

# ENLIGHTENMENT Now

THE CASE FOR  
REASON,  
SCIENCE,  
HUMANISM,  
AND PROGRESS

**STEVEN PINKER**

VIKING

TO

Harry Pinker (1928–2015)  
*optimist*

Solomon Lopez (2017– )  
*and the 22nd century*

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# PART I

# ENLIGHTENMENT

*The common sense of the eighteenth century, its grasp of the obvious facts of human suffering, and of the obvious demands of human nature, acted on the world like a bath of moral cleansing.*

—Alfred North Whitehead

In the course of several decades giving public lectures on language, mind, and human nature, I have been asked some mighty strange questions. Which is the best language? Are clams and oysters conscious? When will I be able to upload my mind to the Internet? Is obesity a form of violence?

But the most arresting question I have ever fielded followed a talk in which I explained the commonplace among scientists that mental life consists of patterns of activity in the tissues of the brain. A student in the audience raised her hand and asked me:

“Why should I live?”

The student’s ingenuous tone made it clear that she was neither suicidal nor sarcastic but genuinely curious about how to find meaning and purpose if traditional religious beliefs about an immortal soul are undermined by our best science. My policy is that there is no such thing as a stupid question, and to the surprise of the student, the audience, and most of all myself, I mustered a reasonably creditable answer. What I recall saying—embellished, to be sure, by the distortions of memory and *l’esprit de l’escalier*, the wit of the staircase—went something like this:

In the very act of asking that question, you are seeking *reasons* for your convictions, and so you are committed to reason as the means to discover and justify what is important to you. And there are so many reasons to live!

As a sentient being, you have the potential to *flourish*. You can refine your faculty of reason itself by learning and debating. You can seek explanations of the natural world through science, and insight into the human condition through the arts and humanities. You can make the most of your capacity for pleasure and satisfaction, which allowed your ancestors to thrive and thereby allowed you to exist. You can appreciate the beauty and richness of the natural and cultural world. As the heir to billions of years of life perpetuating itself, you can perpetuate life in turn. You have been endowed with a sense of *sympathy*—

the ability to like, love, respect, help, and show kindness—and you can enjoy the gift of mutual benevolence with friends, family, and colleagues.

And because reason tells you that none of this is particular to *you*, you have the responsibility to provide to others what you expect for yourself. You can foster the welfare of other sentient beings by enhancing life, health, knowledge, freedom, abundance, safety, beauty, and peace. History shows that when we sympathize with others and apply our ingenuity to improving the human condition, we can make progress in doing so, and you can help to continue that progress.

Explaining the meaning of life is not in the usual job description of a professor of cognitive science, and I would not have had the gall to take up her question if the answer depended on my arcane technical knowledge or my dubious personal wisdom. But I knew I was channeling a body of beliefs and values that had taken shape more than two centuries before me and that are now more relevant than ever: the ideals of the Enlightenment.

The Enlightenment principle that we can apply reason and sympathy to enhance human flourishing may seem obvious, trite, old-fashioned. I wrote this book because I have come to realize that it is not. More than ever, the ideals of reason, science, humanism, and progress need a wholehearted defense. We take its gifts for granted: newborns who will live more than eight decades, markets overflowing with food, clean water that appears with a flick of a finger and waste that disappears with another, pills that erase a painful infection, sons who are not sent off to war, daughters who can walk the streets in safety, critics of the powerful who are not jailed or shot, the world's knowledge and culture available in a shirt pocket. But these are human accomplishments, not cosmic birthrights. In the memories of many readers of this book—and in the experience of those in less fortunate parts of the world—war, scarcity, disease, ignorance, and lethal menace are a natural part of existence. We know that countries can slide back into these primitive conditions, and so we ignore the achievements of the Enlightenment at our peril.

In the years since I took the young woman's question, I have often been reminded of the need to restate the ideals of the Enlightenment (also called humanism, the open society, and cosmopolitan or classical liberalism). It's not just that questions like hers regularly appear in my inbox. ("Dear Professor Pinker, What advice do you have for someone who has taken ideas in your books and science to heart, and sees himself

as a collection of atoms? A machine with a limited scope of intelligence, sprung out of selfish genes, inhabiting spacetime?") It's also that an obliviousness to the scope of human progress can lead to symptoms that are worse than existential angst. It can make people cynical about the Enlightenment-inspired institutions that are securing this progress, such as liberal democracy and organizations of international cooperation, and turn them toward atavistic alternatives.

The ideals of the Enlightenment are products of human reason, but they always struggle with other strands of human nature: loyalty to tribe, deference to authority, magical thinking, the blaming of misfortune on evildoers. The second decade of the 21st century has seen the rise of political movements that depict their countries as being pulled into a hellish dystopia by malign factions that can be resisted only by a strong leader who wrenches the country backward to make it "great again." These movements have been abetted by a narrative shared by many of their fiercest opponents, in which the institutions of modernity have failed and every aspect of life is in deepening crisis—the two sides in macabre agreement that wrecking those institutions will make the world a better place. Harder to find is a positive vision that sees the world's problems against a background of progress that it seeks to build upon by solving those problems in their turn.

