

## Chapter 1

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# Seeking What Is Good in Wonder

*Depending on the company they keep, some wonders are respectable and others disreputable; but none [today] threatens the order of nature and society. Scientists have yet to explain many, perhaps most, wonders, but they subscribe to an ontology guaranteeing that all are in principle explicable. If the first criterion for distinguishing respectable from disreputable marvels is whether they are real, the second is whether there are explanations to reassure us that the apparent exceptions only conform to nature's laws. In practice, the second criterion often decides the first.*

—LORRAINE DASTON AND KATHARINE PARK, *WONDERS AND THE ORDER OF NATURE*

### WONDER AND ITS COGNATE TERMS

What does it mean to wonder? Wonder is almost routinely exalted as a laudable state, but perhaps not all expressions of it deserve to be celebrated. Wonder seems to exist at the border of sensation and thought, aesthetics and science. It has the power to transfix as well as transport us. It is characterized both as a childlike capacity, closely aligned with sensory and emotional engagement, and as a kind of scientific virtue. Wonder is both the province of the wide-eyed child in the woods and the wild-eyed scientist in the lab. Aristotle considered wonder to be the beginning of philosophy, and René Descartes famously categorized wonder as the first of the passions, an *intellectual* passion that orients us toward understanding the object of wonder. Yet, while wonder is often assumed to hold a privileged place in the production of scientific and philosophical knowledge, it is a deeply ambiguous place as well. In romance languages, wonder's etymological origins show connections to an Indo-European word for "smile," but this is not the case in German and English, where wonder (*Wunder*) may be traceable to *wound*—a tear in the fabric of the ordinary, an "uncanny opening."<sup>1</sup> Wonder, typically expressed as awe, may border on terror or horror in the presence of something that overwhelms the mind with its sheer enormity or power. Wonder in the form of terrifying awe is often associated with encountering something holy or otherworldly, as with God's inter-

rogation of Job from the whirlwind. The ambivalence or outright fear evoked by wonder may be met with a desire to control and domesticate the world, to “systematically insulate it against the intrusion of strangeness.”<sup>2</sup> Wonder’s terrifying and even painful elements are captured in the more secular category of the sublime. Often distinguished from the beautiful,<sup>3</sup> which connotes something more pleasing than threatening to the mind or the senses, the sublime may be experienced in the presence of nonsupernatural but vast and imposing or powerful phenomena, such as high mountains or a violent, stormy sea.

Yet another distinction emerges between wonder and wonders. The former refers to an experience or response and the latter designates *objects* themselves, such as odd or interesting items, novelties and marvels housed (as they often were in early modern Europe) in curio cabinets. A catalogue of wonders might include a two-headed dog or a lodestone. Historically, the category of wonders has merged the sacred with the secular, including such phenomena as “plants, animals, and minerals; specific events and exotic places; miracles and natural phenomena; the distant and the local; the threatening and the benign.”<sup>4</sup> Although contemporary discussions tend to focus more on wonder than wonders, this distinction helps us to appreciate that, in judging wonder’s appropriateness or ethical value, we need to attend both to its forms of expression and to its objects.

That wonder and its associated terms can align with such seemingly disparate experiences, ranging from childlike delight to profound destabilization and even pain and death—a “cognitive crucifixion”—suggests its unusual status among our repertoire of responses to the world.<sup>5</sup> Wonder, in its frequent association with scale, may foster a sense of our own smallness or insignificance in relation to its objects, perhaps even a sensed loss of the self. That experience may produce either fear or a more uplifting sense of awe or exhilaration—depending upon how one feels about self-loss! The experience of loss of self, of *letting go* of ego-dominated rationality, is one of the links between wondering responses and experiences often termed religious, as theorists such as William James have noted.<sup>6</sup> In such moments of profound receptivity to the unexpected, we may sense our connection to something that is ontologically or spiritually *more* (as James termed it) than what is given in our daily experience of the world or the world as filtered through familiar categories of knowledge. Loss or decentering of the self, and dispositions that flow from such decentering, can have important ethical value: “openness, availability, epistemological humility in the face of the mystery of being, and the ability to admire and be grateful.”<sup>7</sup> On the other hand, as I will argue, wonder that manifests as blunt and irreverent curiosity, or that follows in curiosity’s wake as a form of admiration at our knowledge, may have the opposite potential of puffing us up with pride. How can we make sense of the fact that wonder variously engenders or accompanies a salutary sense of smallness and humility, as well as aggrandizes admiration of our own feats?

