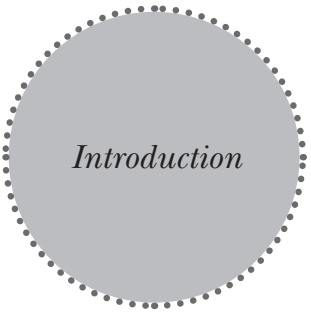

AFTER SCIENCE

Ottoman Practical Naturalism

By 1732 Istanbul had nearly three hundred colleges, possibly the world's largest marketplace for drugs, and a community of naturalists that numbered in the thousands. When measured against the narrative of European science, science in Istanbul during the seventeenth and the eighteenth centuries was far less scholastic, far less philosophical, far more cosmopolitan, and far more practical. In Istanbul everything was new in the seventeenth century: diseases, drugs, almanacs, ephemerides, alchemy, maps all proudly bearing the title *cedid* (new). Yet, this city, arguably the largest in the world at the turn of the eighteenth century, has no place in the global history of early modern science.

This book seeks to place the city in the narrative of early modern science by providing an account of science in Istanbul between 1660 and 1732, from the Great Fire to the quelling of the two-year-long Patrona Rebellion. Both 1660 and 1732 point to clusters of translations from Latin into Turkish and Arabic. In 1660 these translations were of calendars and drug recipes. In 1732 they were also of university textbooks. The process as a whole merits the nominal designation as

early "westernization," because many texts in fact came from the West. However, my focus is on the social transformations that had taken place in Istanbul within three generations, transformations that had nothing to do with the West. In this sense, I follow the spirit of Rifa'at Abou-El-Haj's *Formation of the Modern State* and of Baki Tezcan's recent *Second Ottoman Empire*.[1] This period is also the high point of what has been called the Scientific Revolution and its first successes, notably in England. Thus certain comparisons with narratives about European sciences in this same period will be an essential, but also playful feature of the book—and will help readers see what is distinctive about natural knowledge in Istanbul. My intention here is to contribute to the ongoing discussion rather than to settle the matter. As there is no comparably complete analysis of cities other than Istanbul, I will simply touch on some striking similarities and differences before I proceed to the next matter at hand. I will also provide what I hope will be new perspectives on familiar stories about "Western science." I believe the comparative perspective will also help the reader think beneath what may otherwise appear to be cultural differences between different parts of the world.

Science in Istanbul during this period was practical naturalism. It was neither quite artisanal knowledge nor quite applied science, nor yet popular science. Istanbul produced the kind of natural knowledge that had immediate and tangible results rather than pure cognition as its end. It was productive labor and lacked an essential and sometimes overlooked "unproductive labor" component that gives science as it is often understood its distinctive quality. As purely productive labor, science in Istanbul was missing the higher intellectual registers. It was astronomy that paid no attention to the order of the planets. It was medicine that had lots to say about drug preparation, but nothing about anatomy. It was science where experience replaced proof and logic of practice replaced formal logic. On all these fronts, science in Istanbul closely resembled science as it was practiced around the globe, including most parts of Europe.[2]

Yet the practical naturalism that we find in Istanbul is purer than what historians might find elsewhere, because in this sprawling city the pursuit of natural knowledge was not at all encumbered by theoretical ambitions, nor were naturalists paid for producing works that could not quickly turn into products and services. While historians have thoroughly explored the practical nature of scientific activities

across the globe, Istanbul provides additional insight into how practical naturalisms that flourished in cities and countries without powerful universities may have been inflected.

What did Ottoman practical naturalists do? They cast horoscopes, cured patients, produced elixirs, wrote poems, collected taxes, drank, and a few, like Şemseddin Ahmed (d. 1708), did all of these things. Şemseddin Ahmed was better known as İshak Hocası, or İshak's Tutor, as he taught elementary observational astronomy to İshak Efendi, a court favorite and future chief accountant to the sultan who would one day be involved in Ottoman calendar reform. Trained in Iraq, Şemseddin Ahmed prepared horoscopes in military camps, swore off astrology, tried to quit drinking, and kept a medical shop in the Eminönü neighborhood of Istanbul. He was a follower of Niyazi-i Mısri, an exiled Sufi who profoundly bothered the sultan and his preacher because of his religious beliefs. Şemseddin Ahmed also taught religious sciences for many years in Bursa, but he never really made it big in Istanbul. He harbored doubts about Greek and Arabic measurements for a degree of longitude, but he never cared to resolve the matter. He left behind a book of poems, three short works on using astronomical instruments, and a brief alchemical treatise, plus several scholarly works on exegesis and lexicography.[3]

Compare Şemseddin Ahmed to his contemporary and fellow omnibus naturalist William Whiston (1667–1752), Newton's successor as the Lucasian Chair of Mathematics at Cambridge. Whiston was an Arian who faced heresy trials for rejecting the divinity of Christ. He expounded his religious views in a series of multivolume works and translations of patristic texts. He sat on the Board of Longitude, a prize committee that sought a certain method of finding coordinates at sea. He wrote a book popularizing Newtonian physics, another work on the dipping needle (for which he expected the Longitude Prize), plus a few works on prognoses and practical astronomy. What are the main differences these comparable characters, as both seem to be practical naturalists who seemed to have uncommon religious views? One might be inclined to say "Newton" or "English Christianity" but in this book, I want to bring to your attention the fact that there were no Lucasian chairs in Istanbul, and there were no professors of natural philosophy or of mathematics. As a consequence, Şemseddin Ahmed was never lecturing to large halls full of math students. He was not trained in Cambridge, where Cartesian natural philosophy

was the norm when Whiston was a student. Şemseddin Ahmed never seems to have bothered with natural philosophy.[4]

Natural philosophy, theoretical astronomy, theoretical medicine, and all manner of theory were ancient Greek ways of confronting nature. Engaging in any of these disciplines in any capacity meant that you were at least familiar with Greek texts and disciplines, whether it was handed down in an Arabic manuscript or in a Latin or Greek text produced by a humanist. It meant that you had been not an apprentice but a student, like many people since Aristotle's Lyceum, and had been disciplined into Greek ways of thinking by reading books and listening to lectures. In some cases it also meant that you occupied a university chair, teaching the same Greek disciplines to new generations of young men. It meant that you had the leisure to engage in a very specific kind of nonproductive work. Most people around the world, including many Europeans, did not have the leisure to be students and did not have access to the accumulated knowledge of the past. Most naturalistic practices around the globe were done by people who did not have a university education. Some parts of the world, like China or Latin America, were hardly aware that you could or should confront nature at an abstract, demonstrative, and theoretical level.[5] And herein lies the story Istanbul has to tell: What does science look like in a very large and very cosmopolitan city where institutions of higher education barely inflected scientific practices? How would science work if it was done in a place where nothing resembling a life of leisure was available to scientists? How would familiar disciplines such as astronomy or medicine change in the absence of highly trained people who were not, so to speak, "doing it for the money"? These questions strike at the heart of early modern science—what was early about it and what was modern—and of what remains of the narrative of the Scientific Revolution.