If you still are unsure whether the ideals of Enlightenment humanism need a vigorous defense, consider the diagnosis of Shiraz Maher, an analyst of radical Islamist movements. "The West is shy of its values—it doesn't speak up for classical liberalism," he says. "We are unsure of them. They make us feel uneasy." Contrast that with the Islamic State, which "knows exactly what it stands for," a certainty that is "incredibly seductive"—and he should know, having once been a regional director of the jihadist group Hizb ut-Tahrir.<sup>1</sup>

Reflecting on liberal ideals in 1960, not long after they had withstood their greatest trial, the economist Friedrich Hayek observed, "If old truths are to retain their hold on men's minds, they must be restated in the language and concepts of successive generations" (inadvertently proving his point with the expression *men's minds*). "What at one time are their most effective expressions gradually become so worn with use that they cease to carry a definite meaning. The underlying ideas may be as valid as ever, but the words, even when they refer to problems that are still with us, no longer convey the same conviction."<sup>2</sup>

This book is my attempt to restate the ideals of the Enlightenment in the language and concepts of the 21st century. I will first lay out a frame-

work for understanding the human condition informed by modern science—who we are, where we came from, what our challenges are, and how we can meet them. The bulk of the book is devoted to defending those ideals in a distinctively 21st-century way: with data. This evidence-based take on the Enlightenment project reveals that it was not a naïve hope. The Enlightenment has *worked*—perhaps the greatest story seldom told. And because this triumph is so unsung, the underlying ideals of reason, science, and humanism are unappreciated as well. Far from being an insipid consensus, these ideals are treated by today's intellectuals with indifference, skepticism, and sometimes contempt. When properly appreciated, I will suggest, the ideals of the Enlightenment are in fact stirring, inspiring, noble—a reason to live.

## CHAPTER 1

# DARE TO UNDERSTAND!

What is enlightenment? In a 1784 essay with that question as its title, Immanuel Kant answered that it consists of “human-kind’s emergence from its self-incurred immaturity,” its “lazy and cowardly” submission to the “dogmas and formulas” of religious or political authority.<sup>1</sup> Enlightenment’s motto, he proclaimed, is “Dare to understand!” and its foundational demand is freedom of thought and speech. “One age cannot conclude a pact that would prevent succeeding ages from extending their insights, increasing their knowledge, and purging their errors. That would be a crime against human nature, whose proper destiny lies precisely in such progress.”<sup>2</sup>

A 21st-century statement of the same idea may be found in the physicist David Deutsch’s defense of enlightenment, *The Beginning of Infinity*. Deutsch argues that if we dare to understand, progress is possible in all fields, scientific, political, and moral:

Optimism (in the sense that I have advocated) is the theory that all failures—all evils—are due to insufficient knowledge. . . . Problems are inevitable, because our knowledge will always be infinitely far from complete. Some problems are hard, but it is a mistake to confuse hard problems with problems unlikely to be solved. Problems are solvable, and each particular evil is a problem that can be solved. An optimistic civilization is open and not afraid to innovate, and is based on traditions of criticism. Its institutions keep improving, and the most important knowledge that they embody is knowledge of how to detect and eliminate errors.<sup>3</sup>

What is *the* Enlightenment?<sup>4</sup> There is no official answer, because the era named by Kant’s essay was never demarcated by opening and clos-

ing ceremonies like the Olympics, nor are its tenets stipulated in an oath or creed. The Enlightenment is conventionally placed in the last two-thirds of the 18th century, though it flowed out of the Scientific Revolution and the Age of Reason in the 17th century and spilled into the heyday of classical liberalism of the first half of the 19th. Provoked by challenges to conventional wisdom from science and exploration, mindful of the bloodshed of recent wars of religion, and abetted by the easy movement of ideas and people, the thinkers of the Enlightenment sought a new understanding of the human condition. The era was a cornucopia of ideas, some of them contradictory, but four themes tie them together: reason, science, humanism, and progress.

Foremost is reason. Reason is nonnegotiable. As soon as you show up to discuss the question of what we should live for (or any other question), as long as you insist that your answers, whatever they are, are reasonable or justified or true and that therefore other people ought to believe them too, then you have committed yourself to reason, and to holding your beliefs accountable to objective standards.<sup>5</sup> If there's anything the Enlightenment thinkers had in common, it was an insistence that we energetically apply the standard of reason to understanding our world, and not fall back on generators of delusion like faith, dogma, revelation, authority, charisma, mysticism, divination, visions, gut feelings, or the hermeneutic parsing of sacred texts.

It was reason that led most of the Enlightenment thinkers to repudiate a belief in an anthropomorphic God who took an interest in human affairs.<sup>6</sup> The application of reason revealed that reports of miracles were dubious, that the authors of holy books were all too human, that natural events unfolded with no regard to human welfare, and that different cultures believed in mutually incompatible deities, none of them less likely than the others to be products of the imagination. (As Montaigne wrote, "If triangles had a god they would give him three sides.") For all that, not all of the Enlightenment thinkers were atheists. Some were deists (as opposed to theists): they thought that God set the universe in motion and then stepped back, allowing it to unfold according to the laws of nature. Others were pantheists, who used "God" as a *synonym* for the laws of nature. But few appealed to the law-giving, miracle-conjuring, son-begetting God of scripture.

Many writers today confuse the Enlightenment endorsement of reason with the implausible claim that humans are perfectly rational agents. Nothing could be further from historical reality. Thinkers such as Kant, Baruch Spinoza, Thomas Hobbes, David Hume, and Adam Smith were

inquisitive psychologists and all too aware of our irrational passions and foibles. They insisted that it was only by calling out the common sources of folly that we could hope to overcome them. The deliberate application of reason was necessary precisely because our common habits of thought are not particularly reasonable.

That leads to the second ideal, science, the refining of reason to understand the world. The Scientific Revolution was revolutionary in a way that is hard to appreciate today, now that its discoveries have become second nature to most of us. The historian David Wootton reminds us of the understanding of an educated Englishman on the eve of the Revolution in 1600:

He believes witches can summon up storms that sink ships at sea. . . .

He believes in werewolves, although there happen not to be any in England—he knows they are to be found in Belgium. . . . He believes Circe really did turn Odysseus's crew into pigs. He believes mice are spontaneously generated in piles of straw. He believes in contemporary magicians. . . . He has seen a unicorn's horn, but not a unicorn.

