With regard to authors, it is a mark of supreme cowardice to give unlimited credit to authors and to deny its rights to Time, the author of authors and thus of all authority. For truth is rightly called the daughter of time and not of authority.

—Sir Francis Bacon ([1620] 2004: 69)

Absolute, true, and mathematical time, of itself, and from its own nature flows equably without relation to anything external, and by another name is called duration.

—Sir Isaac Newton ([1687] 1995: 13)

What for others are deviations are, for me, the data which determine my course.—On the differentials of time (which, for others, disturb the main lines of the inquiry), I base my reckoning.

—Walter Benjamin (1999: 456)

Time is a difficult topic for historians. I remember an occasion when I was in the history department and I commented that—alluding to Koselleck—modern history not only is in time but also operates through it (1985: 246). This generated a rather snide comment
from a colleague, a disgust with “theory,” which is the only explanation for something that needlessly complicates what is so obvious and commonsensical as time. This reaction adheres to the words of Bacon in the epigraph without recognizing the power that Bacon bequeaths to time. This conflation of chronology with absolute time parallels what Lefebvre identifies as a double illusion in the simplification of space to absolute space—that of transparency and reality (1991: 26–29). This refusal to entertain the possibility of times other than chronological time is a refusal to inquire into the system that guides our ways of knowing and being. Even more, as I will show in this and the next chapter, the historicity of chronological time is empirically verifiable using normative historical methods. A refusal to accept this history is the denial of the very empiricism that this former colleague espoused. It is the kind of thinking that leads Runia to mutter, “Historians don’t think” (2014: xi).

Thankfully, more and more scholars are attuned to the many forms of time—and indeed, times—that human understanding and reckoning of time are historical, and that history is a key determinant of the social and cultural makeup of communities. A rich literature on time—its history and multiple forms—exists and needs to be brought into our writing of history and, more broadly, historical thinking. Failure to recognize this scholarship has allowed history (and the historical thinking it fosters) to reach at least two contradictory conditions, both of which can be called “fatally confused” (Bastian 2012). First, echoing Castillo and Egginton and Rumsey Smith on information inflation, we seem to be reaching a moment where our knowledge system and understanding of the world are decreasingly able to account for the vast increase of information available today. Bigger and cheaper storage devices only solve a small part of the problem. Bastian provocatively suggests that our continued use of Newtonian time makes us oblivious to the fact that nature (long considered stable and unchanging) is changing faster than modern society. This confusion can be extended to
other realms. Sheldon Wolin argues that “political time is out of synch with the temporalities, rhythms, and pace governing economy and culture” (1997). Ermarth writes, “The tools of thought inherited from modernity are increasingly at odds with our personal and practical situations and thus indicate a growing and even urgent need for consideration and re-consideration of what the changes demonstrated imply for long-familiar assumptions about identity, time, causality, creativity and politics” (2011: 3). The list of examples of this fatal confusion, the disjunction between observation and inherited notions of reality, is growing.

Second, we must accept the possibility that history, the field of knowledge that has ordered the world, is now mythical.4 I will discuss this more below, but at this point, it is enough to point out that since the turn of the twentieth century, the science on which absolute time was based now exists amid newer understandings—for example, Einstein’s special relativity, the laws (especially second) of thermodynamics, chronobiology, and quantum theory. Absolute time is now called “classical time” (not to be confused temporally with the classical period of history), signifying the presence of other notions of time more akin to modern science. Modern history operates on an outmoded notion of time, though it is commonly believed, especially socioculturally. But now that notion is one of several, which, if employed, must at minimum be defended rather than assumed.

Today, more than ever, we need to evaluate the very structure of historical understanding—to discern science, myth, and ideology. This issue is not “new.” The examples cited above suggest also that the disconnect between scientific time and chronological time existed throughout the twentieth century, if not earlier. As science was moving away from absolute time, the international and nation-state systems, the social sciences, and the humanities developed through absolute time. This recalls Elias’s plea for a “spring cleaning.” An initial step toward a richer understanding of how humans use pasts to make sense of their world is rather simply
stated: to bring times into histories rather than describing history in time. There are many different times: the physical happenings, rhythms of chronobiology, and rhythms of assemblages both small and large. Each of these times might have several temporalities within each. These times have been overshadowed, or “colonized,” by linear, progressive time that Geoffrey Bowker (2014) has described as a “sociotechnical imaginary” time. This is our modern time; it will not be easy to reformulate this time, nor am I advocating its elimination. In the sciences, absolute time coexists with relative and quantum times. My goals are not critique and replacement (which often results in supporting the status quo), but I suggest the multiple ways we can understand times that place what Benjamin in the epigraph calls “differentials of time” as constituent elements of our lives rather than as emplotments along a universalizing sociotechnical imaginary.

Before we can move to these differentials of time, it is essential to outline, briefly, a history of time—that is, to show that our current understanding is social, not natural.5

NONMODERN TIMES

Scholars who have studied nonmodern people and places (ancient, medieval, and non-Western) are aware of the different ways that time has been reckoned. When one looks, there are many fine historical accounts of times in ancient, medieval, and early modern places. Anthropologists have long described different understandings of time in the cultures they studied.6 Much of the information that follows in the first section is familiar; my goal is not to present something new but to suggest other ways people have reckoned time when absolute time was not the metric for order and becoming. There were, simply, other ways of understanding, many of which can be found (or would be helpful) today.

