while promoting values of sharing and decentralization that became part of the internet's infrastructure. Similarly, as the internet became commercialized, some early internet-related companies were led by individuals influenced by the communitarian counterculture of the 1970s (Turner 2006). If an egalitarian, hippie lifestyle—supplied by products from the *Whole Earth Catalog*, fueled by the psychedelic drugs of the day, and aimed at cultivating personal freedom—turned out to be impractical, then perhaps new technologies offered a different route to liberation. The old, centralized, mainframe IBM computers of the corporate world came to symbolize the faceless establishment; the new, networked "personal" computers of Silicon Valley entrepreneurial start-ups represented the rebellious empowerment of the individual. A 1984 television commercial from Apple—with its bright, rainbow-striped fruit logo—embodied the sentiment, famously associating its new MacIntosh computer with an assault on an Orwellian "Big Brother" in a bleak, colorless world. This combination of zealous techno-utopianism (sometimes informed by the work of Marshall McLuhan), dressed in a countercultural "rebel" veneer and harnessed to maximize capitalist commercial success, proved to be a potent mixture that influences technological developments to this day. (The irony, of course, is that some of these once hip, rebellious, and disruptive technology companies became the established corporate giants of our age.)

As the internet "grew up," the excitement over the potential money to be made became frantic in the latter half of the 1990s, contributing to wild investment in new "dot-com" companies that drove the U.S. stock market to unprecedented levels. But consumers at the time were not interested in buying groceries (webvan.com), kitty litter (pets.com), or sporting goods (mvp.com) online. As a result, many much-hyped companies collapsed, and the dot-com "bubble" burst in 2000, sending the stock market plummeting.

But as the internet gained a greater foothold in society in the 2000s, more emphasis was placed on how this technology could enable users to customize, create, and share content rather than simply shop online. Web 2.0, one of the popular names given to highlight this collection of interactive capacities, was a label that suggested a technological change from the earlier internet. New technologies, enthusiasts noted, enabled the rise of blogging, social-networking sites, content platforms such as YouTube, collaborative wikis such as Wikipedia, early multiplayer role-playing games such as *World of Warcraft*, and virtual worlds such as *Second Life*.

In fact, Web 2.0 did not reflect any substantial change in the technological capacity of the internet. Instead, Web 2.0 was a concept coined in 2004 to indicate a shift in how software developers and users utilized the existing medium (Scholz 2010). Part of this was marketing hype; in the wake of the dot-com bust,

developers had to convince investors that there was something new and fundamentally different about Web 2.0 that made it a better and safer investment than the failed dot-com era. Just as the uses to which radio and television technology were put evolved over time, Web 2.0 highlighted and developed capabilities of the internet that had existed since its inception. This is another example of how changes that result from social forces have been popularly and erroneously understood as being the result of technological innovations.

The world of internet connectivity was enhanced by the growth of mobile devices, including laptops, tablets, and especially, smartphones. The ease with which users could now access these devices—and the internet—meant they could be easily integrated as an omnipresent element of daily life. The emerging innovations in wearable technologies and the "internet of things (IoT)" suggest this integration of internet with daily life will only increase in the coming years. (We explore some of the implications for users and society of this growth in Chapters 8 and 9.)

Some Characteristics of the Internet Era

As with other media technologies, the internet did not travel in a straight line from introduction to mass adoption. Instead, as we have seen, the current version of the internet is the result of complex social processes, involving government funding, the culture of computer enthusiasts, commercial interests, and user preferences. But the technological infrastructure of today's internet—much of which remains invisible to users—has several unique features with significant social consequences.

First, the internet was designed and built to be an open, decentralized platform, accessible to anyone using its basic language and protocols. Unlike, say, cable television, it was not a private, commercial venture controlled by industry corporations. Instead, its creation was funded by research grants, it accommodated projects that were not commercially viable, and its pioneers encouraged a culture of public service. This enabled early internet pioneers to experiment and innovate at a rapid pace, tackling the enormous challenges they faced in creating a new medium. Some of the solutions they found for these challenges still shape how the internet operates today.

Second, the internet's structure was designed to give users considerable control over their experience; it is a nonspecialized platform made to accommodate whatever the user wants to do. This changes interpersonal communication by enabling user interactivity regardless of location. We can video chat with a friend across the globe or tweet back and forth with people in different locations. As we saw in Chapter 1, this sometimes blurs the distinction between interpersonal and mass communication, supplementing the one-to-many model of traditional mass media with the possibility of a many-to-many network of communication. In addition, unlike with traditional broadcast media defined by a set program schedule, internet users decide what content to access and when. More important, people

with relatively modest financial resources and basic technological literacy can use low-cost digital media tools to create and share original content. The requirements for such a task are still insurmountable hurdles for the world's impoverished and illiterate—and indeed the majority of the world's population—but the creation of widely sharable media content is within the grasp of more people than ever before in human history.