Wonder is a tapestry rich with meanings, but its very richness makes it easy to pull out particular strands while ignoring others. I want to focus critical attention on a few, very particular meanings of wonder that have often been isolated from their broader context. These include: wonder assumed to be (primarily) a function of ignorance; wonder as the force that drives ongoing discovery and successive puzzle-solving—what I call “serial wonder”; and wonder characterized by admiration or pride at that which is assimilated and known. These strands, which are often intertwined in modern discourse on wonder, actually represent only a small portion of all that wonder has signified, in theology, philosophy, and science, over a span of many centuries. Wonder—properly understood—is not merely an ephemeral response to what is poorly grasped or appears novel; it persists even after ignorance is erased or newness wears off. A strong association of wonder with successive puzzle-solving imputes motives to wonder that more properly belong to curiosity (some of those motives prove problematic, as I will argue). To wonder at the vast store of human knowledge may be understandable, but this orientation effectively strips wonder of much of its ethical potential and admirable dimensions. The stripping away of wonder’s virtues also makes wonder the purview of the expert whose task it is to inform the masses where wonder truly resides in the world around us.

The reorientation of wonder as largely a response to *knowledge* will form a focal point of much of the analysis of wonder that follows. In short, much of what passes for wonder in a significant portion of contemporary scientific and environmental discourse (whether the context is celebratory or disdainful of wonder) is scarcely wonder at all. Inappropriate forms of wonder lurk alongside and mingle with more genuine and wholesome varieties. Distinguishing these is not always easy or straightforward. Nevertheless, a good rule of thumb might be this: When expressions of wonder become tinged with celebrations of hubris, or interwoven with triumphalist claims of progress, certainty, or mastery (over nature, or over others, even over ourselves), we can be fairly sure that wonder has somewhere taken a wrong turn. Understanding how and in what ways wonder has been diminished and distorted is the overarching aim of this chapter.

#### NOVELTY, FAMILIARITY, AND THE PROSPECT OF WONDER’S ENDURANCE

At first glance, it might seem that both novelty and familiarity act to undercut wonder’s endurance or resilience—novelty because it gradually wears off, and familiarity because it seems to convey nothing new. But wonder can coexist with either; it is neither—necessarily—dependent on newness nor dispelled by close acquaintance or even intimacy. Wonder as a response to sheer novelty or newness accounts for its common association with children who are more likely than adults to encounter the world with fresh eyes and without the knowledge conditions or

engrained habits of mind that can mute our sense of wonder over time. Some theorists maintain that the very nature of wonder necessarily entails that it “decays” and “declines” with age and experience. Wonder participates in an “epistemology of youth,” according to Philip Fisher,<sup>8</sup> and a “rapid wearing out of the new is also part of the aesthetics of wonder.”<sup>9</sup> However, I am not convinced that this conclusion is warranted (and indeed, there is something fundamentally immature about the demand for constant novelty and titillation in order to sustain a sense of wonder). Prior experiences of wonder, including those in childhood, may serve as a lifelong reference point, a perspective on the world to which we can return again and again. Rachel Carson alludes to a sense of wonder that is sufficiently “indestructible” to last a lifetime, acting as “an unfailing antidote against the boredom and disenchantments of later years, the sterile preoccupation with things that are artificial, the alienation from the sources of our strength.”<sup>10</sup>

R. W. Hepburn argues that some instances of wonder “could not be described at all convincingly in terms of response to the surprising and novel.” They may arise, for example, from “the linking of present experience with memory-traces of very early experience.”<sup>11</sup> As Carson’s account also suggests, emotional impressions from early childhood may lend new life, renewed excitement, to sensory experiences in later adulthood that might otherwise affect us little. Indeed, our very awareness of the “wide temporal gap” between this moment and our own remote past may enhance the feeling of wonder, Hepburn notes.<sup>12</sup> This understanding of wonder and enchantment as “renewable” has been central to educational programs for children that aim to instill wonder at (and later, care and responsibility for) the natural world, ranging from the nature study movement of the early twentieth century to modern-day environmental education and ecological literacy programs. Intense sensory and emotional engagement with nature at an early age may have lasting moral impact, even after maturity supplements the child’s sense of the magical with a more rational, even scientific, understanding of nature and its processes. Again, Carson’s approach to nature education fits this mold. The “emotions and the impressions of the senses are the fertile soil” of early childhood and they prepare the ground for the later acquisition of knowledge.<sup>13</sup> Nature study for children, distinct from training in the *sciences*, has always made sensory and emotional responses central. Given the close, primal link between the senses—particularly the sense of smell—and memory, it seems plausible that wonder has a great deal to do with what Carson calls the remembered delights of childhood.<sup>14</sup> These reflections cast doubt on the pessimistic conclusion that wonder necessarily or completely decays with age.