He believes that a murdered body will bleed in the presence of the murderer. He believes that there is an ointment which, if rubbed on a dagger which has caused a wound, will cure the wound. He believes that the shape, colour and texture of a plant can be a clue to how it will work as a medicine because God designed nature to be interpreted by mankind. He believes that it is possible to turn base metal into gold, although he doubts that anyone knows how to do it. He believes that nature abhors a vacuum. He believes the rainbow is a sign from God and that comets portend evil. He believes that dreams predict the future, if we know how to interpret them. He believes, of course, that the earth stands still and the sun and stars turn around the earth once every twenty-four hours.<sup>7</sup>

A century and a third later, an educated descendant of this Englishman would believe none of these things. It was an escape not just from ignorance but from terror. The sociologist Robert Scott notes that in the Middle Ages "the belief that an external force controlled daily life contributed to a kind of collective paranoia":

Rainstorms, thunder, lightning, wind gusts, solar or lunar eclipses, cold snaps, heat waves, dry spells, and earthquakes alike were considered signs and signals of God's displeasure. As a result, the "hobgob-

lins of fear" inhabited every realm of life. The sea became a satanic realm, and forests were populated with beasts of prey, ogres, witches, demons, and very real thieves and cutthroats. . . . After dark, too, the world was filled with omens portending dangers of every sort: comets, meteors, shooting stars, lunar eclipses, the howls of wild animals."

To the Enlightenment thinkers the escape from ignorance and superstition showed how mistaken our conventional wisdom could be, and how the methods of science—skepticism, fallibilism, open debate, and empirical testing—are a paradigm of how to achieve reliable knowledge.

That knowledge includes an understanding of ourselves. The need for a "science of man" was a theme that tied together Enlightenment thinkers who disagreed about much else, including Montesquieu, Hume, Smith, Kant, Nicolas de Condorcet, Denis Diderot, Jean-Baptiste d'Alembert, Jean-Jacques Rousseau, and Giambattista Vico. Their belief that there was such a thing as universal human nature, and that it could be studied scientifically, made them precocious practitioners of sciences that would be named only centuries later.<sup>9</sup> They were cognitive neuroscientists, who tried to explain thought, emotion, and psychopathology in terms of physical mechanisms of the brain. They were evolutionary psychologists, who sought to characterize life in a state of nature and to identify the animal instincts that are "infused into our bosoms." They were social psychologists, who wrote of the moral sentiments that draw us together, the selfish passions that divide us, and the foibles of shortsightedness that confound our best-laid plans. And they were cultural anthropologists, who mined the accounts of travelers and explorers for data both on human universals and on the diversity of customs and mores across the world's cultures.

The idea of a universal human nature brings us to a third theme, humanism. The thinkers of the Age of Reason and the Enlightenment saw an urgent need for a secular foundation for morality, because they were haunted by a historical memory of centuries of religious carnage: the Crusades, the Inquisition, witch hunts, the European wars of religion. They laid that foundation in what we now call humanism, which privileges the well-being of individual men, women, and children over the glory of the tribe, race, nation, or religion. It is individuals, not groups, who are *sentient*—who feel pleasure and pain, fulfillment and anguish. Whether it is framed as the goal of providing the greatest happiness for the greatest number or as a categorical imperative to treat

people as ends rather than means, it was the universal capacity of a person to suffer and flourish, they said, that called on our moral concern.

Fortunately, human nature prepares us to answer that call. That is because we are endowed with the sentiment of *sympathy*, which they also called benevolence, pity, and commiseration. Given that we are equipped with the capacity to sympathize with others, nothing can prevent the circle of sympathy from expanding from the family and tribe to embrace all of humankind, particularly as reason goads us into realizing that there can be nothing uniquely deserving about ourselves or any of the groups to which we belong.<sup>10</sup> We are forced into cosmopolitanism: accepting our citizenship in the world.<sup>11</sup>

A humanistic sensibility impelled the Enlightenment thinkers to condemn not just religious violence but also the secular cruelties of their age, including slavery, despotism, executions for frivolous offenses such as shoplifting and poaching, and sadistic punishments such as flogging, amputation, impalement, disembowelment, breaking on the wheel, and burning at the stake. The Enlightenment is sometimes called the Humanitarian Revolution, because it led to the abolition of barbaric practices that had been commonplace across civilizations for millennia.<sup>12</sup>

If the abolition of slavery and cruel punishment is not progress, nothing is, which brings us to the fourth Enlightenment ideal. With our understanding of the world advanced by science and our circle of sympathy expanded through reason and cosmopolitanism, humanity could make intellectual and moral progress. It need not resign itself to the miseries and irrationalities of the present, nor try to turn back the clock to a lost golden age.

The Enlightenment belief in progress should not be confused with the 19th-century Romantic belief in mystical forces, laws, dialectics, struggles, unfoldings, destinies, ages of man, and evolutionary forces that propel mankind ever upward toward utopia.<sup>13</sup> As Kant's remark about "increasing knowledge and purging errors" indicates, it was more prosaic, a combination of reason and humanism. If we keep track of how our laws and manners are doing, think up ways to improve them, try them out, and keep the ones that make people better off, we can gradually make the world a better place. Science itself creeps forward through this cycle of theory and experiment, and its ceaseless headway, superimposed on local setbacks and reversals, shows how progress is possible.

The ideal of progress also should not be confused with the 20th-century movement to re-engineer society for the convenience of techno-



crats and planners, which the political scientist James Scott calls Authoritarian High Modernism.<sup>14</sup> The movement denied the existence of human nature, with its messy needs for beauty, nature, tradition, and social intimacy.<sup>15</sup> Starting from a “clean tablecloth,” the modernists designed urban renewal projects that replaced vibrant neighborhoods with freeways, high-rises, windswept plazas, and brutalist architecture. “Mankind will be reborn,” they theorized, and “live in an ordered relation to the whole.”<sup>16</sup> Though these developments were sometimes linked to the word *progress*, the usage was ironic: “progress” unguided by humanism is not progress.