Third, the internet is the first medium to embody *digitization*—the shift from analog to digital media—and *convergence*—the blurring of boundaries among types of media. Analog media exist across largely unbridgeable material divides. The technologies underlying print on paper, sound pressed into the grooves of vinyl records, and images chemically developed on celluloid film, for example, each work in their own distinct ways, and don't mix together easily. In contrast, digitization enables print, sound, images, and video to be recorded, copied, stored, and transmitted in a single universal language: the 1s and 0s of computer code. This common digital foundation is what enables your computer, television, or smartphone to access text, images, video, and sound and to "talk" with other digital devices. Such code can be easily copied and shared, making media content abundant. Digitization sets the stage for convergence, where previously distinct forms of media now blur. "Newspapers," for example, don't need paper, but they can post print stories with interactive graphics and embedded videos on their websites. Over the past few decades, the growth of digital media, the rise of the internet, and the proliferation of mobile devices have combined to burst open the very meaning of media (Bolter and Grusin 2000; Lister et al. 2009).

Finally, the internet is a global system of communication whose governance structure transcends the regulatory reach of any single country. The result is vast gray areas of law and custom. For example, nation-states can impose regulations or even close off parts of the internet, but it is difficult to be totally effective in doing so. Intentionally designed to survive the shutdown of any particular node, the internet's decentralized structure offers many possible work-arounds for tech-savvy users. So who should have unfettered access to the internet? Who can regulate and control it in the face of cyber criminals and other nefarious users? As more and more of our world is connected to the internet and dependent upon it—not only individuals but energy grids, banks, schools, and the media—how can security be enhanced while maintaining the flexibility and openness of the internet? The sprawling reach of the internet raises many such questions and concerns, even while it still offers some of the hopes envisioned by its pioneers.

As Curran, Fenton, and Freedman (2016) note, "In the 1990s, leading experts, politicians, public officials, business leaders and journalists predicted that the internet would transform the world" (p. 1) by bringing prosperity, democratizing culture, rejuvenating political democracy, challenging autocrats, and promoting global understanding. Although falling far short of such idealistic predictions—and producing many unanticipated consequences—the internet has enabled a wide variety of economic, social, and political change, some of which we explore throughout this book.

Conclusion

Helsingborg, Sweden, is home to the Museum of Failure (2018). Among the many technology-based innovation failures featured there are the Divx Disc and the Teleguide, along with the better-known Google Glass, Apple Newton, and Sony Betamax. (You can learn about any one of those by simply searching for them on the internet, which is definitely *not* a failure.) In a sense, the museum is a testament to one of the arguments of this chapter: The development and uses of a new technology are not inevitable. Their fate is determined by economic, political, and social forces. Technology matters, enabling the introduction of vast social change, but its development and application are the result of the people who create, deploy, regulate, and use them.

As we have seen, the last century has featured a series of disruptive innovations in communications technology, including the telegraph, telephone, radio, film, television, cable TV, and the internet. Media scholar Tim Wu (2011) argues that there is some similarity to the evolution of these new technologies. At first, he notes, the introduction of an innovation begins a period of idealistic experimentation. Often, the new technology is touted as providing significant altruistic or even utopian benefits for society. Inventor Nikola Tesla predicted that, with radio, "the entire earth will be converted into a huge brain, as it were, capable of response in every one of its parts." Pioneer film director D. W. Griffith declared that children would never again be asked to read history books because "children in the public schools will be taught practically everything by moving pictures" (quoted in Wu 2011). A study from the 1970s claimed cable television was bringing a revolution that was "nothing less" than that brought by movable type and "may conceivably be more" (Wu 2011:6). And, as noted earlier, the internet has been touted as a transformative development in human history.

However, Wu continues, when the new technology threatens to displace or render obsolete older technologies and their reliable revenues, traditional technology companies seek to control it. They tame the experimental uses of the technology, standardizing it in a closed form that can be centrally controlled—and more efficiently tapped for profits—all in the name of a better user experience. The government is often enlisted to help by regulating against any new competition. Social and economic forces reassert themselves, and the field yields to the control of a few major corporate players. Over time, though, the novelty of the new technology wears off, users become familiar with its flaws and limitations, and dissatisfaction grows. Protected from real competition, the closed industry becomes stale and is ripe for challenges by new players promoting new technology.

Crucially, Wu makes clear that there is nothing inevitable about what he calls "The Cycle" of technological innovation. Instead, key players—including inventors, corporate executives, government regulars, and users—each make decisions and take actions that bring about the changes.

Arguably, the process continues today as debates swirl between public interest advocates and major media corporations concerning the direction the internet

should take. As Wu observes, "It may be true, today, that the individual holds more power than at any time in the past century, and literally in the palm of his hand. Whether or not he can hold on to it is another matter" (p. 299).

DISCUSSION QUESTIONS

1. Explain the differences between technological determinism and social constructionism.
2. What are some examples that show how human agency shapes the development and use of technology? What are some examples suggesting that technology may sometimes influence society?
3. In what ways have the use of electronic media, especially television and the internet, changed social life? What is different about how we live because of the presence of these media? What changes do you think might be coming in your lifetime?
4. What have been some of the most important advantages to the rise of the internet and the expanded use of mobile devices? What are some of the potential negative consequences of these changes?