The Leisured and the Leisureless

Leisure is the central concept that informs this book. It means being in a state of leisure, having leisure time, and producing what I call leisured or scholastic science.[6] My use of *leisure* is not entirely in line with the meaning of *leisure* that one may find in, say, *Travel + Leisure*. In my version, leisure is far closer to the classical concepts of *otium* and *skhole*. I use Bourdieu's critique of scholastic reason as my starting

point, partly because of its explanatory power and partly because Istanbulites themselves talked frequently about leisure since the city provided so little of it. But one does not need to subscribe wholly to Bourdieu's sociology in order to appreciate leisure. It so happens that leisure is central to the oldest social analysis of science. It permeates most of *Nicomachean Ethics*, where Aristotle probes the connection between knowledge and the life of leisure. Leisure is the efficacious freedom to have intellectual pursuits. In this sense, a modicum of wealth, education, and an orderly society as well as good company are requirements of science. All science, without doubt, falls short of a purely intellectual life, but even the imperfect presence of leisure and especially the massification of leisure—when a great number of people prefer edifying pastimes over solely entertaining ones—can make a massive change. All of this requires the teaching of leisure—something we are no longer particularly good at—by someone who has experienced it. And, in most cases, this person is a teacher or a professor.

I believe the reader already has a sense of the relationship between leisure and science. Leisure is what allows someone like Newton to say to an English cannon shooter who needs to improve his shot, 'Let me write a technical treatise on celestial mechanics in Latin and your successors, with the proper training, can perhaps solve this matter after a while.' You go to Max Planck with a light bulb problem and he comes up with blackbody radiation and Planck's constant in several years' time. Leisure is why, for example, the public face of science since at least the sixteenth century has continued to be the physicist—or what we today call astrophysicist, the most nonproductive person among scientists—and not the management scientist. To put it another way, leisure is temporal and cognitive distance, and it is also what gives science much of its specificity.

Leisure allows us to think in timescales that go beyond the moment, the day, or the matter at hand. It is a temporal regime unto its own and it has a sense of a more distant past and a more distant future than what we experience on a daily basis. This is partly why many people today associate science with states, institutions, and traditions. And shortening the temporal cycle of science to keep the rhythm of wars, reigns, grants, elections, fiscal years, or other urgencies has tangible effects. Some scientists even believe that short grant cycles are the culprit when we fail to observe and to understand long-term

changes that are taking place around us.[7] Yet theoretical science is a long game and has always been so. The researcher is lucky to see her nonproductive labor bear fruit in her lifetime. Most research done at laboratories would be meaningless if all of our problems were urgent problems that required a solution today.

Leisure may also challenge the utilitarian arguments for science. Theoretical science may become useful, but by its very nature it is distant from its use. In other words, theory is not possible without risking lack of utility, and those things that seem to us the most scientific are those things where understanding is essential and utility is merely incidental. Doing science for the sake of something else takes away from this essence—and most of us know and feel it when we see it. At the extreme, this brings up the well-known "ivory tower" issue. But some tower, however short and shoddy, is necessary to gain perspective beyond the smoking chimneys of daily life. We can all use some distance from day-to-day concerns, and higher education is uniquely qualified to do that by providing what Max Weber has called *Klarheit*, or clarity.[8]

History of science in the last few decades has made strides toward understanding the relationship between the production and circulation of natural knowledge. However, I think these accounts sometimes omit the "about what" of science. What we do seems to take on a scientific character once we identify our subject by reference to an existing and generally very old textual corpus that is discernibly scientific to our contemporaries. Thus, while scholarship readily explains how Boyle may have figured out a way to establish facts, it is not entirely clear how he could have done so through building a useless and expensive version of an air pump and making it say something about Aristotelian physics unless he was already familiar with and constantly reminded of Aristotle's *Physics*—not familiar enough, it seems, according to Hobbes. How was it that Boyle not only chose scholarship over endless glasses of brandy in front of the fireplace but also went beyond the quintessential gentlemanly pursuit of alchemy to pick a fight on a very specific matter in Aristotelian physics? It seems to me that a discussion of necessary and sufficient conditions is in order. What I propose, based on the example of Istanbul, is that everything that is discernibly theoretical is the beneficiary of extensive education and of massive accumulation of knowledge. I also think that science education is a kind of unappreciated and invisible labor.

The case of Istanbul and the concept of leisure partly explain why we have been unable to shed the Western canon. There is a longue durée element in the history of science that dictates the about what of science despite all the theoretical revolutions we may claim to see. The canon of the Scientific Revolution is still unrivaled in theoretical sophistication during the period despite our best efforts to show that many particular aspects of natural knowledge were in fact global in origin. There is something exceptional about the West, and that is: the survival of the scholastic dispositions toward problems and concerns of daily life. And the expansion of the university has made many nonacademics a bit more scholastic in their approach to life—an approach they can sustain for as long as they do not feel crushing pressure from material exigencies. Those of us who have an excess of the scholastic disposition find our homes in universities—Western institutions that have somehow survived and expanded across the globe.

Science still is a register of human activity that attaches to leisure. While we should critique the canon of the Scientific Revolution, we are also heirs of it if we are engaging with theory at any level—and I suspect almost everyone at a modern university is. We consume the productive labor past and present of technicians visible and invisible as well as the surplus produced by many more people, but our task, so to speak, is essentially nonproductive. That is, we are direct beneficiaries of a past we have come to despise. Certainly, none of us are pure and free minds, but the case of Istanbul suggests that thoughts may get a lot purer and freer if someone is paid to pursue them seriously and at leisure. The specific virtue of seventeenth-century Europe was not innovation or rationalism; it was, rather, accumulation and preservation of knowledge and, to a lesser extent, providing access to this knowledge. I think it is self-evident to most of us non-Westerners that this is still the virtue of the West—most academics outside the West complain about the poverty of libraries and about the lack of education.

Innovation was and still is all around the globe. These become scientific innovations only when they say something about accumulated knowledge and about the higher registers of intellectual pursuits. That is, scientific or knowledge capital is real capital, but is not reducible to or readily exchangeable with monetary capital. If the exchange between monetary capital and knowledge capital is

too fast and too ready, science loses its autonomous status as a kind of capital. This perspective identifies the unambiguous European achievement during the seventeenth-century crisis as accumulation and preservation, but also broadly legitimates the recent calls for the redistribution of scientific credit without exacerbating existing cultural antagonisms. A series of factors, from the printing press to universities, from colonialism to wealth, helped Europe accumulate and preserve a greater amount of knowledge than the rest of the world.

In this book, leisure is doing double duty as an analyst's category—expressions that social scientists today use to explain phenomena—and as an actor's category—expressions that past actors used to explain their own social world. In Istanbul, people who had it called it by myriad names such as *rahat* or *asudelik*, both of which literally meant *leisure*, and people who did not have it called it *zevk-ü-sefa*, or a kind of hedonistic enjoyment of bliss.[9] Furthermore, some Ottoman courtiers who attained leisure in the early eighteenth century identified the absence of institutionalized leisure and thus of proper schooling to be the greatest failure of Istanbul's practical naturalists.