As this portrait of resilient and recurring wonder suggests, repeated exposure to and knowledge of something, or someone, need not dispel wonder. Familiarity may indeed deepen a wondering appreciation, so long as familiarity is of a sort that disclaims exhaustive, totalizing comprehension of its objects. We may well

remain in a state of wonder at that which seems well understood, and we may also experience very little wonder at things that are poorly understood. Even though I cannot say precisely how my toaster works, I do not consider it an object of wonder. The birth process, on the other hand, is rather well understood, but nevertheless remains a process at which we often marvel, and rightly so, for as theorists of wonder have often observed, wonder may have less to do with how or what a thing is than *that* it is. Ontological or existential wonder can foster a mood in which “certainties give way to questions which, so long as wonder remains, can never receive final answers.”<sup>15</sup> Hence, while we may be able to explain childbirth in minute detail, we cannot explain why it is “that love should bear fruit in such a strange fashion.”<sup>16</sup> Put differently, that which presents itself to us as a mystery is not necessarily unknown or vaguely understood. On the contrary, we can come to know something *as* a mystery. “It is too often assumed that the mysterious is equivalent to the unknown and that, in the light of adequate knowledge, mystery will give way to clarity.”<sup>17</sup> Wonder enables us to see things anew in encounters with what we think we “know,” but much may depend upon the general attitude that attends the acquisition of knowledge, as I argue in chapter 7.

#### DEFICIENT KNOWLEDGE: WONDER’S PARTNERSHIP WITH CURIOSITY

An association of feelings of wonder with a deficient state of knowledge has led some thinkers, past and present, to regard wonder with wariness or even disdain. Conflation of wonder’s mysterious quality merely with that which is not (yet) understood recurs frequently in science writing. It is a particular hallmark of Richard Dawkins’s treatment of scientific wonder, as we will see. When wonder is narrowly defined in terms of deficient knowledge, its presence may evoke a strong sense of dis-ease, even hostility, particularly among those who understand success in science as the progressive eradication of unknowns. On this account, wonder is of value primarily because it can mobilize us to find answers, to *eliminate* the very conditions that gave rise to wonder. But if the sensation of wonder is deemed pleasant and desirable in and of itself, such mobilization may not occur and ignorance will prevail. Thus Francis Bacon referred to wonder as a form of “broken knowledge”—a tendency of the mind to break off its train of thought, to enjoy itself *instead* of knowing.<sup>18</sup> Wonder’s capacity to stall the mind, to induce stupefaction, can entail a sudden halt to the process of scientific investigation. Thus, while we may commend and encourage a gaping and gawking form of wonder in children, wonder of this sort might—appropriately—be considered unseemly in adults, and particularly in the world of professional science.

Even when not accompanied by a strong desire to remain in ignorance, wonder has a contemplative or meditative quality that—for better and for worse—can

interfere with or distract from mundane and task-oriented activities. Concerns about wonder's potential sloth or lack of utility are bound up with the crucially important distinction between curiosity and wonder. Descartes, as noted above, praised wonder as the first of the passions—the passion that initially energizes the intellect. Yet his celebration was also tinged with suspicion of wonder, a need to liquidate and drain away its potentially dangerous power to disrupt the acquisition of knowledge.<sup>19</sup> Thus, curiosity is sometimes understood as a kind of wake-up call, a jolt to wonder's soporific inclinations: curiosity can narrow and focus the wondering response, encouraging the mind to search for explanation. To the extent that wonder is regarded as something unseemly or unpleasant—or dangerous—curiosity performs a valuable service. Curiosity enters into the wondering process as a helpful heuristic by posing particular (and in principle, answerable) questions.

Contemporary science writing often invokes this dynamic of active, hardworking curiosity and gaping, dreamy wonder. Relatively few scientists write openly nowadays about their experiences of wonder, but such professions of wonder were once fairly common. Those who do so today are often at pains to highlight the uniqueness of scientific forms of wonder from all (or at least most) other kinds; they particularly want to cordon off scientific wonder from forms of wonder that are evoked by, related to, or in any way celebratory of a state of *not* knowing. In order to do so, these thinkers often turn to curiosity as wonder's saving grace. Some scientists maintain that a hallmark of scientific wonder is that, while the nonscientist may spontaneously wonder at any number of phenomena and think "how strange!"; the scientifically minded will cultivate wonder to a "more intellectual height" and then devise explanatory hypotheses that can be tested and verified.<sup>20</sup> The claim that all nonscientific forms of wonder are at best only weakly interested in explaining wonder-evoking phenomena is not uncommon, simplistic (and often flattering to the scientist) though it seems. Mark Silverman, a Harvard physicist, argues that the scientist, and the scientist *alone*,<sup>21</sup> "goes beyond 'gapes and stares' employing his experimental and mathematical resources in an effort to understand in some more profound way the significance of his observations."<sup>22</sup> (Note that the scientist's hard work pays off in the form of "*more profound*" insights than the dreamy wonder of the nonscientist can ever produce.) Silverman characterizes curiosity as the laudable dimension of wonder, wonder's "scientific" sidekick, and the driving force of inquiry. Science moves beyond *naïve* wonder—philosophy may do so as well—to a form designed for self-destruction. As Marie George argues, the scientist recognizes that "his wonder will cease upon learning the cause . . . it is proper to science and philosophy to break matters down into questions which are resolvable."<sup>23</sup> But as we will see, the story of the relationship between wonder and curiosity is much more complex than these accounts suggest, and it is largely a story about distinguishing—ethically, theologically, and scientifically—appropriate and inappropriate forms or objects of inquiry. This task

of discernment remains vital today and it has largely been neglected in the blithe celebrations of scientific wonder that I analyze in later chapters.