Prior to the modern period, and in places not dominated by abstract time, time is episodic, local, uneven, and irregular. Some
days are more favorable than others. Indeed, calendars were used not to show the passage of time but to mark place, significance, and meaning. In post-Reformation Europe, Friday was “thought unlucky for any venture, whether marrying, making a journey or even cutting one’s nails,” and in Yorkshire (England), servants considered Monday an unlucky day to change employer (Thomas 1971: 619). The luni-solar calendar in Tokugawa society (Japan) was not a grid of passing days but an information sheet of major and minor months, divinatory signs, and auspicious/inauspicious days. The magnificent clock at the Strasbourg cathedral includes an automated astrolabe, a perpetual calendar, a carillon, a virgin holding the Christ child, a mechanical cock that flapped its wings and crowed, and “a tablet showing the body parts and their correlation with the zodiac for the favorable and unfavorable times for bloodletting” (Haber 1975: 399–400). Such uneven time remains: our legacy of “superstitions” like Friday the 13th are an example, and in Japan today, many calendars (Gregorian) still mark the auspicious (taian) or inauspicious (butsumetsu) days (now important for deciding celebratory events like weddings). In some working-class communities, the regularity of the everyday is as much or more valued than the developmental time of middle-class societies (Perovic 2017; Negt and Kluge 1993).

In medieval and early modern societies, mechanical time was secondary to social time. What we now see as exquisite detail and craftsmanship on early clocks exhibited socially meaningful information. Derek de Solla Price argues, “The first great clocks of medieval Europe were designed as astronomical showpieces, full of complicated gearing and dials to show the motions of the Sun, Moon and planets, to exhibit eclipses, and to carry through the involved computations of the ecclesiastical calendar. As such they were comparable to the orreries of the 18th century and to modern planetariums; that they also showed the time and rang it on bells was almost incidental to their main function” (1959: 86). In other words, the positions of celestial bodies were more important
than the time of the day. The movement of the stars was a way to discern auspicious and inauspicious days, weather, the growth of crops, and medical information about the human body. The “hour” of the day, the temporal hour, was also uneven, divided into equal units of daylight and night. Many early mechanical clocks (fourteenth-century Europe) did not have a minute hand, and if they did, it needed to be periodically corrected using a sundial. In East Asia after the Jesuits introduced clocks, these mechanical devices became markers of wealth and prestige. In Edo society (seventeenth- to nineteenth-century Japan), craftsmen added a second folio so that these status symbols could follow the temporal hour. Mechanical time had to be adjusted to social time.

Previous reckoning systems for the year varied widely. Medieval Jews used three chronological systems: the era of creation, the era of the destruction of the Second Temple, and the Seleucid era (Yerushalmi [1982] 1996: 41). Our current chronology, the linear reckoning of years as BC/AD or BCE/CE, is relatively recent, becoming the principal system in the seventeenth century.9 Dionysus Exiguus first proposed in 532 a reckoning system, beginning with the birth of Christ (anno Domini) as year one.10 Dionysus’s system was not dominant but coexisted with numerous others. Time systems were local. Local events, not abstract years, served as the key markers. The olympiads provided a regular marker for dating the year in ancient Greece, the indiction was a common system in the Roman world, and the Bible provided another.

Chronological reckoning came with the Enlightenment. At the end of the sixteenth century, Joseph Scaliger formulated a Julian period, a singular, continuous, and linear time of 7,980 years. Christ’s birth within this system was year 4713. In the seventeenth century, Domenicus Petavius moved chronology closer to an absolute time by removing time from religion. He wrote, “Chronology indeed inquires after one thing, by what signs and marks each thing may be arranged in its years and times” (Wilcox 1987: 205). Nevertheless, Petavius retained Dionysus’s birth of Christ—not, he
claimed, for its religious significance but as a conventional point of reference. Petavius’s major (and lasting) contribution was to add years before Christ to fill out the chronology. In the western Pacific, when new leaders sought to create the nation-state of Japan following the Meiji ishin (the revolution in 1868), they adopted two systems, a linear sequence beginning from the ascension of the mythical emperor Jinmu and a modified nengo that counted years by emperors’ reigns. The subsequent rendering of previous events and the temporal systems of other societies according to Petavius’s timeline is a translation into this Enlightenment system.

Clearly time was not central to the organization and makeup of these societies, but it would be a mistake to conclude from this brief outline that nonmodern places (ancient, medieval, non-West) did not understand or were “indifferent to time” (Gurevich 1985: 151). Jeffrey J. Cohen argues that time was very important, but it was not the mechanical, absolute time of our world. He writes, “Medieval writers were just as enamored of investigating the complexities of both temporality (the nature and working of time) and history (the transformation of time into narrative) as recent theorists have been” (2003: 2). Cohen, like so many scholars of medieval and early modern periods, as well as those of non-Western places, is reacting to the propensity in history to conclude facilely that earlier periods were not as sophisticated as ours, the modern. One need merely peruse Bede’s reckoning to see incredible sophistication on lunar and solar cycles, sacred time, and sociopolitical times. The Mayan calendar is a remarkable system comprehensible today only to specialists. Calendar keeping was a prestigious role; controlling time bore significant power. In Edo society, the imperial court, the bakufu (government), and some domains employed astronomical scholars to determine the calendars. The major concern among scholars in Christian Europe was determining the date of Easter. Adolph Holl discerned a new desire to “know the time” around twelfth- and thirteenth-century Europe (cited in Nowotny 1994: 16). This desire was partly fueled by an expanded
world in which merchants needed to calculate the costs of distant trade. This increased concern for time began an interaction between space and time that has continued through the spatial compression we experience today.

As the above suggests, time need not be a metric to emplot and organize but a way to understand the world that surrounds us. It was (is) a mysterious and powerful world. The historian Aron J. Gurevich writes, “Both space and time are axiologically and emotionally charged: time and space can be good or evil . . . there is a sacral time, a time to make merry, a time for sacrifice, a time for the re-enactment of the myth . . . and . . . there are sacred places or whole worlds subject to special forces” (1985: 29). Interestingly, time is something to pay attention to. It is internal to society, something that one can change: “Time in archaic society is not something outside people, unrelated to their lives and doings. On the contrary, it is something within them, and therefore it is possible to influence its course and even its quality” (103). Today, in contrast, because we operate with time as an externality, we feel caught up by time (Eriksen 2001; Levy 2007; Rushkoff 2013).