The comfortable professor is both the ideal leisure scientist and the leaven of leisured approaches to nature. Professorship is what makes someone a serious player in the ancient game of pure thought. Comfort helps her cultivate the *illusio*, or the belief that what she is doing is valuable for the sake of itself, and thus devote her efforts to playing the game seriously. The comfortable professor is different from the gentleman, who engages with pure thought as an avocation—a player, but not a serious one—but also from the uncomfortable professor, for whom life is too serious to leave room for play.[10]

Study, knowledge, having free time, enjoying a predictable course of life, and being comfortably above daily concerns were all integral parts of leisure for the Ottomans. For example, Katip Çelebi (d.1657), a wealthy private scholar who served as accountant to the Imperial Council when he felt like it, believed that the study of geography constituted part of the statesman's leisure, as quietly studying books and atlases felt like "resting on four pillows."[11] Later in the book, I will engage in a deeper analysis of especially *rahat* in *Hayriyye* (ca. 1700), a philosophical poem the Ottoman poet Yusuf Nabi (d.1712) addressed to his son, but here I would like to lay out my Bourdieu-inspired

framework.[12] My attention is somewhat more attuned to political economy than to culture.

Following Aristotle, Bourdieu defines leisure or *skhole* as "free time, freed from the urgencies of the world, that allows a free and liberated relation to those urgencies and to the world."[13] This is "the first and most determinant of all the social conditions of possibility of 'pure' thought, and also the scholastic disposition which inclines its possessors to suspend the demands of the situation, the constraints of economic and social necessity, and the urgencies it imposes or the ends it proposes."[14] Having leisure is also "the fact of being detached for a more or less long time from work and the world of work, from serious activity, sanctioned by monetary compensation, or, more generally, of being more or less completely exempted from all the negative experiences associated with privation or uncertainty about the morrow."[15] But this freedom needs to take on a specific form at a specific stage of one's life to turn into a type of scholastic disposition: "This time liberated from practical occupations and preoccupations, of which the school (*skholè* again) organizes a privileged form, studious leisure, is the precondition for scholastic exercises and activities removed from immediate necessity, such as sport, play, the production and contemplation of works of art and all forms of gratuitous speculation with no other end than themselves."[16] Such a group of leisurely men lived in the Ottoman Empire in the fifteenth and sixteenth centuries, but they were exceptionally rare in Istanbul during the second half of the seventeenth century.

I am repeating Bourdieu's critique of scholastic reason not as a critique of the Ottoman scholars, who, by all measures, led a life of urgency rather than of leisure over the seventeenth century. The point I wish to make is rather that, when such leisure disappears—and scholasticism crumbles as its economic and social basis disappears—this does not in some way put an end to practical naturalism. But it does end certain kinds of scientific work—incidentally, the kinds of scientific work that most readily attach to our current definitions of science. Thus, this book asks but does not answer in the general whether practical naturalism is science, although the two are obviously connected. By extension, I also ask whether science is possible without a group of people comfortably but seriously and habitually engaged in the nonproductive labor of educating and studying.

One of Bourdieu's goals was to point out the academy's role in perpetuating inequality, and his later methodological works, such as *The Logic of Practice* and *Pascalian Meditations*, also present how the academy failed to understand both society at large and the role of the academy within society. Bourdieu's works may appear to be a far cry for those who study the natural sciences—after all, he was attacking overly zealous Marxists and anthropologists in the modern social sciences. But I have found that the same critique of scholastic reason is no less applicable to the study of the natural sciences and to the study of the early modern period. The European documentary record is littered with people who claim that they were pursuing knowledge for the sake of knowledge or for the sake of God—the two are indistinguishable from one another when viewed by a person who lacks leisure. This is why, for example, Andrew Cunningham could claim that European science in the early modern period was natural philosophy or natural theology.[17]

As the case of Istanbul will show, certain disciplines today exist only because a few European universities were sites of leisure in the early modern period. Thus, the case of Istanbul suggests that perhaps science was not born in the seventeenth century. It barely survived the seventeenth century. The general health of higher education, especially good professorial salaries, is essential to scholarship that can maintain a certain distance from daily life. Physics, also called natural philosophy, is a good case, because physics has possibly been the most leisurely of the natural sciences since Aristotle's time—and there is no such thing as physics outside of the Aristotelian tradition broadly understood. As the philosopher said, "It is necessary to lead ourselves forward this way: from what is less clear by nature but clearer to us to what is clearer and better known by nature."[18] Doing physics means removing ourselves from the world of the senses to the world of reason and of causes. Leisure is a prerequisite for physics. However, very few people in fact can look at observed nature from a cool distance. Most people who deal with nature as part of their work never stray from sensory realities, as the work of Pamela Smith and many others shows.[19] Universalism of natural philosophy was possibly the least universal ambition for people who engaged with nature in the early modern period. This book expands the case of physics to include theoretical medicine as well as theoretical astronomy. These belong to Hellenic higher education alone.[20] As counterintuitive ways

of knowing nature, they exist only because they have been handed down from generation to generation, from the Greeks to the Muslims and, finally, to good universities in Europe. We cannot assume that everyone around the world had a kind of physics, a cosmology, an understanding of the human anatomy, or a concern for the order of the planets.

I follow the tenet that when texts fail to provide explicit statements of physics or anatomy, we must abstain from inventing it by reading it into poetry, literature, and daily practices. The opposite tack suffers from the fallacy that everyone is equipped with different but equally abstract understandings of the natural world. This latter approach may also be built into histories of science done in the anthropological mode as they may read an intellectual plenum where there is in fact a noticeable absence. In sum, it amounts to Hellenizing the entire world. But beyond rejecting the axiom that everyone is equipped with a complete worldview—theories and all—the inclusion of leisure as an analytic category also reveals the field-bending powers of science that is done by leisured individuals. A field is a rule-governed space of interactions between agents who occupy unequal social positions. The rules are conveyed by the *habitus*, what Bourdieu defines as structuring structures, of which schooling is an integral part.

Higher education is a special category for two reasons: one, it habituates people to certain ways of thinking about and working with nature at a young age. The Ottoman case reveals that habituation through higher education is necessary for the theoretical impulse. And two, universities are serious places, in that they make theory into a vocation rather than an avocation. While the specific Greek categories of inquiry that survive to this day at the university may be more fragile and contingent than is generally assumed—there is nothing obvious about physics—academics regardless of discipline have a tendency to think beyond their daily concerns if they have the material conditions to do so.

My understanding of leisure is more materialist than that of Bourdieu, but it is not a materialist category in the Marxist sense. I may best locate it as a counterpoint to what Fernand Braudel has called "material life"—food, shelter, health, consumption, and so forth.[21] As Charlie Thorpe put it in response to a talk I gave at my alma mater, University of California, San Diego, I am "letting idealism in through the back door." I make room for idealism because I myself am not as

attuned to the material conditions that make my scholarship possible as I could be. In fact, I do my best work when I completely forget about my material circumstances. And if one were to provide a fully materialist explanation of what I am doing, it would go only halfway toward explaining my mode of inquiry. This is because my pursuit is habitual and self-serving, as are all purely academic pursuits. They are conditioned by the globalization of the university and the normalization (albeit with limited success, especially in places where professorial salaries are very low) of university categories.[22] Thus, I am keenly aware that I am able to do the history of science mainly because I can make a living (and could foolishly but not falsely hope to do so as a graduate student) as a historian of science without having to worry about the strictly productive qualities of my work. I do not think I am at all special in this regard. Leisure rather than productive labor is what academics crave most so that they can focus on their own brand of nonproductive work. And I believe that a modicum of unreflexive dedication to and belief in one's work—what Bourdieu calls *illusio*—is essential for any scientific inquiry in a world filled with hunger and misery. From the perspective of leisure, I do not think seventeenth-century scholars and scientists were substantially different from me.