As this discussion of the dynamic between wonder and curiosity suggests, wonder becomes something eradicable and self-eliminating: curiosity comes in as a “cure” for wonder, displacing it with new knowledge.<sup>24</sup> Wonder, in this view, is like a ladder we throw down once we have reached understanding. There seems to be little reason to value the state of wonder, *or* the phenomena—including natural entities—that produce it, given that our attraction to such phenomena was rooted in ignorance or muddled thinking. Both the object and the wondering response are merely a means to a more valuable end, the production of clear understanding. To the extent that wonder is seen as rooted in false, misguided, or ignorant perception, the entities that engender our false perception may themselves begin to appear less real, once our wondering response is replaced with clarifying knowledge. Knowledge of the object, in other words, *becomes* the reality.

The claim that curiosity acts as a cure for wonder’s vices has deep roots in Western thought.<sup>25</sup> Wonder and curiosity were intimately linked in the minds of seventeenth-century natural philosophers like René Descartes and Francis Bacon, owing to curiosity’s “essential role as bait and motivation for intense efforts of attention.”<sup>26</sup> This perspective remains alive and well today among some scientists, science writers, and philosophers of science. Over the course of the intertwined history of wonder and curiosity, curiosity has come to be seen as diligent and respectable, while wonder has largely fallen into disrepute as something childish and gaping. By examining some key moments in this history, we can appreciate the way in which we moderns have inherited a greatly diminished version of wonder; moreover, as this history reveals, curiosity has always attracted its own set of vocal and incisive critics, and it is worth keeping them in mind. In recounting some of wonder’s fascinating history—a task made more manageable by exhaustive studies of wonder already in existence<sup>27</sup>—I focus special attention on a dubious form of wonder that emerged in the seventeenth and eighteenth centuries, wherein wonder became synonymous with a response to knowledge obtained through scientific investigation. That is, wonder becomes response to the *end product* of inquiry rather than a goad to inquiry. I propose that a contemporary version of this problematic form of wonder—oriented largely toward scientific knowledge and an elite set of knowledge-producers—animates the new cosmology and the worldviews of certain thinkers who are demonstrably foundational to that cosmology.

#### THE DECLINE AND REORIENTATION OF WONDER

The ascendance of virtuous, industrious curiosity over dull, stupefied wonder is a relatively recent development in the history of science, or what was once termed natural philosophy. In theological circles, by contrast, wonder has sometimes been

highly regarded as a fitting response to the divine and to the intricate marvels of the created world. This is not true of the natural philosophy tradition that sought to explicate the basic laws that govern and order the natural world. Among their ranks (and among some natural scientists today) wonder was more likely to be greeted with ambivalence, as an ally of superstition or ignorance of natural causes. In the twelfth century and beyond, wonder came under suspicion by natural philosophers who “marginalized both the passion of wonder and wonders as objects, in favor of a view that emphasized both the regularity of nature and the completeness of the philosopher’s knowledge, marred by no unseemly gaps.”<sup>28</sup> With increasing professionalization of knowledge and the rise of universities during the scholastic period, wonder increasingly took on this aura of superstition, laziness, or ignorance, a taint it still carries for many today. The pleasure that the philosopher experiences, Roger Bacon (1214?–1294) argued, “arises not from the process of inquiry into the unknown, but rather from the *possession of knowledge already perfect and complete*”—that is, it arises from possession of a solution to or elimination of the “unknown.”<sup>29</sup>

Dismissal of wonder as a bedfellow of ignorance contrasts with a venerable old strain, discernible in Christian theology, that saw certain forms of ignorance, and the wonder they generate, as commendable and pious dispositions. Augustine (d. 430) described wonder in these terms as “the proper expression of humility before the omnipotence of God.”<sup>30</sup> He considered aimless or restless curiosity, or the pursuit of inessential knowledge, as a function of pride, or lust, something akin to incontinence or concupiscence—a weakness of the flesh, a movement of the sensuous appetite. This earlier understanding of curiosity as sensuous and lustful points to its addictive and potentially insatiable dimensions—qualities evident in what I call “serial wonder.” The morally dubious features of curiosity were brought into sharp relief in the early modern period when curiosity was increasingly aligned with greed and avarice rather than lust; that is, curiosity was seen as an unquenchable desire that aims not at *satisfaction* but at the “perpetuation of desire.”<sup>31</sup> It is difficult to say with certainty, of course, which forms of knowledge are essential and which are idly sought merely for their own sake. These categories are not static. Augustine’s concern about idle curiosity centered largely on the presumptuous *attitude* that accompanied curiosity—the likelihood that such knowledge “puffs us up” with pride verging on self-deification. Philosophers’—in our day, we might say scientists’—presumptive curiosity culminated in a “twofold trespass,” Augustine warned: The vainglorious attitude would interfere with an appreciation of the mystery and wonder of the created world (and by extension, of its Creator) that the less knowledgeable masses readily experience. The same attitude also “led [philosophers], and encouraged them to lead others, into error, usurping for themselves the wonder that ordinary Christians should direct not toward other humans, however learned, but rather should reserve for God.”<sup>32</sup>