One of the hardest ideas for us to grasp is that the constant passage of time—past, present, and future—did not always exist as we understand it today. Ancient Greeks perceived and experienced their world “as remaining at rest, or as orbiting in a great circle” (Gurevich 1985: 31). Repetitive time was in the contemporaneous, while movement was the transition toward eternity. Gurevich writes, “Man did not feel himself to be existent in time; ‘to be’ for him meant ‘to abide,’ not ‘to be in the process of becoming’” (133). The passage that did exist (history) was devolution toward the end, then renewal. Jacques Le Goff notes that the prevailing idea in medieval Europe was mundus senescit, “the world grows old” (Le Goff 2015: 8). This connection with passage and decay was also built into the Confucian Mandate of Heaven, which calls for the overturning of incompetent governance, and farther east, in what is now Japan, renewal was allowed within imperial
reigns. What we today call the past—things that happened and are prior and distinct—was not distant nor different; inherited ideas that were important enough to be retained were of the present. In a world that grows old, the future as something better did not exist. In his discussion of the famous early historians Polybius and Sima Qian, Gurevich writes that “history was no more than the eternal return in a prescribed order of the same political forms” (1985: 33). Anticipation of something to come, of course, existed. But for something to be anticipated, it had to be based on some experience. Some peoples whose horizon is based on experiential knowledge point behind themselves to indicate the future (Nunez and Sweetser 2006; Nowotny 2008: 1). This directionality recalls Benjamin’s interpretation of Paul Klee’s “Angelus Novum,” in which the angel is being blown to the future while looking backward at an ever-increasing accumulation of destruction (1968b: 257–58).

In these places, iterative acts of recurrence, where knowledge is handed down through memory and oral traditions, can be a way of maintaining a particular place. Gurevich described time during the ancient period as “spatialized”—that is, dependent on space and environment: “Ancient man saw past and present stretching round him, in mutual penetration and clarification of each other. An event which took place previously and an event happening now can be perceived by the archaic consciousness as manifestations in one and the same plane, extended in one and the same temporal duration” (1985: 29). In these worlds, repetition invokes either a sense of stability through constancy or a connection to some eternal ideal.

This certainly does not mean that these societies were static. Repetition and redundancy can be conservative (place-making and maintenance); it can also lead to variation and change. For example, in Japan, the architecture of the Ise Shrine, because its periodic rebuilding depended on the memory, skill, and materials available, evolved over the millennia despite its reputation for originality (Isozaki 2006). We know that stories, fables, and epics changed
as they were disseminated, a mode of preservation. Today as well, such repetitive time from chronobiology, habits and customs, and repetitive labor are a constituent part of modern society (Young 1988; Sharma 2014). Recent scholarship shows that as economic processes become more efficient, we increasingly depend on cyclical, commodified labor. We see this process in the elevation of subcontracting work in Japanese factories; Sarah Sharma has shown how participation in the hypermanaged and efficient clock time of global capitalism depends heavily on cyclical and on-demand labor; and Lilly Irani describes how a technological startup increasingly turns to subcontracting of mundane tasks to maintain its rapid momentum (Sharma 2014; Irani 2019).

Koselleck’s notion of two forms of social organization—spaces of experience and horizons of expectations—is useful while also showing the limitation of categories that derive from stability and motion. Nonmodern places are characteristic of spaces of experience. The emphasis is in the present past; depth did (and does) exist in an “eternal present.” The space of experience is one where locale, not time, provided a different understanding of depth and connectivity. In such places where recursive acts are the norm, perfection might be the goal, but change was often seen as deterioration—humans could not replicate what the gods or God created: mundus senescit. The horizon of expectations is more common to bourgeois society: the future made present. It is directed toward the not-yet as something to be revealed (Koselleck 1985: 267–88). We will be moving to abstract time shortly. Koselleck argues that these forms are successive and/or coexistent, and in his later writings, he argues for a layering of time (Zeitschichten; 2018: 3–9).

At this point, it is important to decouple descriptions of nonmodern places from chronology. This tendency to linearity has been a principal reason that these accounts are easily overlooked. Mobility (change) and stability are conditions of communities and are not characteristics of the modern/premodern. An important difference is in the placement of time. When time is internal,
various aspects of the activity remain present; both change and repetition are evident. When time is externalized—that is, with the discovery of absolute time—it becomes possible to obscure, hide, or ignore various parts of the process. This principally happens in two ways. First is the practice of translating (or, more accurately, transmuting) times to modern, chronological time as if it is a mechanical act. Second, and more important, is that these accounts of nonmodern places are located as some temporal condition of the inferior or unsophisticated. In anthropology, Fabian calls this allochronism, a denial of coevalness where the culture, even though contemporary, is primitive and foreign (1983). In nonmodern histories, it is of places that are past and different. A description of the way that these acts reinforce chronological time will be discussed in chapter 2.

“ABSOLUTE, TRUE, AND MATHEMATICAL TIME”

Our modern time—that is, the notions that time is external (absolute), constantly flows linearly (true), and is regular (mechanical)—came into being gradually. I will only offer a general overview, enough to make my point; there are several fine accounts of this transformation to an absolute time (see, for example, Adam 2004; Elias 1992; Fraser 1987; Nowotny 1994; Toulmin and Goodfield 1965; Wilcox 1987). This shift toward abstract time occurred in Europe, and universal time was formulated there. Le Goff (1980) writes about the transformation of time between the twelfth and fifteenth centuries as a difficult effort to deal with the coexistence of natural time (the various cycles of seasons, stars, planets, sun, and moon), professional time (measurement for trade and transactions), and supernatural time (religious and supernatural understandings). By the nineteenth century, absolute time reoriented these times: natural time was relegated to an originary status, professional time used absolute time to reconceive social processes and value, and supernatural time was relegated to the past.
By the sixteenth century, changes were manifold. The breakdown of the feudal order involved the spread of printing presses, the formation of states, the discovery of the New World, the rise of merchants, and the Protestant Reformation (Shapin 1996: 119–65; Standage 2013: 48–63). This crisis contributed to a perceived need for order, what Carolyn Merchant argues was the “fundamental social and intellectual problem for the seventeenth century” ([1980] 1989: 192). In this search, absolute time was one alternative. Mystics explored a mystic science in the sixteenth and seventeenth centuries (Certeau 1992, 2015), universal history recognized multiple chronologies (Jordheim, forthcoming), and self-organization—a distant predecessor to complex systems—gained ground in the early eighteenth century (Sheehan and Wahrman 2015).