Money is certainly an important factor when it comes to leisure, but there is sometimes a substantial wedge between quantity of money and amount of felt leisure. Family backgrounds and circumstances, personal habits and dispositions, exigencies of social life, life disciplines acquired in youth, and gender are constituent elements of this wedge. Missionary activity illustrates this matter. Jesuits, who became tremendously visible in the late sixteenth and early seventeenth centuries, had taken vows of poverty, and people who had taken vows of poverty fared reasonably well in an environment where most professors in Europe were getting poorer anyway. Certain Sufi orders to which some Ottoman scientists of the fifteenth and the sixteenth century belonged prescribed an ascetic, almost Cynical lifestyle. That is, spiritual discipline could sway certain people from seeking lucrative work when seeking such work would be advisable from a common sense perspective. Aside from these, the specific quantity of leisure time and money a person required varied. Take two titans of European science: Galileo and Newton. They had comparable purchasing power at the start of their career. Galileo, a married man and a father of

three, went looking for additional income as soon as he took up a teaching post in Padua. Newton, a celibate man with strong religious beliefs, did not undertake any lucrative extracurricular activities for over twenty years and happily lived in his Cambridge apartment with a comparable salary.

Did the Ottomans not have universities or similar institutions? They certainly did. In Istanbul alone there were hundreds of colleges, but they paid the instructors extremely low salaries. The period covered in this book also was a time when teaching salaries had been low for so long that it had altered the very meaning of teaching and also of the various naturalistic fields. Some people complained about the material conditions of scholarship for about fifty years following the salary slump of the late sixteenth century. Yet by 1660, almost everyone in Istanbul believed that very low pay and unstable careers were integral parts of the teaching profession. Ottoman colleges were particularly sensitive to leisure because teachers were mostly free to teach what they wanted. Since the most—or rather, the only—lucrative job for a *medrese* graduate was working as a *qadi* (judge), *medrese*s (Islamic colleges) turned into schools of law over the long seventeenth century. They were filled with professors and students who one day wanted a judicial appointment. They certainly did not teach natural philosophy. There was no one who drew salary as a professor *of* mathematics or a professor *of* natural philosophy because such fields simply were not essential parts of an already fuzzy curriculum that students completed quickly and under duress. Those who taught naturalistic subjects did so out of personal interest, often took students on an individual basis, and possibly charged fees.

Ottoman and Islamic Decline

What differentiated Istanbul from certain parts of Europe that snatch the limelight in the history of science was that the material conditions of scholarship in Istanbul had declined. Decline is by far the most loaded and most controversial element of my analysis, but I believe that it is a better alternative to excessively cultural and analytically unproductive alternatives. The old version of the decline thesis argued that after the reign of Süleyman the Magnificent, which ended with his death in roughly 1566, the empire entered a period of total decline. Orientalists such as H. A. R. Gibb and Bernard Lewis took

the expansion, stasis, and contraction of Ottoman borders as key indicators. Since the old understanding of decline reduced Ottoman society to its military and political prowess, this proved to be a highly problematic approach when scholars turned to social and cultural history.

Most Ottoman historians today rightly and categorically reject the notion that the Ottoman Empire had declined. However, turning to the first forceful rejection of the orientalist line of reasoning, Cemal Kafadar's "The Question of Ottoman Decline," it should be clear that the kind of decline I speak about—the decline of teaching salaries and decline in the material conditions of scholarship in Istanbul—does not implicate the entire empire, nor does it reduce the empire to its army.[23] Kafadar argued that decline was a relative and Eurocentric term and that the Ottoman Empire enjoyed a trade surplus, technological parity, and military success vis-à-vis Europe—things that Ottomanists can now take for granted thanks to two generations of research. He highlighted the adaptability and pragmatism of the empire and finally, pointed to the ascendancy of bureaucrats and gentlemen, called çelebis, over the seventeenth century. He also emphasized transformation over above decline. And, yes, there was a cultural transformation over the seventeenth and the eighteenth centuries, but the transformation was the result of the decline in the material conditions of scholarship. If you asked a professor whose purchasing power was reduced to one-tenth of what it used to be, he would not say that he had undergone a transformation.

In my account of the decline, the pivotal point is what is alternatively called the Price Revolution or the Great Debasement of the late sixteenth century. As Şevket Pamuk has shown, the Price Revolution as well as the previous debasements were choices that administrators made. Thus, this point is more oriented toward political economy than it is to economy as such. I have devoted a chapter to the decline in the material conditions of scholarship, but to summarize here, beginning with Mehmed the Conqueror in the fifteenth century, sultans used a strategy of reducing the silver content of the *akçe*, the main currency. Most Ottoman medreses were religious endowments, the founding deeds of which stipulated salary amounts expressed in akçe. When the akçe had lost more than half of its purchasing power between Mehmed's reign and the middle of the sixteenth century, new medreses addressed this issue by doubling lower salaries from

about 20–25 akçe to 40–50 akçe. Between the late sixteenth century and the period beginning in 1660, the purchasing power of the akçe was reduced to about one-tenth of what it used to be, with no correction in teaching salaries.

For several decades in the late sixteenth and the early seventeenth centuries, scholars complained about money. Some scholars managed to get extra pay on a case-by-case basis, but from 1660 onward this trend came to an end—possibly because of troubles in the imperial budget—leaving the highest-ranking and oldest scholars with a per diem wage of fifty akçe—about fifteen dollars in today's money. For many scholars, such near-starvation wages had already been the norm for more than half a century. Therefore, the story presented in this book takes place at a time when extremely low salaries and career instability were seen as normal, if not entirely inescapable, elements of the scholastic profession. By contrast, Galileo started teaching at Padua in the early seventeenth century with what would be three hundred akçe or ninety dollars per diem, and spent his entire career trying to boost his income and standing. Cesare Cremonini, a famous Aristotelian philosopher, made twice what Galileo did. Professors of anatomy drew salaries between those of Cremonini and Galileo. The difference is substantial. And despite the mitigating influence of gentlemen and independently wealthy individuals both in Istanbul and in parts of Europe, the poverty and the leisure of the professors made a substantial difference in scientific practices. In other words, no number of gentlemen or private scholars could replace higher education.