Rather than trying to shape human nature, the Enlightenment hope for progress was concentrated on human institutions. Human-made systems like governments, laws, schools, markets, and international bodies are a natural target for the application of reason to human betterment.

In this way of thinking, government is not a divine fiat to reign, a synonym for “society,” or an avatar of the national, religious, or racial soul. It is a human invention, tacitly agreed to in a social contract, designed to enhance the welfare of citizens by coordinating their behavior and discouraging selfish acts that may be tempting to every individual but leave everyone worse off. As the most famous product of the Enlightenment, the Declaration of Independence, put it, in order to secure the right to life, liberty, and the pursuit of happiness, governments are instituted among people, deriving their just powers from the consent of the governed.

Among the powers of government is meting out punishment, and writers such as Montesquieu, Cesare Beccaria, and the American founders thought afresh about the government’s license to harm its citizens.<sup>17</sup> Criminal punishment, they argued, is not a mandate to implement cosmic justice but part of an incentive structure that discourages antisocial acts without causing more suffering than it deters. The reason the punishment should fit the crime, for example, is not to balance some mystical scale of justice but to ensure that a wrongdoer stops at a minor crime rather than escalating to a more harmful one. Cruel punishments, whether or not they are in some sense “deserved,” are no more effective at deterring harm than moderate but surer punishments, and they desensitize spectators and brutalize the society that implements them.

The Enlightenment also saw the first rational analysis of prosperity. Its starting point was not how wealth is distributed but the prior question of how wealth comes to exist in the first place.<sup>18</sup> Smith, building on French, Dutch, and Scottish influences, noted that an abundance of use-

ful stuff cannot be conjured into existence by a farmer or craftsman working in isolation. It depends on a network of specialists, each of whom learns how to make something as efficiently as possible, and who combine and exchange the fruits of their ingenuity, skill, and labor. In a famous example, Smith calculated that a pin-maker working alone could make at most one pin a day, whereas in a workshop in which “one man draws out the wire, another straightens it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head,” each could make almost five thousand.

Specialization works only in a market that allows the specialists to exchange their goods and services, and Smith explained that economic activity was a form of mutually beneficial cooperation (a positive-sum game, in today’s lingo): each gets back something that is more valuable to him than what he gives up. Through voluntary exchange, people benefit others by benefiting themselves; as he wrote, “It is not from the benevolence of the butcher, the brewer, or the baker that we expect our dinner, but from their regard to their own interest. We address ourselves, not to their humanity but to their self-love.” Smith was not saying that people are ruthlessly selfish, or that they ought to be; he was one of history’s keenest commentators on human sympathy. He only said that in a market, whatever tendency people have to care for their families and themselves can work to the good of all.

Exchange can make an entire society not just richer but nicer, because in an effective market it is cheaper to buy things than to steal them, and other people are more valuable to you alive than dead. (As the economist Ludwig von Mises put it centuries later, “If the tailor goes to war against the baker, he must henceforth bake his own bread.”) Many Enlightenment thinkers, including Montesquieu, Kant, Voltaire, Diderot, and the Abbé de Saint-Pierre, endorsed the ideal of *doux commerce*, gentle commerce.<sup>19</sup> The American founders—George Washington, James Madison, and especially Alexander Hamilton—designed the institutions of the young nation to nurture it.

This brings us to another Enlightenment ideal, peace. War was so common in history that it was natural to see it as a permanent part of the human condition and to think peace could come only in a messianic age. But now war was no longer thought of as a divine punishment to be endured and deplored, or a glorious contest to be won and celebrated, but a practical problem to be mitigated and someday solved. In “Perpetual Peace,” Kant laid out measures that would discourage leaders from dragging their countries into war.<sup>20</sup> Together with international com-

merce, he recommended representative republics (what we would call democracies), mutual transparency, norms against conquest and internal interference, freedom of travel and immigration, and a federation of states that would adjudicate disputes between them.

For all the prescience of the founders, framers, and *philosophes*, this is not a book of Enlightenment. The Enlightenment thinkers were men and women of their age, the 18th century. Some were racists, sexists, anti-Semites, slaveholders, or duelists. Some of the questions they worried about are almost incomprehensible to us, and they came up with plenty of daffy ideas together with the brilliant ones. More to the point, they were born too soon to appreciate some of the keystones of our modern understanding of reality.

They of all people would have been the first to concede this. If you extol reason, then what matters is the integrity of the thoughts, not the personalities of the thinkers. And if you're committed to progress, you can't very well claim to have it all figured out. It takes nothing away from the Enlightenment thinkers to identify some critical ideas about the human condition and the nature of progress that we know and they didn't. Those ideas, I suggest, are entropy, evolution, and information.

## CHAPTER 2

# ENTRO, EVO, INFO

**T**he first keystone in understanding the human condition is the concept of entropy or disorder, which emerged from 19th-century physics and was defined in its current form by the physicist Ludwig Boltzmann.<sup>1</sup> The Second Law of Thermodynamics states that in an isolated system (one that is not interacting with its environment), entropy never decreases. (The First Law is that energy is conserved; the Third, that a temperature of absolute zero is unreachable.) Closed systems inexorably become less structured, less organized, less able to accomplish interesting and useful outcomes, until they slide into an equilibrium of gray, tepid, homogeneous monotony and stay there.

In its original formulation the Second Law referred to the process in which usable energy in the form of a difference in temperature between two bodies is inevitably dissipated as heat flows from the warmer to the cooler body. (As the musical team Flanders & Swann explained, "You can't pass heat from the cooler to the hotter; Try it if you like but you far better notter.") A cup of coffee, unless it is placed on a plugged-in hot plate, will cool down. When the coal feeding a steam engine is used up, the cooled-off steam on one side of the piston can no longer budge it because the warmed-up steam and air on the other side are pushing back just as hard.