Newton brought together a series of ideas that culminated in the late seventeenth century—in particular, the desire to understand mathematically the mechanical operations of the world. In the epigraphs from Bacon and Newton, the assertions are seductively simple and seem obvious to us today. Bacon inverted authority from the past (God) to the present (science), and Newton’s often-quoted declarative statement of time removed time from human activity to an externality. It has its own regularity, flows, and can be measured, creating duration. The order that is made possible through Principia is one in which the world can be rendered as matter and material that, subject to universal laws, can be ordered, known, and manipulated mathematically (i.e., quantitatively). But this notion of time shifts scholarship from relations—understanding, experience, and sensation—to knowledge about material objects, their movement, and how they compare. Prigogine and Stengers write, “The ambition of Newtonian science was to present a vision of nature that would be universal, deterministic, and objective inasmuch as it contains no reference to the observer, complete inasmuch as it attains a level of description that escapes the clutches of time” (1984: 213).
The clutches of time of Prigogine and Stengers is the life processes, the creativity, and the social conventions that Fraser (1987) calls for in the epigraph to the introduction. The escape from this time was to remove time (and scientific laws) from human activity and sensibility and turn it into an externality that is ostensibly neutral for all measurable knowledge. Barbara Adam succinctly describes the strength of Newtonian time: “[Time] is linked to a number and the measure of motion, duration, and rate” (1990: 51). Chronological time is now hidden in plain sight, yet the transformation is profound. On the one hand, the scientists, who know the laws and abstract principles, become the omniscient, neutral observer. On the other hand, it transposes all previous connections of time in society away from experience. Fraser writes, “Gone were the attempts to relate time to the motion of the stars (as proposed by Plato), to the ‘number of motion’ (Aristotle), to the mind (Augustine), to the world and mankind (Averroës), or to life and feeling. Time became a type of universal order that existed by and in itself, regardless of what happened in time” (1987: 41). Fraser is describing the transition from various understandings of finite worlds where stability begins in fixity (creation) to an infinite universe always in motion.

This is the escape from the “clutches of time.” Time changes from activity and sensibility of humans to a mechanical, clock-like movement, a putatively neutral time that is bidirectional and turns motion into a default condition. Newtonian time establishes a single system that will be used to unify the many reckoning systems into one system that, though formulated in Europe, is presented as universal. That is, the world becomes renderable mechanically and mathematically.

CLOCK TIME

A central, or perhaps the most important, device and symbol that fostered this transition to mechanical time is the clock. The impact
of the clock cannot be overemphasized. Mumford states matter-of-factly, “The clock, not the steam-engine, is the key-machine of the modern industrial age” (1934: 14). Indeed, it predates absolute time. Bells from thirteenth-century Europe and Tokugawa Japan and then public clocks in fourteenth-century Europe slowly began to order the work day (Le Goff 1980; Frumer 2018; Glennie and Thrift 2009). Clock time as a common system to synchronize large groups of people became widespread with industrialization (Le Goff 1988; Gurevich 1985; Thompson 1967).

Perhaps the greatest significance of the clock for my discussion is as a metaphor, a machine. It was a part of the transition of knowledge from a world of gods, spirits, or animistic powers to the laws that we now see as a part of science (Shapin 1996; Merchant [1980] 1989). Johannes Kepler writes, “My aim in this is to show that the machine of the universe is not similar to a divine animated being, but similar to a clock.” (quoted in Shapin 1996: 33). The artificial, which is man-made, was no longer an inferior version of the world. This image represents a particular notion of the machine as humankind’s ability to exploit energy and to mechanize (i.e., develop) productive enterprises. The clock dissociates time from human activity and reinforces the idea that time is independent and measurable.

Within this metaphor of a clock, both a progressive time and a repetitive time coexist; indeed, they depend on each other (Bowker 2014). Up to this point, time was isotropic; Newtonian time could move in both directions. Clock time suggests forward motion, while cycles of the hour and day reinforce repetition and redundancy. The calendar does the same through the lunar cycle, seasons, and solar cycle. It is important to point out that clock time reoriented life and work around mechanically repetitive, not lived processes (Thompson 1967). Much has been written about the transformation of industrial society around clock time. Mumford writes, “Abstract time became the new medium of existence. Organic functions themselves were regulated by it: one ate, not
upon feeling hungry, but when prompted by the clock: one slept, not when one was tired, but when the clock sanctioned it” (1934: 17). Clock time has become so naturalized that social and organic functions have merged with mechanical time. It dominates our modern world to the extent that efforts to resolve our imbrication in time have usually been to become more efficient, further entangling us in absolute time. Leisure too acts as a respite from regulated work life, yet it replicates the structure and regularity of clock time (Elias 1986).21

Applying this idea of time occurred gradually, and it was not until the eighteenth and nineteenth centuries that it was widely accepted. Change does not occur linearly; linear narratives often obscure the multiple strands of transition.22 During a transformation, there is the maintenance of inherited forms; unsuccessful efforts to create an alternate understanding; multiple, parallel ideas; dismissal of novel ideas that only later become recognized as significant; and, of course, the great figures (Bacon and Newton) who bring together many of the parallel and competing ideas. A linear time did not replace cyclical time. These are not antithetical; repetitive time is a constituent part of absolute time. Shapin writes that even during the age of Newton and Boyle, “the idea of linear, cumulative intellectual progress was still novel and not widely accepted” (1996: 74). My point here is that progressive time is a particular understanding of absolute time where the inversion, repetitive time, though central, has been backgrounded in order to highlight progressive time. This is evident in the epigraph from Bacon in which he inverted the relationship between repetition (authority) and linearity (time).