Istanbul's explanatory advantage over Latin America, China, or South Asia for the general history of science has to do with decline because both the Ottoman medreses and European universities inherited a comparable body of Greek and Arabic knowledge. There were old and fundamental differences, say, between China and Greece.[24] Whatever differences there were between the medrese and the university was much younger and much shallower. And, I argue, there is a long material path that we need to tread before a discussion of differences in purely cultural preferences becomes meaningful. The substantial divergence in the paths of science in the Ottoman Empire and in certain parts of Europe, which has otherwise been ascribed to vague and uncertain generalities such as a great divergence in gross domestic product, Islam, or genius, comes down largely but not

exclusively to economic indicators that are too small to draw interest from economic historians and too mundane to attract intellectual historians. And the long-term career of science in the West, broadly defined as India and the west of India, was the result of the extent to which seventeenth-century economic circumstances in the academy were normalized and accepted or remedied and rejected. The decline narrative is not a condemnation of the Ottoman situation. It cuts both ways by showing that people generally seemed not to care about physics, theoretical astronomy, or theoretical medicine unless someone in their habitus was paid well to do so. That is, the overwhelming majority of science is about habituation into certain ways of Greek thinking that persist to this day. I also think that an alternative to expanding the scope of science, which is a more common route, may be to recognize the multiplicity of ways to deal with nature. This is as true for knowledge as it is for science: is knowledge the only or the most effective way to deal with nature or with the unknown? Treating science as a kind of practice also overlooks a major and persistent element in our experience of nature: suffering.[25] Herein lies the material conditions of Eurocentrism: normalizing Greek categories means normalizing affluence, which existed in ample amounts outside of Europe for centuries. However, normalizing Greek categories in the modern period means normalizing the European condition because affluent parts of Europe were where Greek thought survived. Greek science became Western because of inflation.

Decline significantly reduces what we may otherwise ascribe to cultural differences. It looks at the changing and contingent material conditions of scientific thought. Decline shows that certain material conditions and continuities are necessary—hence the connection between European political hegemonies and scientific hegemonies, without reducing one to the other—to sustain certain scientific activities and, without those conditions and continuities, it becomes impossible to think about nature philosophically. My declinist view extends to define what we may call the more recent spread of Western science as nothing other than the numerical increase and the geographical expansion of universities that paid their professors well. What Dimitri Gutas has called the "decline of Hellenism" is, in the case of Istanbul, the decline of the material conditions of Greek thought. At the same time, this is not simply jealously signaling the privilege that obtained in affluent European universities. To the contrary, in Istanbul the

alternative to institutionalized leisure at the university was an even wider gap between the haves and the have-nots and a smaller number of people who enjoyed leisure.

Did Islamic conservatism cause the decline? In the specific case of Istanbul, the deterioration of economic conditions did not lead to Islamic conservatism, because conservatism of an articulate sort also requires a tremendous amount of education and hence access to old knowledge. If anything, a barely literate scripturalism, a contradiction in terms, was the result of the decline and not the cause. When the medrese declined it did not leave in its wake drones of commonplaces of stern religiosity and of scholastic dicta.[26] That kind of obstinacy was a luxury that only the very elite—true rarities like Robert Bellarmine or Thomas Hobbes, who only flourished in very affluent circumstances—could afford in the seventeenth century. Our general tendency is to read history forward from an imagined dark age by focusing on novelty. I suggest that reading backward, as Braudel has done, from a neoliberal dystopia gives us a much more accurate understanding of the seventeenth century.

However, this book is also not about saving the Islamic world from bad press, because I have yet to see any proof for the existence of an Islamic world in this period. Islam has long been a fraught matter in the academy, and the reception of Edward Said's *Orientalism* shows that Islam can be an area of serious study, but, used loosely and adjectivally, it can also serve as an excuse to avoid social science altogether. This is by no means a negative judgment of my highly skilled colleagues. . In this book, I am assuming an antagonistic position for heuristic reasons.[27] I present a deflationary account based on fairly hard evidence to challenge the counterproductive and excessively positive assumptions about what the sources tell us. I reject the unscrupulous use of the terms *Islamic* and *Islamicate* because they may inflate rather than explain. I do not attribute a general efficaciousness or a cultural identity to Islam, just as I do not ascribe a unified worldview to the Muslims of Istanbul. In order to deploy such categories, there needs to be proof of transgenerational transmission of a sophisticated body of Islamic natural knowledge. Yet such transmission was precisely the challenge in Istanbul. That is, certain opportunistic ways of engaging the Islamic world reify and homogenize a large geography that generally lacked philosophical or scientific common denominators—again, those things that required

a robust and coherent curriculum of education—in the seventeenth century. If anything, Istanbul's connections between different parts of what is considered the Islamic world were far weaker than they were with different parts of what is considered Europe. These criticisms also hold for "European" and "Western," because, looking at professor salaries, I do not see a coherent Europe, either. What I see, rather, is a fragmented and uneven history of science education. And, if I were to venture a definition from the evidence presented in this book, I would say that good professor salaries and "European science" are mutually constitutive at the discursive level and the vast majority of Europe had neither for much of the period known as the Scientific Revolution. When I say "Europe" in this book, I use the term loosely to improve intelligibility and not to redistribute credit. Furthermore, from the perspective of science education, the Enlightenment with its public spirit and focus on utility may be not the zenith but the nadir of "knowledge for the sake of knowledge" in Europe. Societies today—even those most saturated with Enlightenment values—may be intolerant of the notion that knowledge is worthwhile in and of itself. In the best case, they simply put up with it.

On a pragmatic level there are some unambiguously Islamic elements in this history and I do not wish to cause an Islam-fatigue by calling Islamic those things that are only ambiguously Islamic. Take, for example, the notion of *nafi amel*, "works conducive to commonweal," which was the dominant value of practical naturalism in seventeenth-century Istanbul. It was only nonspecifically Islamic and you could as well call it mercantile or republican. Working under the banner of commonweal was compatible with if not reinforced by the puritanical movements in Istanbul. But that was the case precisely because many puritans were merchants and artisans. State regulations beyond a bare minimum stipulated by the Koran meant more taxes on and less mobility for goods.[28] Any analysis of utilitarianism in science would be missing pertinent information if we omitted the economic element and focused on Islam as the privileged vantage point. If anything, some Istanbulites seemed to share their love of utility, without any causal connection, with the English Puritans. We do not yet have a good framework that would help us make that leap between faiths.

Many naturalists in Istanbul enjoyed religious legitimacy, especially in the medical field, in a way that capitalized on the sixteenth-century

thinker Mehmed Birgivi's (1523–1573) authority. Then again, Istanbul was a sick city that was struck every few years with lethal epidemics that claimed many lives. It was also a center of drug trade. There were pragmatic reasons, far more pressing than any doctrinal consideration, that drove the medical field. Empiricism, too, at some abstract level was compatible with Birgivi's doctrinal subjectivism; namely, that each Muslim should discover faith on his or her own.[29] But what was a naturalist supposed to do if he faced the urgent and the unknown without a sophisticated scholastic field or well-stocked libraries of accessible knowledge on which to lean?

Natural knowledge was as useful to Muslims as to anyone else. Thus, Ottoman geographers, physicians, astrologers, and engineers presented their works, which usually were not the product of an Islamic tradition in any discernible sense, as gifts to Muslims. The Turkish translation of Willem Janszoon Blaeu's (1571–1638) *Atlas maior* was called "The triumph of Islam and joy in the writing of *Atlas maior*"; Chief Physician Ömer b. Sinan el-İzniki's (fl. 1700) pharmacopeia was called "Healing for the faithful"; Chief Astrologer Ahmed Dede's (1631–1702) pharmacopeia was called "The highest good"; Hezarfenn Hüseyin's (d. 1691?) book of recipes, which also included recipes for gunpowder drawn directly from his experiences as the master of the gunpowder mill, was called "The most useful medical and spiritual gift." What almost no one did was to engage in naturalism to understand God's works, as Avicenna, Nasir al-Din al-Tusi, Ibn al-Nafis, and many other medieval Islamic luminaries claimed to do. It was precisely the leisureless, practice-driven science of Istanbul that proved uninhabitable to philosophical naturalism of any cultural origin in the seventeenth century.