The Augustinian association of curiosity, vanity, and pride, on the one hand, and wonder, humility, and ignorance, on the other, has never faded entirely from Christian thought; the basic spirit of this critique of curiosity was reissued in the sixteenth century by such thinkers as Desiderius Erasmus and Michel de Montaigne, for example. But it has at times fallen out of favor. Augustine's concerns posed difficulties for later thinkers such as Aquinas (d. 1274), who recognized the vicious potential of curiosity but also regarded ignorance as unseemly for natural philosophers concerned with causal knowledge of the world. The task for philosophers like Aquinas was to sort out which forms of inquiry were acceptable and which were not. Problematic curiosity was recognizable in its dilettantish, "half-hearted" quality while true and serious devotion to knowledge—studiousness—was lauded as a virtue. In deploying this distinction Aquinas "simply laid aside the heart of Augustine's argument, replacing it with another set of values, less sympathetic to wonder and more sympathetic to curiosity."<sup>33</sup>

Subsequent centuries witnessed an "intricate minuet of wonder and curiosity" in the Western world.<sup>34</sup> Over the course of the early modern period, curiosity gradually lost some of its taint of lust and pride and took on the mantle of respectability, even a whiff of elitism; wonder, once associated with pious or awe-filled reverence, was now the province of the ignorant masses. So dramatic was the fall of wonder that by the mid-eighteenth century, wonder would be "demoted from premiere philosophical passion to its very opposite, and once-frivolous curiosity took on the virtuous trappings of hard work."<sup>35</sup> And yet, the period from roughly the mid-seventeenth to the mid-eighteenth century saw a brief efflorescence of wonder, as well as a temporary rapprochement between wonder and curiosity. Interestingly, this same period saw the rise of "modern" science, and of the mechanical worldview promulgated by Descartes and Bacon, and often censured by environmentalists, religion scholars, and historians, for its radical disenchantment of the natural world.<sup>36</sup> How is it that this "age of wonder" was simultaneously an age of disenchantment?

One answer to this question leads us to the forms of wonder currently advocated by scientists such as Dawkins as well as some advocates of the new cosmology. But in order to arrive there, we need to look more closely at the terms of the rapprochement that briefly obtained between wonder and curiosity during the rise of modern science.

#### A REVERSED DYNAMIC: WONDER AT KNOWLEDGE

If wonder has often been regarded with ambivalence, curiosity too has its share of critics. The problem lies not in curiosity's lack of discipline (as associations with restlessness might suggest), for curiosity can bring highly focused concentration. For this reason, it often appears a necessary companion to wonder. During the seventeenth and eighteenth centuries, wonder's marriage with curiosity was, in a

sense, one of necessity because, left to its own devices, wonder might be content to dwell wherever it was, to marvel and gawk rather than get to work investigating its objects. The term Descartes used to describe this stunned or stalled mental state was “astonishment” (*l'étonnement*)—an excess of wonder (the roots of this word suggest turning to stone). Too much wonder was pernicious and paralyzing, but too little might not spark the curiosity needed to sustain the spirit of inquiry over a long and sometimes tedious haul. Wonder, therefore, was necessary but not sufficient for science. With this dynamic of curiosity and wonder in place, however, wonder began to appear the less virtuous of the pair. From there, it was but a small step to seeing curiosity, and the knowledge it engenders, as a cure or antidote to wonder, rather than wonder’s abiding companion.<sup>37</sup> The marriage of convenience between wonder and curiosity thus turned out not to be a marriage of equals, and by the mid-eighteenth century, the two seemed headed for divorce. Without the prestige and refinement of its erstwhile partner, wonder increasingly became regarded as the “dull, effusive” companion of the vulgar, untutored masses, a disposition far removed from science.<sup>38</sup> (Today, although scientists like Silverman or Dawkins often refer to wonder in science, it is scientific *curiosity*—focused, disciplined investigation inspired by discovery of puzzles—that they actually single out for praise, whatever term they may use.)