One can cite many intellectuals who helped develop and spread this idea. At the end of the seventeenth century, John Locke described the human in developmental terms.23 In his Some Thoughts Concerning Education, Locke used a metaphor of wax tablets to describe the education of children. That is, children were blank slates that needed to be schooled so that they would develop
into proper gentlemen. Jean Jacques Rousseau went further in his *Emile*, arguing that children learn and develop as they grow—it is a natural process—and deviation, even an acceleration of learning, leads to precocious, malformed adults. In both cases the human is now born with limited abilities and must develop, and this development depends on upbringing and education. Development becomes the structure to understand physiological growth, subsuming the organic, cyclical process. Moreover, in the eighteenth century, the emergence of mathematics and probability offered a new way to look at patterns, and a sense of a future gained substance. Actuary tables and the lottery were two early applications of this new predictive form of knowledge. Individual experience is subsumed into a larger, abstract whole, and pasts—the data extracted to create the aggregates—are used to point to a future.

Nature too was discovered to fit within absolute time. During the late eighteenth and early nineteenth centuries, people began to question the age of the earth, separating its creation from the biblical account. Comte de Buffon, using the contemporary understanding of physics, calculated that the earth was approximately seventy-five thousand years old, not the four thousand years commonly accepted from the Bible (Toulmin and Goodfield 1965: 142–50). Charles Lyell’s *Principles of Geology* built on Buffon and many others to demonstrate that the earth has a history that is independent of the Bible (or other creation myths). By the nineteenth century, there was a general agreement in the idea of progress. To reinforce this as a part of the sociotechnical imaginary, it is an idea (desire) attached to time, giving it direction. Koselleck (2002: 229–30) points out that progress becomes a historical agent: “progress of time.” It gained status as a collective singular that combines numerous experiences; and by the nineteenth century, it became nominal: “progress itself.”

To complete this brief story, the unification of the globe at the official level around a universal time took a big step in 1884 at the International Meridian Conference. The conference adopted
a single global time of twenty-four time zones with Greenwich as the prime meridian. Here, again, was the interrelation of an expanded world and its connection to time. The Harrison H4 chronometer won the Longitude Prize for an accurate chronometer that helped captains of ships reckon longitude. The railroad necessitated a time synchronized according to a single standard, and the proposal for the twenty-four time zones emerged from standard railroad time in the US (Bartky 2000). The meridian conference, in a sense, brought Kepler’s desire to fruition—the clock synchronized the world. More broadly, the conference institutionalized the idea of progress, which was confirmed by technological advances—telegraph, steam engine, railroad, clock, and so on. However, acceptance of this unified time occurred gradually: Japan unified time according to the twenty-four-hour clock in 1873 and synchronized that time to Greenwich mean time (GMT) on July 13, 1886; Germany unified time in 1893; France conformed to GMT in 1911; and the US did not officially accept GMT until March 19, 1918. Interestingly, the International Meridian Conference also codified the East and the West, the Orient and the Occident, by setting the beginning of the day at 180 degrees longitude, not at GMT. This unified time culminated the increasing synchronization of the world, the annihilation of time and space, and the rise of simultaneity in the twentieth century. These processes are, of course, highly uneven; Vanessa Ogle cautions that it was not until the 1950s that universal time became global (2015: 75–98). Another way to characterize the spread of absolute time is in its relation to the rise of the nation-state and of industrial society. In short, our current use of chronological time is a metric that reinforces the liberal-capitalist system that emerged since the Enlightenment.

This is a good moment to bring up a statement by Serres, who describes the connection of progressive time to the global and technological history of nineteenth and twentieth centuries:

“Let me say a word on the idea of progress. We conceive of time as an irreversible line, whether interrupted or continuous,
of acquisitions and inventions. We go from generalizations to discoveries, leaving behind us a trail of errors finally corrected—like a cloud of ink from a squid. ‘Whew! We’ve finally arrived at the truth.’ . . . That’s not time, only a simple line. It’s not even a line, but a trajectory of the race for first place—in school, in the Olympic Games, for the Nobel Prize. This isn’t time, but a simple competition—once again, war” (Serres with Latour 1995: 48–49).

Serres’s trenchant critique points to the way that linear time structures knowing and relations. Neither absolute time nor its application to society is neutral. The quantitative penchant (measurement) of chronology prioritizes competition—a race or even war. This is the history of the late nineteenth and twentieth centuries. It is perhaps a coincidence—but nevertheless an interesting one—that Eric Hobsbawm’s Age of Empire began in 1875 around the same time that the world was synchronized according to absolute time and the historical discipline was becoming professional.

CLASSING OF TIME AND SPACE

This progressive time necessitates an obvious but unstated process, the “classing” (Serres 1995) or “breakup” of the whole (Lorenz and Bevernage 2013) into units that interact with each other.  

Such classing is a constituent part of absolute time, necessary for the ordering and measuring of places, things, and events. It is the organization of parts into a whole—a competitive system.