The naive inclusion of fanaticism and its allied vocabularies is a persistent risk in any study of Islam nowadays. Consider the following situation: In the middle of the seventeenth century Vani Mehmed Efendi (d. 1685), Sultan Mehmed IV's puritanical preacher, often—and often wrongly—counted among the darkest zealots of his time, and Abdurrahman Abdi Paşa (d. 1686), a close second to Vani in his zeal but of a more deserved reputation for ignorance, spent a lot of time in the company of palace physicians and astrologers. We know this because Abdurrahman Abdi Paşa took pride in his ability to hold conversations with them.[30] Vani tried and failed to convert to Islam the Jesuit-trained Greek astrologer Panagiotis Nikousios (1613–1673).

Grand Vizier Fazıl Ahmed (1635–1676) continued to patronize both Nikousios and Vani. He was also arguably of puritanical Islamist temperament and categorically opposed intoxication and occultism, yet he employed opium-eating physicians, heavy-drinking astrologers, and chain-smoking talisman makers. Anyone wishing to present him as a cosmopolitan and openminded patron of the arts and sciences would have to explain the role he played in ousting the Jews, almost completely, from Eminönü after 1660. Religion was a complex matter.

The liveliest naturalistic fields in seventeenth-century Istanbul, medicine and astrology, cared little about what "Islam" thought of them. Astrologers invoked pieties, such as "God knows best" or "this is a guess," all the while engaging exclusively in judicial astrology—the one type of astrology the Muslim orthodox historically disliked the most—and almost never in pious sorts of astronomy, such as *ilm-i mikat*, the "science of reckoning prayer times." Ibn Sellum (d. 1669), chief physician to the sultan in the 1660s and the figurehead of the Paracelsian new medicine movement, cited a saying of the prophet (*hadith*) that was known to be a false attribution since the tenth century: "Science, 'tis two: First comes the science of bodies, then comes the science of religions." No one seemed to show concern about this erroneous attribution, which was repeated by almost every physician in the late seventeenth and early eighteenth centuries. Ibn Sellum presented his pharmacopeia with the false hadith to the sultan in 1664, got a sable fur and a fair amount of money for it, and got along just fine with Vani, who, incidentally, was a professor of hadith. This kind of confraternization, quite common in the history of this period, makes any Islam-centric intellectual history impossible because properly intellectualized Islam, much like properly philosophized science, requires a robust scholastic field. There are no known seventeenth-century records of astrologers—at least one of them, Küfri Hasan, or Hasan the Profane (d. 1660), openly rejected obligatory religious practices—or physicians being executed or even taken to the court for religious reasons. In many cases, it was involvement with the field of power that posed the greatest harm. A poor forecast from the astrologer or a poisoning incident at the palace would be dangerous situations for a naturalist in the service of the palace. Fanaticism would not.

Finally, there is the issue of the decline of Islamic science more generally. I completely reject it not because there was no decline

anywhere but because the Islamic or Islamicate world in the seventeenth century does not lend itself to a unified history of science. There were serious faultlines between the Ottoman Empire's Turkish-speaking and Arabic-speaking territories.[31] The economic conditions were different between Cairo and Istanbul. Cairo never had as many medreses as Istanbul did. Teaching at medreses was more of a *noblesse de robe* because Al-Azhar, the most prestigious medrese in Cairo, never paid salaries to begin with. You had to come from a wealthy family, most often a merchant family, in order to teach. Aleppo and Damascus were different from both Cairo and Istanbul. I can only fathom that this fragmentation would be greater still in the broader Islamic world. For Iran, a cursory survey reveals the prominence of landed clerics, *mir*s and *mirza*s, among the men of learning. There also were notable differences between Istanbul and much smaller Ottoman towns in Eastern Anatolia. Erzurum and Amed/Diyarbakır, for example, preserved Arabic and Perso-Islamic learning to a certain degree during the period covered in this book. Perhaps part of the reason was the leisure and the stability that the countryside provided. From a bibliographic perspective, none of the other cities of the Islamic world seem to have produced nearly as many pharmacopeias and almanacs as did Istanbul. In the absence of a survey of the Islamic world with special emphasis on the material conditions of scholarship, I will abstain from using Islamic science as a coherent category for the seventeenth century, though scholarly mobility in the earlier periods warrants a more ecumenical understanding of Islamicity. I speak only for Istanbul and its environs, a multiethnic and multireligious geography.

This book also challenges the notion that colonial modernity was the culprit for all the ills of Muslim polities. The notion that the Islamic world was both thoroughly Islamic and medieval prior to the nineteenth century is unreasonably common, as is the notion that modernity was a Western, violent, abrupt, and colonial intervention in the natural flow of Islamic intellectual life prior to the nineteenth century. The medieval order of Islamic knowledge, as useful as it may be for understanding previous periods, is entirely useless for understanding the realities of being an Istanbulite in the seventeenth century. And there was nothing Western in the waning of the good times for Istanbul's naturalists. The transformation of Ottoman naturalism was not caused by the influx of Europe's revolutionary

ideas. To the contrary, the disappearance of scholasticism and the polymathic curriculum surrounding scholastic theology created the very conditions for the adoption of a variety of naturalistic practices by a variety of actors who had no investment in collegiate life. "Westernization"—a noncategory that I recognized as a noncategory only very recently—was simply an indistinct part of a longer process of *amel*-ization, or practicalization of natural knowledge in a city where the urban gentry, the artisans, and the merchants always included Christians from the European continent. And the natural company of *amel*-ization was the transformation of Istanbul's naturalists into a giant group of shopkeepers and service providers, generally called *esnaf*. As for big ideas drawn from the Scientific Revolution, they were as insignificant as the subtleties of Islamic theology were. Tezkireci İbrahim (fl.1660), who prepared ephemerides based on those of Noël Duret (1590–1650), saw the superiority of modern European astronomy not in a cosmological shift but in a type of practicality that helped with easy and accurate calendrical and astrological calculations.[32] Even in the later eighteenth century, which is beyond the scope of this book, Galileo appeared not as a radical philosopher but as the founder of the science of gunnery (*fenn-i humbara*), and Descartes appeared as a late seventeenth-century Dutch anatomist rather than an early seventeenth-century French metaphysical thinker.[33] The high-register intellectual accomplishments of both Islam and Christianity were of little import in comparison to the snippets of *practica* from Amsterdam, Damascus, Cairo, Padua, Bandar Abbas, or Paris that flooded Istanbul. The disappearance of the scholastic leisure in general, and scholastic naturalism in particular, had the effect of leaving in its wake a free and unregulated market. This freedom is evident in the remarkable textual, confessional, and disciplinary promiscuity of Ottoman naturalism, but also in the absence of the leisurely pursuit of naturalistic learning through long and passive studentship instead of a short and active apprenticeship. As a consequence, natural knowledge of a type that yielded tangible results, often service, was propagated through means that had remunerative practice rather than scholastic cognition as its goal.