Once it was appreciated that heat is not an invisible fluid but the energy in moving molecules, and that a difference in temperature between two bodies consists of a difference in the average speeds of those molecules, a more general, statistical version of the concept of entropy and the Second Law took shape. Now order could be characterized in terms of the set of all microscopically distinct states of a system (in the original example involving heat, the possible speeds and positions of all the molecules in the two bodies). Of all these states, the ones that we find useful

from a bird's-eye view (such as one body being hotter than the other, which translates into the average speed of the molecules in one body being higher than the average speed in the other) make up a tiny fraction of the possibilities, while all the disorderly or useless states (the ones without a temperature difference, in which the average speeds in the two bodies are the same) make up the vast majority. It follows that any perturbation of the system, whether it is a random jiggling of its parts or a whack from the outside, will, by the laws of probability, nudge the system toward disorder or uselessness—not because nature strives for disorder, but because there are so many more ways of being disorderly than of being orderly. If you walk away from a sandcastle, it won't be there tomorrow, because as the wind, waves, seagulls, and small children push the grains of sand around, they're more likely to arrange them into one of the vast number of configurations that don't look like a castle than into the tiny few that do. I'll often refer to the statistical version of the Second Law, which does not apply specifically to temperature differences even- ing out but to order dissipating, as the Law of Entropy.

How is entropy relevant to human affairs? Life and happiness depend on an infinitesimal sliver of orderly arrangements of matter amid the astronomical number of possibilities. Our bodies are improbable assemblies of molecules, and they maintain that order with the help of other improbabilities: the few substances that can nourish us, the few materials in the few shapes that can clothe us, shelter us, and move things around to our liking. Far more of the arrangements of matter found on Earth are of no worldly use to us, so when things change without a human agent directing the change, they are likely to change for the worse. The Law of Entropy is widely acknowledged in everyday life in sayings such as "Things fall apart," "Rust never sleeps," "Shit happens," "Whatever can go wrong will go wrong," and (from the Texas lawmaker Sam Rayburn) "Any jackass can kick down a barn, but it takes a carpenter to build one."

Scientists appreciate that the Second Law is far more than an explanation of everyday nuisances. It is a foundation of our understanding of the universe and our place in it. In 1928 the physicist Arthur Eddington wrote:

The law that entropy always increases . . . holds, I think, the supreme position among the laws of Nature. If someone points out to you that your pet theory of the universe is in disagreement with Maxwell's equations—then so much the worse for Maxwell's equations. If it is

found to be contradicted by observation—well, these experimentalists do bungle things sometimes. But if your theory is found to be against the second law of thermodynamics I can give you no hope; there is nothing for it but to collapse in deepest humiliation.<sup>3</sup>

In his famous 1959 Rede lectures, published as *The Two Cultures and the Scientific Revolution*, the scientist and novelist C. P. Snow commented on the disdain for science among educated Britons in his day:

A good many times I have been present at gatherings of people who, by the standards of the traditional culture, are thought highly educated and who have with considerable gusto been expressing their incredulity at the illiteracy of scientists. Once or twice I have been provoked and have asked the company how many of them could describe the Second Law of Thermodynamics. The response was cold: it was also negative. Yet I was asking something which is about the scientific equivalent of: *Have you read a work of Shakespeare's?*<sup>4</sup>

The chemist Peter Atkins alludes to the Second Law in the title of his book *Four Laws That Drive the Universe*. And closer to home, the evolutionary psychologists John Tooby, Leda Cosmides, and Clark Barrett entitled a recent paper on the foundations of the science of mind "The Second Law of Thermodynamics Is the First Law of Psychology."<sup>5</sup>

Why the awe for the Second Law? From an Olympian vantage point, it defines the fate of the universe and the ultimate purpose of life, mind, and human striving: to deploy energy and knowledge to fight back the tide of entropy and carve out refuges of beneficial order. From a terrestrial vantage point we can get more specific, but before we get to familiar ground I need to lay out the other two foundational ideas.

At first glance the Law of Entropy would seem to allow for only a discouraging history and a depressing future. The universe began in a state of low entropy, the Big Bang, with its unfathomably dense concentration of energy. From there everything went downhill, with the universe dispersing—as it will continue to do—into a thin gruel of particles evenly and sparsely distributed through space. In reality, of course, the universe as we find it is not a featureless gruel. It is enlivened with galaxies, planets, mountains, clouds, snowflakes, and an efflorescence of flora and fauna, including us.

One reason the cosmos is filled with so much interesting stuff is a set

of processes called self-organization, which allow circumscribed zones of order to emerge.<sup>5</sup> When energy is poured into a system, and the system dissipates that energy in its slide toward entropy, it can become poised in an orderly, indeed beautiful, configuration—a sphere, spiral, starburst, whirlpool, ripple, crystal, or fractal. The fact that we find these configurations beautiful, incidentally, suggests that beauty may not just be in the eye of the beholder. The brain's aesthetic response may be a receptiveness to the counter-entropic patterns that can spring forth from nature.

But there is another kind of orderliness in nature that also must be explained: not the elegant symmetries and rhythms in the physical world, but the functional design in the living world. Living things are made of organs that have heterogeneous parts which are uncannily shaped and arranged to do things that keep the organism alive (that is, continuing to absorb energy to resist entropy).<sup>6</sup>

The customary illustration of biological design is the eye, but I will make the point with my second-favorite sense organ. The human ear contains an elastic drumhead that vibrates in response to the slightest puff of air, a bony lever that multiplies the vibration's force, a piston that impresses the vibration into the fluid in a long tunnel (conveniently coiled to fit inside the wall of the skull), a tapering membrane that runs down the length of the tunnel and physically separates the waveform into its harmonics, and an array of cells with tiny hairs that are flexed back and forth by the vibrating membrane, sending a train of electrical impulses to the brain. It is impossible to explain why these membranes and bones and fluids and hairs are arranged in that improbable way without noting that this configuration allows the brain to register patterned sound. Even the fleshy outer ear—asymmetrical top to bottom and front to back, and crinkled with ridges and valleys—is shaped in a way that sculpts the incoming sound to inform the brain whether the soundmaker is above or below, in front or behind.