This classing brings out the relation of absolute space and absolute time, and the repositioning of repetitive time in the application of absolute time to human society. In his discussion of the nation, Lefebvre argues that the nation arises from two moments, the market and violence. The market is the place of repetitive activity that gives focus and hierarchy. Violence is the power that controls and exploits—in Serres’s words, a race, competition, or war. The units that make up that “market” on the global level are the newly forming nation-states. I read Lefebvre as arguing that
the nation-state is historical. It is spatialized time. Lefebvre writes, “According to Hegelianism, historical time gives birth to that space which the state occupies and rules over. . . . Time is thus solidified and fixed within the rationality immanent to space” (1991: 21). In this repetition, time is spatialized; repetitive time facilitates a slowing down of time to formulate these units, the nation-state. My emphasis is on the interrelation between time and space, time-spaces (and the obfuscation created by absolute time and absolute space) in the classing or breaking up of time into subunits. I will discuss this relation between classing, nation-state, and history in the next chapter.

Repetition also slowed time in another way—presented as the opposite of linear time, repetitive time became identified as an originary temporality, closer to nature. It is a part of an early state from which forward motion emerges; it is akin to the repetitive worlds from which a modern society has developed. Things closest to an original state are removed from time. These are the past, dead, or inert objects. It enables what Carolyn Merchant calls the “death of nature”: “The removal of animistic, organic assumptions about the cosmos constituted the death of nature—the most far-reaching effect of the Scientific Revolution. Because nature was now viewed as a system of dead, inert particles moved by external, rather than inherent forces, the mechanical framework itself could legitimate the manipulation of nature” ([1980] 1989: 193). Nature serves at least two functions. First, things within nature are inert objects to be used or exploited. Second, it serves as an origin from which, using chronological time as a metric, movement (i.e., development or progress) is measured. This is where repetition is inverted from a condition of stability to a condition of those on the lower end of this developmental scale: the primitive or backward people (labor) or societies (non-West) who are not quantifiably advanced. Repetitive things that do not move forward are closer to a nature that embodies some state of lacking, and movement away from nature orders objects onto a scale of development. This
connects well to the clockmaker who serves as the metaphor for man’s (Merchant points out that this order is gendered) manipulation (i.e., improvement) of nature.

In the eighteenth century, this classing or spatialization was facilitated by a new technology that was gaining popularity—mathematics. Aggregates became a way to make sense of the heterogeneity of this expanding world. Aggregation (and the numerical data such as averages) was a way to order the variation of individual cases. Serres, for example, writes, “A multiplicity marks and shows some redundancy, it becomes spatial when this repetition increases” (1995: 116). Through repetition or redundancy, commonalities, classings, categories, and places come into being. Like the allure of Big Data today, numbers and aggregates were a way to discern “secret patterns hidden inside masses” (Sheehan and Wahrman 2015: 60) so that they could be emplotted along a timeline to measure and compare. Individual variability is not eliminated but subsumed into some aggregate—categories of more or less like things. The heterogeneity of individuals gives way to the commonality of the category that is meaningful within a larger matrix. Bowker (2014: 572) calls this process of classing a “colonizing temporality.” Probability provided a way to move the study of humans from individuals to categories; absolute time provided a way to measure and compare those categories. The result is the transformation of understanding from individuals and what they believe to quantifiable knowledge about people, things, and places.

Once the chronological order is classed, chronological time returns within each classed unit to naturalize, through history, that space. The discovery of the past through chronological time and the emergence of mathematics and probability are deployed again, but this time it obscures the historicity of this new spatialized time. This form of successive time combines with a historical narrative that begins from some origin to the present day. This form of linking of events chronologically is Newton’s duration, but this notion of duration is spatial.
The mapping of categories (including nation-states) along the chronological structure, the use of chronology to write histories that naturalize those units, and the breakup of time into eras has provided a powerful sense of order for the international and now global world. We are able to map everything onto \( x \) and \( y \) coordinates of a time and space grid. This is what the great mathematician and philosopher Alfred North Whitehead calls “simple location.” On the one hand, motion becomes stabilized as a mass (or event) that is between two points, while the mass has an existence independent of time. Whitehead describes this aspect of Newtonian time: “The material is fully itself in any sub-period however short. Thus the transition of time has nothing to do with the character of the material” (1925: 50). Everything has a distinct position in absolute space and occurs at unique moments that are measurable. This rendering of things according to simple location has been possible at a very reductive or simplistic level, but Whitehead disputes this very possibility: “I shall argue that among the primary elements of nature as apprehended in our immediate experience, there is no element whatever which possesses this character of simple location” (1925: 58). I will take up this issue again in chapter 2; it is history that gives content to this simple location and makes it “real.”

A fundamental problem with this system is the alignment of human action with the movement of matter. Henri Bergson points to the reductionism necessary to use this mechanistic reckoning for human consciousness. He writes, “We can understand that material objects, being exterior to one another and to ourselves, derive both exteriorities from the homogeneity of a medium which inserts intervals between them and sets off their outlines: but states of consciousness, even when successive, permeate one another, and in the simplest of them the whole soul can be reflected. We may therefore surmise that time, conceived under the form of a homogeneous medium, is some spurious concept, due to the trespassing of the idea of space upon the field of pure
This application of Newtonian physics has been effective because of its simplicity (two variables), but we now know that when applied to people, systems, and ideas, there are many more variables. We know that people and objects change as they move; they do not remain unchanged. Whitehead argues for what I will later call relationality, the “interconnectedness of things,” both material and human. He appeals to an everyday experience rather than learned knowledge: “Your perception takes place where you are, and is entirely dependent on how your body is functioning. But this functioning of the body in one place, exhibits for your cognisance an aspect of the distant environment, fading away into the general knowledge that there are things beyond” (1925: 92). Historians might object that history covers this change of the unit. But in the adoption of Newtonian physics, an object, the nation-state, has been naturalized as a “mass” and removed from time before chronological time can measure its motion, duration, or rate. History structures the ordering of these masses, and it operates within the unit of the nation-state, the mass. I will discuss this separation of history into a system and the reinsertion of history of particular units in the next chapter.