On the specific case of Istanbul, I also take "medievalism,"—the notion that the mere fact of living in a major city in a Muslim empire gave one automatic access to the entire intellectual heritage of medieval Islam—to be more harmful and Eurocentric than most other

anachronisms and Eurocentrisms. As risky is the use of older medrese categories such as the rational or the transmitted sciences, because Istanbul was intellectually far away from the world in which these categories had any meaning or power. There certainly was a considerable amount of mobility within and between the Muslim polities in the seventeenth and eighteenth centuries. However, the medrese sciences that Abdelhamid I. Sabra described on the example of the fourteenth century were largely irrelevant to such mobilities.[34] One aspect of medievalism is ecumenical Arabism, which appears to take its (anachronistic) cue from late nineteenth-century notions of the Muslim world.[35] Was Arabic the language of Ottoman science? Not in Istanbul and not unless you were born in the Arab provinces or had extensive training. Even then, many people born in the Arab lands but ended up in Istanbul wrote in Turkish. Arabic was a foreign language to many Istanbulites and it even attached to an ethnicity for which some elite Ottomans had no love.[36] Why would there be so many Turkish translations of Arabic texts in the seventeenth and the eighteenth centuries if everyone read Arabic?

Analytic Hygiene

Since I am pursuing a somewhat unusual style of analysis, I would like to remark on two further points of analytical hygiene. I believe these will better serve an account of practical naturalism qua practical naturalism rather than as a proxy for science. First, I will avoid any discussion of discoveries and prior discoveries, mainly because they assume that innovators are working in a panopticon. Such assumptions may dangerously lead us to reading the entire textual traditions into the works of people whose material conditions were far less ideal than ours. Other times and places may have been blessed with a broader view of history, but Istanbul was covered in a dense cloud. Ottoman scholars and naturalists did not have anything approaching a full retrospect of their Islamic forebears, let alone contemporary literature growing around them, before Katip Çelebi's (1609–1657) *Discovery of Opinions*, which also served as the foundation of d'Herbelot's *Bibliothèque orientale* and of Europe's bibliographic command of the Islamic past.[37] Many of the books that were known to exist could not be seen. Most manuscripts were rare luxury commodities in the hands of an elite few, not common goods that were accessible

to the general population. İsmail Hakkı of Bursa (d. 1725), a prolific Ottoman author, spent the entirety of his mother's wealth, more than thirty kilograms of solid silver, on setting up a personal library. In the middle of the seventeenth century, Katip Çelebi, another staggeringly erudite historian and geographer, burned two inheritances on books. Physically accessible books were intellectually or linguistically inaccessible to the untrained. In late seventeenth-century Istanbul, people who had the monetary capital to buy books and those who had the intellectual capital to read them were not the same people. You needed patronage simply to be able to see some books.[38]

A case in point is the influence of Islamic astronomy on Copernicus, as studied by George Saliba and F. Jamil Ragep. There is no doubt that medieval Arabic astronomy exerted an enormous influence on early modern European astronomy. With or without a smoking gun connecting Copernicus to his Islamic forebears, it is easy to see that medieval Arabic astronomers and early modern European astronomers worked at a similar type of technical sophistication, a type that would not even occur to anyone unless he or she had been trained into it by a teacher who knew Ptolemy. That is, it was more unlikely for someone back then to "just pick up" Ptolemy's *Almagest* and teach himself or herself than it is now. While Hayy ibn Yaqzan, a Muslim character that informed Robinson Crusoe, could find God and reason on an island, he could not find the epicycles of planetary astronomy. This is because Ptolemy himself was the fruit of over two thousand years of inquiry that spanned the entire geography between Egypt and Babylon. There never was anything self-evident about it.

If we define Islamic astronomy as the high-register occupation with Ptolemaic models of planetary motion, seventeenth-century European astronomy was more Islamic than astronomy in Istanbul was. There was not a single person in Istanbul for the entirety of the seventy-odd years after 1660 who could appreciate the Tusi couple or the Urdi lemma, important mathematical devices that brought flexibility to Ptolemaic astronomy and possibly contributed to Copernicus's work, because people who engaged with Copernicus in Istanbul did not practice mathematically sophisticated astronomy, either of the Islamic or of the Christian kind. There is no indication that anyone in Istanbul knew about the higher technical achievements of Urdi or Tusi. It is not surprising that the first priority disputes

between European science and Islamic science emerged in the nineteenth century and with the rise of colonialism, because that is when exceptionally well-trained librarians such as Ferdinand Wüstenfeld gave us panoptic catalogs of Islamic manuscripts that could later be studied by exceptionally well-trained scholars, such as Bernard Carra de Vaux or his Muslim counterparts.[39]

Until 1731, there were no printed Turkish- or Arabic-language scientific books in Istanbul. Although the romantic notion of a "functioning manuscript culture" may seem attractive to some, running a large literate domain through manuscripts was a highly inefficient enterprise. An early modern scientific culture in manuscript is an ambiguous cause for celebration at best. Copying and recopying scientific manuscripts meant redundant labor, often the valuable labor of a learned person who understood the manuscript he or she copied, and hence served as a natural barrier to the quick dissemination of books.[40] The printing press was not the only or a necessarily viable successor to the manuscript culture because printed books were also few and expensive. Large and public libraries were far more important in the Ottoman Empire than the printing press was—and there were many such libraries by the second half of the eighteenth century.[41] However, libraries were important precisely because they defied the most central feature of the prior scientific manuscript culture: a few expert readers reading a few canonical books and taking notes on the physical copies.[42] A fair amount of eighteenth-century scholarship following the establishment of public libraries—a period that is beyond the scope of this book—focused on rendering physically accessible books also intellectually accessible. Abbas Vesim's (fl. 1740) *Commentary on the Ephemerides of Ulugh Beg*, a manuscript work from 1745, taught in Turkish how to use the thirteenth-century ephemerides for common tasks such as timekeeping and calendar making.[43] Armenian Petros Baronyan's (fl. 1730) *Compendium of the Science of Geography*, another manuscript work from 1738, provided an elementary course in geography, because students and artisans could not understand the Turkish vocabulary of modern geography, although geography books were available in print.[44] The lack of access to older and formal scholarship in Hebrew, Attic Greek, or Arabic also pushed forward vernacularizing movements in eighteenth-century Istanbul.[45] Most of the surviving scientific manuscripts—there is no reason to assume that fire-prone Istanbul's libraries today

would be so rich with manuscripts if it weren't for the stone libraries established mostly in the eighteenth century—are neatly copied, but they also lack subsequent annotations. They generally do not present the kind of paratextual cornucopia that would help us read the readers. That is, library manuscripts generally provide all the advantages of printed books, but none of the advantages of manuscript volumes.