Organisms are replete with improbable configurations of flesh like eyes, ears, hearts, and stomachs which cry out for an explanation. Before Charles Darwin and Alfred Russel Wallace provided one in 1859, it was reasonable to think they were the handiwork of a divine designer—one of the reasons, I suspect, that so many Enlightenment thinkers were deists rather than outright atheists. Darwin and Wallace made the designer unnecessary. Once self-organizing processes of physics and chemistry gave rise to a configuration of matter that could replicate itself, the copies would make copies, which would make copies of the copies, and so on, in an exponential explosion. The replicating systems would compete for

the material to make their copies and the energy to power the replication. Since no copying process is perfect—the Law of Entropy sees to that—errors will crop up, and though most of these mutations will downgrade the replicator (entropy again), occasionally dumb luck will throw one up that's more effective at replicating, and its descendants will swamp the competition. As copying errors that enhance stability and replication accumulate over the generations, the replicating system—we call it an organism—will appear to have been engineered for survival and reproduction in the future, though it only preserved the copying errors that led to survival and reproduction in the past.

Creationists commonly doctor the Second Law of Thermodynamics to claim that biological evolution, an increase in order over time, is physically impossible. The part of the law they omit is “in a closed system.” Organisms are open systems: they capture energy from the sun, food, or ocean vents to carve out temporary pockets of order in their bodies and nests while they dump heat and waste into the environment, increasing disorder in the world as a whole. Organisms’ use of energy to maintain their integrity against the press of entropy is a modern explanation of the principle of *conatus* (effort or striving), which Spinoza defined as “the endeavor to persist and flourish in one’s own being,” and which was a foundation of several Enlightenment-era theories of life and mind.<sup>7</sup>

The ironclad requirement to suck energy out of the environment leads to one of the tragedies of living things. While plants bask in solar energy, and a few creatures of the briny deep soak up the chemical broth spewing from cracks in the ocean floor, animals are born exploiters: they live off the hard-won energy stored in the bodies of plants and other animals by eating them. So do the viruses, bacteria, and other pathogens and parasites that gnaw at bodies from the inside. With the exception of fruit, everything we call “food” is the body part or energy store of some other organism, which would just as soon keep that treasure for itself. Nature is a war, and much of what captures our attention in the natural world is an arms race. Prey animals protect themselves with shells, spines, claws, horns, venom, camouflage, flight, or self-defense; plants have thorns, rinds, bark, and irritants and poisons saturating their tissues. Animals evolve weapons to penetrate these defenses: carnivores have speed, talons, and eagle-eyed vision, while herbivores have grinding teeth and livers that detoxify natural poisons.

And now we come to the third keystone, information.<sup>8</sup> Information may be thought of as a reduction in entropy—as the ingredient that distin-

guishes an orderly, structured system from the vast set of random, useless ones.<sup>9</sup> Imagine pages of random characters tapped out by a monkey at a typewriter, or a stretch of white noise from a radio tuned between channels, or a screenful of confetti from a corrupted computer file. Each of these objects can take trillions of **different** forms, each as boring as the next. But now suppose that the devices are controlled by a signal that arranges the characters or sound waves or pixels into a pattern that correlates with something in the world: the Declaration of Independence, the opening bars of "Hey Jude," a cat wearing sunglasses. We say that the signal transmits *information* about the Declaration or the song or the cat.<sup>10</sup>

The information contained in a pattern depends on how coarsely or finely grained our view of the world is. If we cared about the *exact* sequence of characters in the monkey's output, or the precise difference between one burst of noise and another, or the particular pattern of pixels in just one of the haphazard displays, then we would have to say that each of the items contains the same amount of information as the others. Indeed, the interesting ones would contain *less* information, because when you look at one part (like the letter *q*) you can guess others (such as the following letter, *u*) without needing the signal. But more commonly we lump together the immense majority of random-looking configurations as equivalently boring, and distinguish them all from the tiny few that correlate with something else. From that vantage point the cat photo contains more information than the confetti of pixels, because it takes a garrulous message to pinpoint a rare orderly configuration out of the vast number of equivalently disorderly ones. To say that the universe is orderly rather than random is to say that it contains information in this sense. Some physicists enshrine information as one of the basic constituents of the universe, together with matter and energy.<sup>11</sup>

Information is what gets accumulated in a genome in the course of evolution. The sequence of bases in a DNA molecule correlates with the sequence of amino acids in the proteins that make up the organism's body, and they got that sequence by structuring the organism's ancestors—reducing their entropy—into the improbable configurations that allowed them to capture energy and grow and reproduce.

Information is also collected by an animal's nervous system as it lives its life. When the ear transduces sound into neural firings, the two physical processes—vibrating air and diffusing ions—could not be more different. But thanks to the correlation between them, the pattern of neural activity in the animal's brain carries information about the sound in the world. From there the information can switch from electrical to chemical

and back as it crosses the synapses connecting one neuron to the next; through all these physical transformations, the information is preserved.