A temporal hierarchy emerges from the classings organized through this flow of time. There is a troubling connection to the emphasis on technology and its application to large units. This is one characterization of the history of the twentieth century—resource extraction, exploitation of labor, colonialism, and imperialism. But I will emphasize the implicit hierarchies of this system. On the one hand, we can cite Bacon’s simple declaration that the recent is better than what existed before; indeed, the fetish of the new seems built into our thinking, but Serres writes rather caustically, “It follows that we are always right, for the simple, banal, and naive reason that we are living in the present moment” (Serres with Latour 1995: 48). But this is also part of a system that turns relational conditions into fixed temporal positions. One part of society that this system removes from history is what Lefebvre calls “lived time.”
He writes, “With the advent of modernity time has vanished from social space. . . . Lived time loses its form and its social interest—with the exception, that is, of time spent working” (1991: 95). We see the effect of the escape from the clutches of time—the supremacy of space over time is the dominance of the state over lived experience, of the technological apparatus over the human.

In the context of this brief history of time, the relation between society and time is inverted. Time is now external to human activity, which is organized according to absolute time. Nowotny calls this focus an “intoxication with time” (1994: 26–32). This intoxication is in the freedom from the past, the order and predictability of the world, and speed—the perceived reduction of social and geographical distance. But this intoxication is possible by obscuring the role of chronology; it structures and orients. Michael Young speaks to this power within Nowotny’s notion of intoxication: “By giving people a sense of control over their environment, technology has also encouraged them to think they can create their own future, and perhaps nothing has nourished linearity more than that” (Young 1988: 156). This intoxication is possible because the naturalization of absolute time along with its classing operations has removed this part of time, the historicity of time, from the historiographical operation. In his book System, Clifford Siskin notes the increasing connection between system and history by the end of the eighteenth century. But it is not just adjacency but interrelation. He says that an unexpected finding is that system “shaped modern knowledge” by reshaping “history itself” (2016: 4). This system is the chronological structure—external time—that has ordered the world to become the framework in which modern history is written.

TWENTIETH-CENTURY TIMES AND CLASSICAL TIME

Interestingly, during the late nineteenth and early twentieth centuries, as absolute time was being used to organize knowledge
about nation-states and academic disciplines emerged, science was discovering that time is not mechanical and linear. Einstein’s special theory of relativity demonstrates that the measurement of time is dependent on the framework of observation—that is, time is relative to the observer. “Relativity tells us there is no such thing as a fixed interval of time independent of the system to which it is referred” (Adam 2004: 61). Einstein calls this time *Eigenzeit*, often translated as “proper time.” This proposal of an *Eigenzeit* recalls the local notions of time of the medieval, non-West, and nonmodern places. It brings out the different times inherent to each unit of analysis. Moreover, the direction of time in a progressive system does not match the arrow of time in physics (Mitchell 2009: 43). The second law of thermodynamics is the only law of physics in which time is directional. However, that arrow moves toward dissipation and decay, not improvement and progress. Perhaps this dichotomy is one reason that thermodynamics has rarely been included in social applications of time. For my purpose, entropy requires that we recognize multiple outputs from the use of energy, even if it is not the desired outputs. Processes of development or progress also contain transformation that is closer to decay; in history, some of these outcomes have been marked as waste, ignorance, or unintended consequences.

Again, as Adam (1990) points out, in the social sciences we have known for quite a while that studies often change the object being studied (quantum physics—the very acts of observation and measurement affect what is seen) and that perspective does depend on the position of the observer. Research in the humanities and social sciences also questions the notion of simple location and supports Whitehead’s emphasis on relationality. For example, work on color perception shows that perceived color can change depending on adjacency (Albers [1963] 1975). Research in the cognitive and neurosciences shows that observation varies according to surrounding conditions and that environment does alter what is known and remembered (Vygotsky 1978; Hutchins 1995; Stafford 2007).
Research on reading and learning shows that people incorporate new information through their received understanding (Jauss 1982; Wolf 2008); complex systems theories offer a different way to think of connections, relations, and causality (J. Holland 1995; Mitchell 2009; Page 2008). In his discussion of the importance of entropy in social analyses, Fraser uses Escher’s image “Ascending and Descending” to argue for the importance of the whole process and to place repetition and decay as central rather than an earlier, inferior, or external part of the process (1987: 281). This understanding of an internal time gains further support in cybernetics, the work of scientists seeking to connect the workings of machines to organisms during the second quarter of the twentieth century. What begins as an effort, in Jean-Pierre Dupuy’s analysis, to “mechanize the human” ultimately exposes the limitations of classical time and points to the possibility of multiple times and the centrality of nonlinear temporalities.

A key element in this history of time is the recognition of biological times. At the turn of the century, biological work largely focused on collection, description, and classification. Darwin’s evolution fits this classificatory tendency, and even though Darwin’s evolution argues that adaptation leads toward greater diversity, its application to society by Herbert Spencer fits the ideology of progress according to a homogenous time. Two important mid-twentieth-century ideas that criticized linear science are the General System Theory (GST) founded by Ludwig von Bertalanffy and cybernetics, especially the work connected to the Macy Conferences (1946–53). Norbert Wiener describes cybernetics through a language analogous to history: “the study of messages as a means of controlling machines and society” (1950: 15). The messages (or, more commonly, information) of cybernetics can be likened to facts and data of history. We don’t think of history as a mode of control, but it is a knowledge system that orders and guides. A key difference is that these sciences recognize the simplistic reductionism of classical science and offer more complex understandings
and frameworks. Cybernetics and GST have often been merged as early attempts to overcome a key problem of classical science, the reduction of phenomena to two variables, or simple location (Pias 2016; Bertalanffy 1968). Warren Weaver, a key member of the Macy Conferences, calls the interests of classical physics “problems of simplicity” (1948: 536–37); Heinz von Foerster categorizes those problems as “trivial” (2014: 15–19); and Bertalanffy argues that it is the difference between a static (classical) and continuously changing (complex) system. We must remember that the basis of history, “simple location,” is based on the classical physics they are criticizing.