Effusive wonder found a somewhat respectable second career in natural theology—distinct now from natural philosophy—during the late seventeenth and early eighteenth centuries. If wonder’s vices lay in its tendency to *excess*, then excessive wonder was acceptable (perhaps even virtuous and commendable) so long as it was evoked by *God*, who alone was deemed incomprehensible, worthy of a mind-numbing, gaping form of wonder. Another solution to the problem of “excessive or misplaced wonder” was to permit wonder a more carefully delineated role in natural philosophy as well: here wonder was directed not to God per se but to the comprehended natural order—the “tidy regularity of nature” and the “simplicity and economy of its underlying principles.”<sup>39</sup> We see the legacy of this form of wonder in the work of E. O. Wilson and those who seek the tidy, law-like knowledge Wilson promises with consilience. Intimations of the magical or marvelous in nature are antithetical to this type of wonder; then as now, aberrations were deemed less worthy of wonder than were regularity and orderliness. Advocates of this view, such as the French scientist Bernard de Fontenelle (1657–1757), were the Richard Dawkinses of their day, censuring those who turned away from scientific *study* of nature in favor of wonder and admiration at nature *itself* “which one supposes absolutely incomprehensible.”<sup>40</sup> False forms of wonder revel in nature without wishing to understand it, Fontenelle believed, for nature “is never so wondrous . . . as when she is known.”<sup>41</sup> This attempt to rehabilitate wonder cleanses it of vulgar or mind-numbing excess by reversing its age-old dynamic. That is, it makes wonder not the beginning but the *result* of inquiry, a response to *knowledge obtained* rather than to

the puzzling, awesome, or mysterious phenomenon itself. Oddly, it is particularly this form of wonder—wonder at knowledge, and at the discovery of an orderly and comprehensible universe—that makes a strong showing in contemporary science-based mythmaking and the new cosmology.

I say *oddly*, because this interpretation of wonder would seem to have little broad appeal. Wondering at knowledge already obtained stripped wonder of much of its popular allure and failed to elicit great enthusiasm among laypeople (and perhaps even among would-be scientists). Wonder thus continued its downward spiral. “In the end,” Daston and Park observe, “wonder proved intractable to such a dramatic reorientation and ceased to be a philosophical passion.”<sup>42</sup> From there, wonder gradually reverted to a pedestrian and somewhat silly disposition among common people—the stuff of cartoon superheroes and spongy white bread.<sup>43</sup> Curiosity, on the other hand—in the form of “earnest application” utterly purified of strong pleasure and desire—became the abiding cognitive skill of the natural philosopher, or what we today call the scientist.

It is not very difficult to see why wonder at nature’s regularity, predictability, or economy (rather than perceived novelty or marvels), or wonder at knowledge already obtained (rather than mysteries themselves) failed to catch fire, particularly among nonscientists. For only those who have participated in obtaining such knowledge, through investment of long hours spent studying natural objects in tedious and laborious detail, would be rewarded with feelings of wonder at all that they ultimately comprehend. The wondrous aspects of the order revealed by hours of intensive, but dispassionate, study would not necessarily be inviting, or even apparent, to the nonexpert. Moreover, the expert was now in a position to inform the laypeople (or not) of wonders not readily accessible to them in their ordinary experience of the world. The reorientation of wonder as a response to knowledge gained also reaches toward an *internalization* of wonder. As Mary-Jane Rubenstein observes, this redirection of wonder at hard-won knowledge is often “related to a certain will toward mastery, even toward divinity: by *comprehending* the source of the wondrous, the thinking self in effect *becomes* the source of the wondrous.”<sup>44</sup> Wonder was now “bestowed on the knowledge won,” and by extension, on the one who *knows*, the one who dispenses wondrous knowledge.<sup>45</sup> The role of the scientist may then become, as it has for Dawkins and others, one of explaining to the masses not just why abstruse science is wondrous, but why it is *more* wondrous and awe-inspiring than the delusional or vulgar objects of wonder—religious miracles, tales of the supernatural, fictional stories of children with magical powers, or celebrity reality shows—with which the public seems stubbornly preoccupied. Scientific knowledge is wondrous because it is *real*. The scientist becomes the arbiter of reality.

This reversed dynamic is not just one of many permutations wonder has undergone over the centuries. I believe it has *disproportionately* shaped much of our contemporary thinking about wonder, particularly wonder as a laudatory facet of

science. For example, philosopher Jesse Prinz joins with Dawkins in attempting to save wonder from total eradication by reorienting it toward science's ability to unravel mystery. "Scientists," Prinz writes, "are spurred on by wonder. . . . Knowledge does not abolish wonder; indeed, scientific discoveries are often more wondrous than the mysteries they unravel."<sup>46</sup> The power of science to reveal ever greater depths of wonder brings it into close relationship with religion, he believes. Yet, the supposed intimacy of science and religion, allegedly fueled by scientific wonder at discovery, is not obviously occurring in much of the contemporary discourse I examine in this book, and least of all in the new cosmology. Rather, when paired side by side with science, religion is often seen to offer only weak or immature forms of wonder. Nature too, as apprehended by our ordinary senses, may be similarly derided. For "without science, we are stuck with the drab world of appearances."<sup>47</sup> With science, we can wonder at what is real.