A momentous discovery of 20th-century theoretical neuroscience is that networks of neurons not only can preserve information but can transform it in ways that allow us to explain how brains can be *intelligent*. Two input neurons can be connected to an output neuron in such a way that their firing patterns correspond to logical relations such as AND, OR, and NOT, or to a statistical decision that depends on the weight of the incoming evidence. That gives neural networks the power to engage in information processing or computation. Given a large enough network built out of these logical and statistical circuits (and with billions of neurons, the brain has room for plenty), a brain can compute complex functions, the prerequisite for intelligence. It can transform the information about the world that it receives from the sense organs in a way that mirrors the laws governing that world, which in turn allows it to make useful inferences and predictions.<sup>12</sup> Internal representations that reliably correlate with states of the world, and that participate in inferences that tend to derive true implications from true premises, may be called knowledge.<sup>13</sup> We say that someone knows what a robin is if she thinks the thought "robin" whenever she sees one, and if she can infer that it is a kind of bird which appears in the spring and pulls worms out of the ground.

Getting back to evolution, a brain wired by information in the genome to perform computations on information coming in from the senses could organize the animal's behavior in a way that allowed it to capture energy and resist entropy. It could, for example, implement the rule "If it squeaks, chase it; if it barks, flee from it."

Chasing and fleeing, though, are not just sequences of muscle contractions—they are *goal-directed*. Chasing may consist of running or climbing or leaping or ambushing, depending on the circumstances, as long as it increases the chances of snagging the prey; fleeing may include hiding or freezing or zigzagging. And that brings up another momentous 20th-century idea, sometimes called cybernetics, feedback, or control. The idea explains how a physical system can appear to be teleological, that is, directed by purposes or goals. All it needs are a way of sensing the state of itself and its environment, a representation of a goal state (what it "wants," what it's "trying for"), an ability to compute the difference between the current state and the goal state, and a repertoire of actions that are tagged with their typical effects. If the system is wired so that it triggers actions that typically reduce the difference be-

tween the current state and the goal state, it can be said to pursue goals (and when the world is sufficiently predictable, it will attain them). The principle was discovered by natural selection in the form of homeostasis, as when our bodies regulate their temperature by shivering and sweating. When it was discovered by humans, it was engineered into analog systems like thermostats and cruise control and then into digital systems like chess-playing programs and autonomous robots.

The principles of information, computation, and control bridge the chasm between the physical world of cause and effect and the mental world of knowledge, intelligence, and purpose. It's not just a rhetorical aspiration to say that ideas can change the world; it's a fact about the physical makeup of brains. The Enlightenment thinkers had an inkling that thought could consist of patterns in matter—they likened ideas to impressions in wax, vibrations in a string, or waves from a boat. And some, like Hobbes, proposed that "reasoning is but reckoning," in the original sense of *reckoning* as calculation. But before the concepts of information and computation were elucidated, it was reasonable for someone to be a mind-body dualist and attribute mental life to an immaterial soul (just as before the concept of evolution was elucidated, it was reasonable to be a creationist and attribute design in nature to a cosmic designer). That's another reason, I suspect, that so many Enlightenment thinkers were deists.

Of course it's natural to think twice about whether your cell phone truly "knows" a favorite number, your GPS is really "figuring out" the best route home, and your Roomba is genuinely "trying" to clean the floor. But as information-processing systems become more sophisticated—as their representations of the world become richer, their goals are arranged into hierarchies of subgoals within subgoals, and their actions for attaining the goals become more diverse and less predictable—it starts to look like hominid chauvinism to insist that they don't. (Whether information and computation explain *consciousness*, in addition to knowledge, intelligence, and purpose, is a question I'll turn to in the final chapter.)

Human intelligence remains the benchmark for the artificial kind, and what makes *Homo sapiens* an unusual species is that our ancestors invested in bigger brains that collected more information about the world, reasoned about it in more sophisticated ways, and deployed a greater variety of actions to achieve their goals. They specialized in the cognitive niche, also called the cultural niche and the hunter-gatherer niche.<sup>14</sup> This embraced a suite of new adaptations, including the ability

to manipulate mental models of the world and predict what would happen if one tried out new things; the ability to cooperate with others, which allowed teams of people to accomplish what a single person could not; and language, which allowed them to coordinate their actions and to pool the fruits of their experience into the collections of skills and norms we call cultures.<sup>15</sup> These investments allowed early hominids to defeat the defenses of a wide range of plants and animals and reap the bounty in energy, which stoked their expanding brains, giving them still more know-how and access to still more energy. A well-studied contemporary hunter-gatherer tribe, the Hadza of Tanzania, who live in the ecosystem where modern humans first evolved and probably preserve much of their lifestyle, extract 3,000 calories daily per person from more than 880 species.<sup>16</sup> They create this menu through ingenious and uniquely human ways of foraging, such as felling large animals with poisoned arrows, smoking bees out of their hives to steal their honey, and enhancing the nutritional value of meat and tubers by cooking them.

Energy channeled by knowledge is the elixir with which we stave off entropy, and advances in energy capture are advances in human destiny. The invention of farming around ten thousand years ago multiplied the availability of calories from cultivated plants and domesticated animals, freed a portion of the population from the demands of hunting and gathering, and eventually gave them the luxury of writing, thinking, and accumulating their ideas. Around 500 BCE, in what the philosopher Karl Jaspers called the Axial Age, several widely separated cultures pivoted from systems of ritual and sacrifice that merely ward off misfortune to systems of philosophical and religious belief that promoted selflessness and promised spiritual transcendence.<sup>17</sup> Taoism and Confucianism in China, Hinduism, Buddhism, and Jainism in India, Zoroastrianism in Persia, Second Temple Judaism in Judea, and classical Greek philosophy and drama emerged within a few centuries of one another. (Confucius, Buddha, Pythagoras, Aeschylus, and the last of the Hebrew prophets walked the earth at the same time.) Recently an interdisciplinary team of scholars identified a common cause.<sup>18</sup> It was not an aura of spirituality that descended on the planet but something more prosaic: energy capacity. The Axial Age was when agricultural and economic advances provided a burst of energy: upwards of 20,000 calories per person per day in food, fodder, fuel, and raw materials. This surge allowed the civilizations to afford larger cities, a scholarly and priestly class, and a reorientation of their priorities from short-term survival to long-term harmony. As Bertolt Brecht put it millennia later: Grub first, then ethics.<sup>19</sup>



When the Industrial Revolution released a gusher of usable energy from coal, oil, and falling water, it launched a Great Escape from poverty, disease, hunger, illiteracy, and premature death, first in the West and increasingly in the rest of the world (as we shall see in chapters 5–8). And the next leap in human welfare—the end of extreme poverty and spread of abundance, with all its moral benefits—will depend on technological advances that provide energy at an acceptable economic and environmental cost to the entire world (chapter 10).