I also tried to avoid in this book the necromantic vocabulary of "continued vitality" or "revival," because such expressions generally lack a sound doctrine of resurrection. Hardly anything comes back from the distant past without passing through the immediate past, and revivers rarely have disinterested interests in old texts. Thus, I wrote the history of the early eighteenth century—a period of limited intellectual efflorescence—with the full recognition that the late seventeenth century, the nadir of scholasticism in Istanbul, happened as it did. For example, when natural philosophy emerged in Istanbul after 1715 as an elite occupation (producing only two voluminous manuscripts with no more than ten extant copies between them), it was precisely because there was some question about whether practical naturalists deserved to be elites at a time when Ali Paşa, a young magician and counterfeiter, had become grand vizier. Many naturalists had become true protocol elites in living memory at the end of the seventeenth century. This practical naturalism was euphemistically viewed by some as a kind of intuitionist philosophy that originated in medieval Iran, but as Yirmisekiz Mehmed Çelebi (d. 1731) reveals, no one actually seemed to know much medieval philosophy in any detail because there were no books.[46] Yirmisekiz was an alchemist, the master of the mint, and a client of Ali Paşa (1667–1716). He started studying fairly late in his life and defended practical natural knowledge as the highest fruit of all learning in a translation of the natural philosophy section of a twelfth-century illuminationist theological compendium, the only modern book that he could find on physics. Esad of Ioannina (d. 1731?), librarian to Ahmed III (r.1703–1730), claimed that elite natural philosophy was not about utility but about temperance toward worldly goods. He did so through an Arabic translation of a Latin commentary on Aristotle written by an Ottoman Greek who taught at the University of Padua, the graduates of which had also started enjoying elite status in Istanbul at the end of the seventeenth century. One way to read this efflorescence is by

reference to the continued vitality of Arabic philosophy and of the long-term tensions between two schools of Islamic philosophy, but that approach would conveniently overlook the fact that the source texts were someone else's scholastic texts with minimal contribution from the translators, that they had no prehistory in the Ottoman context, and certainly did not yield a crop of scholastic philosophers.

All of this brings up the notion that there is a separate, practical register of Ottoman natural inquiry that was specifically early modern but not specifically Islamic or European. Ottoman science, in this context, was an emergent phenomenon and a site of tension and contention. And this book will reproduce these tensions in the narrative. Can we call practical naturalism science? Can science ever be fully reduced to productive labor? Can the productive labor of the practical naturalist by itself turn into the nonproductive labor of the scientist? If it can, what are the material conditions of this transformation? A good reference point is Lorraine Daston's notion of the moral economy of science.[47] Daston argues that science can never be fully reduced to economy and the relationship between scientists is never purely economic. But how do moral economies emerge? From the morality of the economy, which is a type of utilitarianism, or from the economy of morality, which is a way to create distinction in a setting where the economic field has a tendency to dominate? Limited moral economies of science emerged in the Ottoman Empire during the eighteenth century, but they emerged through a dialectical process. That is, science was an iterative escalation of personal and community differences within market parameters into a discourse on method.[48] I am loathe to use the term *protoscience* for the emergent science of the Ottoman Empire, mainly because the very back-and-forth that gave rise to methodological debates never reached the level of true medieval *scientia* or *'ilm* as certain knowledge. Any demarcation below that line is bound to be arbitrary. Ottoman science, it seems to me, was always emergent. Perhaps the period that this book investigates comes not before but after science.

Outline of the Book

This book has roughly three parts, though the divides are not hard enough to merit explicit partitions: The first three chapters comprise the first section and provide crucial economic and bibliographic

background to the case studies I present. Chapters 4 and 5, the second section, present case studies on seventeenth-century astronomy and medicine. Here, I revisit well-known sites of "westernization" to show that the proper subject for inquiry in these texts are long-term dynamics rather than the arrival of European texts. They showcase how practical naturalism works when philosophical approaches to nature are wholly absent. The third section provides how natural knowledge started to work in the eighteenth century, after elites began to voice skepticism toward pure practical naturalism. Chapter 6 observes early eighteenth-century skeptics who were very close to the palace. Chapter 7 turns to practical naturalists who took a mild cue from the skeptics' demand for philosophical justification, while Chapter 8 approaches empiricism from the perspective of practical naturalism.

The first chapter provides a bird's-eye view of Istanbul to give the reader a sense of, especially, the temporal regime of the city. Time was faster in seventeenth-century Istanbul, and urgencies greater than they used to be. Urgency was a constituent element of different scientific fields, as Istanbul's urgencies limited the temporal and, to a certain extent, spatial horizons of people engaged in the study of nature. Following this analysis, the reader will find a bibliographic overview of the kinds of manuscript works Istanbul's naturalists wrote, which show how all natural knowledge had a practical bent.

The second chapter presents "the way things were." I provide brief and somewhat idealized versions of natural philosophy, astronomy, and medicine as they attached to the medreses of Istanbul. I also familiarize the reader with the material conditions that made Istanbul's flourishing field of higher education possible. The second part of this chapter lends an ear to the late sixteenth-century chatter about the medrese, chatter that creeping inflation prompted. Here, I juxtapose and, to a certain extent, reinterpret some of the canonical texts of the sixteenth century.

The third chapter is a study of Ottoman scholars and elite practical naturalists in seventeenth-century Istanbul, when medrese salaries had declined to the point where teaching was an undesirable if not detestable undertaking. Occasioning the rise of elite practical naturalism was the decline of scholasticism in general, and scholasticism in naturalistic subjects in particular. Here, I provide an outline of what I call the "scholastic field," with an eye to discerning its concerns and its limitations.

The fourth chapter takes the focus off generalities and turns to Kandilli Manuscript 403, Tezkireci İbrahim's partial Turkish translation of Duret's *Nouvelle théorie des planètes*. This text, dated 1662, shows that practical astronomers—mainly bureaucrats by this point—had little to no interest in not just Duret's planetary hypotheses but the category of *nouvelles théories* in general. I provide the habitual or the long-term context of astronomical inquiry in the absence of scholasticism. I also provide the readers with the immediate background to the translation, which was the failed conversion of Panagiotes Nikousios. The chapter ends on tax calendar reform, which I argue provides the correct microteleology—rather than a general appreciation of Western astronomy—that explains the translation.

The fifth chapter turns to the "new medicine" movement of the seventeenth century and goes over some of the canonical texts that attach to this movement. The thrust of this chapter is that, rather than a distant interest in the superior medical culture of the West, the texts point to the increasing prevalence of drugs in the field of medicine. They also point to the remarkable freedom of the medical marketplace in the absence of scholastic oversight. Istanbul provided a lucrative place to set up a medical shop, and European and Muslim doctors flocked to the city to make money.

The sixth chapter is a study of Nabi, Esad of Ioannina, and a host of other figures whom I call men of taste, and highlights the new elites' moralizing discourses that targeted practical physicians, practical astrologers and practical alchemists. I show that practical naturalism is a necessary middle term that explains two apparently disparate movements in the eighteenth century: intellectualized piety and a fresh demand for natural philosophy.

The seventh chapter studies Yirmisekiz Mehmed Çelebi and İbrahim Müteferrika, who were engineers and practical naturalists that had a modicum of philosophical training. Here I argue that vocal, elite skeptics helped create a more educated idiom in engineering but also led to a utilitarian or "fruitarian" reaction toward elites who seemed to be impervious to the fact that they existed in the first place thanks to the work of practical naturalists. Here, my focus is on the machines of governance and the moral attitudes of people who operated these machines.

The eighth chapter presents a fresh take on what empiricism means when we measure it against practical naturalism rather than against

scholasticism. Here, I present a case study of İbrahim Müteferrika's *Magnetic Effluvia*, a translation of Christoph Eberhard's *Specimen theoriae magneticae*. I follow the journey of the text to Istanbul with Johann Friedrich Bachstrom, a Polish Pietist missionary. I also take a look at how practical naturalists used and exploited empiricist discourses to make and sell luxury goods to discerning elites.