One of the interesting connections of the Macy Conferences today is the belief that mechanical and physical laws, through what we now understand as digital technology, can be applied to biological processes. These scientists were ambitious; they sought “to design overarching orders of knowledge with nothing short of epoch-changing implications” (Pias 2016: 11). According to Dupuy, the goal was a “sciences of the mind” (2000: 77). The initial title of the Macy Conferences, “Feedback Mechanisms and Circular Causal Systems in Biological and Social Systems,” indicates the effort to bring together the biological and social through attention to nonlinear processes. When the meetings began, Wiener suggested the analogy between organisms and machines. In 1955, Warren McCulloch still stated confidently, “Everything we learn of organisms leads us to conclude not merely that they are analogous to machines but that they are machines” (Dupuy 2000: 50). In Wiener’s case, machines were technological (computational) objects; in McCulloch’s case, they became “logico-mathematical being embodied in the matter of the organism” (Dupuy 2000: 50). It is hard to overstate the significance of cybernetics; it was a major development and warrants the assertion that this event marked the beginning of a second industrial revolution: first, the steam engine, and second, information theory based on digital forms. It brought nonlinear time—circular causality, feedback loops, and homeostasis—to discussions
of temporality. It helped spawn fields as diverse as information theory, computer science, artificial intelligence, autonomous systems, and cognitive science.47

Its limits, though, are in this ambition. In the records of the last five meetings, discussions also show the difficulty of applying the analogy of the machine to the mind. One of the pithy descriptors of cybernetics states that it is concerned with “ways of behaving,” not the knowledge of things (Ashby 1956: 1). This focus on activity and doing when applied to biological and social systems necessarily encounters human variability. Some of the papers touched on perception—both psychological and physiological (through a frog’s eyes)—language and symbolism, humor, emotions, and communication patterns in humans and animals. In a way, it replicates the separation of history. “Ways of behaving” emphasize the classifications, patterns of activity, and regularity of action in modern society. What is more difficult are issues that are beyond closed, classificatory problems such as the difference between causality and correlation, parsing abstractions, and performing logical inference (Jordan 2018; see also Marcus 2018). It should be an opening for scholars interested in processes by which humans know, decide, and act (like history).

A few did tackle these issues. Von Foerster founded his Biological Computer Lab, which gave rise to what has become known as second-order cybernetics. The key difference in second-order cybernetics is that the observer cannot be autonomous; the observer observes, is an actant, and reports. It questions the possibility of objectivity and points to the limitations of Newtonian science as “universal, deterministic, and objective” and with a neutral observer. This work punctuates the impossibility of escaping what Prigogine and Stengers call the “clutches of time” (1984: 213).

Finally, today, simultaneity is more apparent than ever. We have increasing writings, scholarly and popular, raising the compression of time to the extent that the future is frequently displaced by an extended present or presentism (Nowotny 1994; Hartog
2015; Harootunian 2015; Rushkoff 2013). As an example, Nowotny begins her book *Time*, “Today the tension between present experience that does not value what is past and an expectation oriented towards what is, in tendency, endless improvement has largely collapsed” (1994: 16). But rather than examining this changing relationality of time and space, today, in response to this collapse, we talk about innovation and invention as if they are different than improvement. Moreover, this seems to be our response to work that shows that the major technological discoveries that had the greatest impact on modern society occurred in the first half of the twentieth century (Gordon 2016). There is a conceptual disconnect. Society and academia seem so wedded to our chronological system—that is, have so naturalized its values—that the “new” suffices for innovation even though such improvements are usually a means of maintaining the past (the current structure), more efficiently. At minimum, we need to disaggregate processes. Michael Young (1988), for example, argues that we need to separate social evolution from progress—the existence of the former does not mean that there is progress. In his effort to revive the idea of progress, Peter Wagner separates social and political change from technological and economic progress. The past two centuries have seen the advance of the latter (enjoyed always by an elite), while the former is much more mixed. We still haven’t addressed Simmel’s sage observation: “The things that determine and surround our lives, such as tools, means of transport, the products of science, technology and art, are extremely refined. Yet individual culture, at least in the higher strata, has not progressed at all to the same extent; indeed, it has even frequently declined” ([1900] 1990: 448). In short, abstract time orders societies and fosters technological progress, and it is the latter that has, in Nowotny’s words, intoxicated us to accept its elevation to a concept external to our world (1994: 26–28). In the rise of science, in the continued violence throughout the world, and in historical understanding, classical time is decreasingly apposite to our world (if it ever was).
To conclude this brief history, I return to the epigraph from Elias’s essay on time where he calls for a “spring cleaning.” We need to ask whether our application of absolute time to society has arrested our own development in the name of innovation and progress. Complex systems both close off history from the field and simultaneously provide an opening. The former occurs through emphasis on mechanistic forms of analysis; the latter appears in the limitations on addressing human variability. It provides fascinating possibilities for reconceiving relations between pasts and the present. Herbert Simon, more than fifty years ago, issued an oblique challenge to historians: “The profession of history places a greater value upon the validated particular fact than upon tendentious generalization. I shall not elaborate upon my fancy, therefore, but will leave it to historians to decide whether anything can be learned for the interpretation of history from an abstract theory of hierarchic complex systems” (1962: 473). This general avoidance of generalization in favor of the particular—the derision of theory at the start of this chapter—helps mask the role of history in maintaining what Postone (1993: 300) calls a dual temporality of modern capitalist societies underneath an ongoing, even accelerating flow; there is the conversion of time into a constant present—again, linear flow and repetition. In the next chapter I will explore how this dual temporality—motion and stasis—is enabled through the conflation of chronology and history.