In the history of science and theology, thoughtful critics of this reversed dynamic of wonder—wonder at knowledge and explanation rather than mysterious or awe-evoking phenomena—have emerged again and again. They rightly point to its tendency to engender idolatry, vanity, and pride, or self-deification. They worry about wonder that becomes detached from a broader context or horizon of meaning, turning inward toward the self and its catalogued knowledge. We see this warning, for example, in Augustine's portrait of humans who, having become puffed up with pride at their knowledge of creation, turn away from glorification of the Creator. In the seventeenth century, British mechanical philosopher and natural theologian Robert Boyle assailed scientists' desire to usurp God, warning that natural knowledge—whether it generated wonder at nature or at humans themselves—"stole praise and gratitude from God."<sup>48</sup> Closer to our own time, Rachel Carson characterized human pride in our technological and scientific mastery as "idolatry"; she worried that humans, despite their psychological handicaps, were positioning themselves to take over "many of the functions of 'God.'"<sup>49</sup> One need not juxtapose human power and wisdom to the power and wisdom of a *divine* entity in order to discern something problematic in these "puffed up" forms of wonder at human knowledge and achievements (note that Carson puts scare quotes around the word God). Carson, unlike Boyle, did not see wonder at nature as a threat or rival to wonder at God. Yet both Carson and Boyle point to a pious or wholesome form of wonder that is directed outward at something greater than ourselves, wonder strongly shaped by a sense of humility regarding the proper limits of human knowledge and power.

#### WHAT REMAINS OF WONDER?

Much of the foregoing discussion of wonder, and its relationship and rivalry with curiosity, may give the impression that we have few options: either we can preserve

wonder by remaining in an ignorant or stupefied state, or we can pursue knowledge while risking (or celebrating, as the case may be) curiosity's encouragement of pride and hubris. The choice, in other words, seems to be between humble and naive but ignorant wonder, or knowledge tainted by potentially reckless pride and related vices. But other accounts maintain that wonder is not driven out by knowledge; that which evokes wonder is never quite fit back into the ordinary but "breaks open the fabric of the ordinary itself and changes it forever."<sup>50</sup> As our perceptions of the world are fundamentally altered, so too are we. In a phrase often attributed to Oliver Wendell Holmes, "The mind, once expanded to the larger dimensions of new ideas, never returns to its original size." A part of the process that wonder sets in motion can itself be "wonder-preserving."<sup>51</sup> Wonder's capacity for self-preservation rather than self-elimination—even in the presence of scientific understanding—is one of the topics I will pursue further in the following chapters. Wonder of this sort can reinforce an awareness of the *limits* of our knowledge (and vice versa, as advocates of "virtuous ignorance" suggest) without devaluing science.<sup>52</sup> Awareness of these limits, in turn, allows us to see the world with fresh eyes, to remain open to new possibilities, new ways of perceiving the world, because we are not stubbornly invested in current concepts and frameworks. This openness may set the stage for additional encounters with wonder, as well as additional knowledge.

In praising an awareness of the limits of our knowledge, I do not mean that wonder simply *resides* within those unknowns, for this would, once again, entail a banishment of wonder as knowledge is gained and gaps filled in. I am not advocating serial wonder that solves one puzzle and moves eagerly to the next; such a view not only relegates wonder to (temporary) unknowns but also tends to assume that all unknowns will ultimately be overcome. Rather, my claim is that wonder may provide the conditions for novel forms of knowledge to emerge, even as wonder is not exhausted by new knowledge. Confidence in what we know, or think we know, can lead to a freeze-framing of the world around us. Scientific habits of mind—abstraction, isolation, reductionism—may well encourage such freeze-framing. Certainly, celebratory declamations of *all that we now know*—such as those to which I draw attention throughout this work—close off avenues of newfound wonder and knowledge, and discourage the intellectual modesty and prudence needed to engage with complex problems, like environmental problems. Enamored of our own knowledge, we may also forget that scientific concepts provide only a "fragmented view of the world." Failing to recognize this, we "continue to produce myriad unintended effects that inform the ecological, social, and economic problems dominating our times."<sup>53</sup> The modest habits of mind that accompany (genuine) wonder can also encourage deeper reflection on which paths of investigation we ought and ought not to pursue, and why. Indeed, a difference between curiosity and wonder, as I define the latter, is that curiosity is often seen to be deficient in this

moral perspective—hence, the frequent critiques of curiosity’s vicelike tendency toward greedy appropriation or arrogant and unseemly prying.

Science appropriately has as its object not mysteries but *problems* to be solved; as Gabriel Marcel famously argued, not all mysteries are problems, and vice versa.<sup>54</sup> Taken to its extreme, however, the quest to solve puzzles can become pathological, manifesting as a desire to “seal the ego off against further novelty.”<sup>55</sup> When this directed form of curiosity and serial puzzle-solving comes to stand in for wonder as *a whole*—and, I would add, when the knowledge produced by such focused inquiry is understood to comprise full “reality”—a tremendous loss has occurred, with far-reaching implications, ethically, aesthetically, spiritually, and intellectually.

Genuine wonder is the grounding for intellectual virtues and habits of mind. Focusing on the element of mystery commonly associated with wonder helps us to round out a sketch of wonder’s ethical potential, that potential having been obscured by our inherited discourse on wonder and curiosity. Mysteries *involve* us in a way that problems do not; this sense of involvement is a key element of wonder. We cannot stand back objectively from a mystery and evaluate it, as we can a problem. Encountering something in wonder may be more like meeting a person, Sam Keen argues, than like analyzing an object. Martin Buber’s account of I/Thou encounters (in which we regard the other not as a discrete “it” but as a source of meaningful relationality) is relevant to the experience of wonder. “When Buber speaks of an I-Thou encounter with a tree or Marcel speaks of discovering a presence in a flower, each is indicating a level of experience at which what we normally call an object ceases to be inert and passive.”<sup>56</sup> There is often a quality of interchange but not of appropriation. Related to this: we may “take up” an object in curiosity, but an object (or, better, a *presence*) of wonder has the power to take *us* up. The power it exerts allows one to lose oneself in the presence of wonder, or to feel one’s smallness vis-à-vis wondrous phenomena. In a telling phrase, Rachel Carson alludes to the sensation (and accompanying ethical insight) of putting oneself “under the influence” of nature.

Wonder’s non-appropriative quality and uncoerced relinquishment of control allows recognition of the significance and singularity of what we encounter, even as it takes us up and involves us. Caroline Walker Bynum goes so far as to suggest that “only that which is really different from the knower can trigger wonder.”<sup>57</sup> Similarly, Bynum argues, “we wonder at what we cannot in any sense incorporate, or consume, or encompass in our mental categories.”<sup>58</sup> We do not, I believe, have to posit the absolute and radical otherness of that at which we wonder to appreciate that wonder involves an encounter with an *external* reality—or many external realities—not merely with the workings of our own minds. Wonder takes us out of ourselves. It is contrary to the solipsistic impulse. This emphasis on otherness, radical or otherwise, might seem paradoxical, or even contradictory, for if we are taken up by wonder, are we not somehow “absorbed” into it? Does not a loss of

self, in other words, also bring with it a sense of oneness with something greater or all-encompassing (as in accounts of mystical experiences, where boundaries between self and other dissolve and strong feelings of connection prevail)? How can we encounter a presence that is truly different and other, while denying, as Buber's I/Thou encounter would have it, the separateness and discreteness of the other? The language of oneness or connectedness is appropriate to wonder if it means that we gain a new sense of ourselves as bound up with something that retains some autonomy, that remains at some level unassimilable or unpredictable. If oneness entails homogenization that renders the other—or the world—comprehensible and appropriable, then an important quality of wonder has been muted, if not silenced. Thus, a "comprehensive" story of the universe that integrates all entities together as a cosmic community governed by the same patterns and principles may have a deadening effect on wonder. And even more so, when humanity and its discoveries are given pride of place in the positioning of ourselves vis-à-vis the cosmos. The very task of actively organizing cosmic and human history into a seamless narrative forecloses surprise and novelty. It weakens the wondering perception that we dwell, with awe, fear, delight, sorrow, and ambiguity, in what Loren Eiseley calls an *unexpected* universe.<sup>59</sup> The spirit of wonder sustains the perception of strangeness and is inimical to "investigative thinking that endeavors to assimilate that strangeness."<sup>60</sup> It defies the static ordering of a universal narrative and the quest for security that so often impels such ordering. We risk losing wonder's most laudable dimensions when we seek to grasp the world in its totality, devoid of deep mysteries, uncertainties, and "unseemly gaps."

If wonder is a rich and complex tapestry, which strands do we wish to carry forward into a future seemingly defined by ubiquitous human presence and transformation of the natural world? Which lend themselves to the cultivation of greater reverence for the more-than-human world, and which shift our gaze inward, inviting self-glorification? In practical terms, what difference does it really make, for our own lives and for the lives of other beings with whom we share the planet, how we choose to define and celebrate wonder? To begin thinking through these questions, I turn in the following chapters to two of the world's foremost champions of scientific wonder and enchantment: biologists Richard Dawkins and E. O. Wilson.