Entro, evo, info. These concepts define the narrative of human progress: the tragedy we were born into, and our means for eking out a better existence.

The first piece of wisdom they offer is that *misfortune may be no one's fault*. A major breakthrough of the Scientific Revolution—perhaps its biggest breakthrough—was to refute the intuition that the universe is saturated with purpose. In this primitive but ubiquitous understanding, everything happens for a reason, so when bad things happen—accidents, disease, famine, poverty—some agent must have *wanted* them to happen. If a person can be fingered for the misfortune, he can be punished or squeezed for damages. If no individual can be singled out, one might blame the nearest ethnic or religious minority, who can be lynched or massacred in a pogrom. If no mortal can plausibly be indicted, one might cast about for witches, who may be burned or drowned. Failing that, one points to sadistic gods, who cannot be punished but can be placated with prayers and sacrifices. And then there are disembodied forces like karma, fate, spiritual messages, cosmic justice, and other guarantors of the intuition that “everything happens for a reason.”

Galileo, Newton, and Laplace replaced this cosmic morality play with a clockwork universe in which events are caused by conditions in the present, not goals for the future.<sup>20</sup> *People* have goals, of course, but projecting goals onto the workings of nature is an illusion. Things can happen without anyone taking into account their effects on human happiness.

This insight of the Scientific Revolution and the Enlightenment was deepened by the discovery of entropy. Not only does the universe not care about our desires, but in the natural course of events it will appear to thwart them, because there are so many more ways for things to go wrong than for them to go right. Houses burn down, ships sink, battles are lost for want of a horseshoe nail.

Awareness of the indifference of the universe was deepened still fur-

ther by an understanding of evolution. Predators, parasites, and pathogens are constantly trying to eat us, and pests and spoilage organisms try to eat our stuff. It may make us miserable, but that's not their problem.

Poverty, too, needs no explanation. In a world governed by entropy and evolution, it is the default state of humankind. Matter does not arrange itself into shelter or clothing, and living things do everything they can to avoid becoming our food. As Adam Smith pointed out, what needs to be explained is wealth. Yet even today, when few people believe that accidents or diseases have perpetrators, discussions of poverty consist mostly of arguments about whom to blame for it.

None of this is to say that the natural world is free of malevolence. On the contrary, evolution guarantees there will be plenty of it. Natural selection consists of competition among genes to be represented in the next generation, and the organisms we see today are descendants of those that edged out their rivals in contests for mates, food, and dominance. This does not mean that all creatures are always rapacious; modern evolutionary theory explains how selfish genes can give rise to unselfish organisms. But the generosity is measured. Unlike the cells in a body or the individuals in a colonial organism, humans are genetically unique, each having accumulated and recombined a different set of mutations that arose over generations of entropy-prone replication in their lineage. Genetic individuality gives us our different tastes and needs, and it also sets the stage for strife. Families, couples, friends, allies, and societies seethe with partial conflicts of interest, which are played out in tension, arguments, and sometimes violence. Another implication of the Law of Entropy is that a complex system like an organism can easily be disabled, because its functioning depends on so many improbable conditions being satisfied at once. A rock against the head, a hand around the neck, a well-aimed poisoned arrow, and the competition is neutralized. More tempting still to a language-using organism, a *threat* of violence may be used to coerce a rival, opening the door to oppression and exploitation.

Evolution left us with another burden: our cognitive, emotional, and moral faculties are adapted to individual survival and reproduction in an archaic environment, not to universal thriving in a modern one. To appreciate this burden, one doesn't have to believe that we are cavemen out of time, only that evolution, with its speed limit measured in generations, could not possibly have adapted our brains to modern technology and institutions. Humans today rely on cognitive faculties that worked well enough in traditional societies, but which we now see are infested with bugs.

People are by nature illiterate and innumerate, quantifying the world by "one, two, many" and by rough guesstimates.<sup>21</sup> They understand physical things as having hidden essences that obey the laws of sympathetic magic or voodoo rather than physics and biology: objects can reach across time and space to affect things that resemble them or that had been in contact with them in the past (remember the beliefs of pre-Scientific Revolution Englishmen).<sup>22</sup> They think that words and thoughts can impinge on the physical world in prayers and curses. They underestimate the prevalence of coincidence.<sup>23</sup> They generalize from paltry samples, namely their own experience, and they reason by stereotype, projecting the typical traits of a group onto any individual that belongs to it. They infer causation from correlation. They think holistically, in black and white, and physically, treating abstract networks as concrete stuff. They are not so much intuitive scientists as intuitive lawyers and politicians, marshaling evidence that confirms their convictions while dismissing evidence that contradicts them.<sup>24</sup> They overestimate their own knowledge, understanding, rectitude, competence, and luck.<sup>25</sup>

The human moral sense can also work at cross-purposes to our well-being.<sup>26</sup> People demonize those they disagree with, attributing differences of opinion to stupidity and dishonesty. For every misfortune they seek a scapegoat. They see morality as a source of grounds for condemning rivals and mobilizing indignation against them.<sup>27</sup> The grounds for condemnation may consist in the defendants' having harmed others, but they also may consist in their having flouted custom, questioned authority, undermined tribal solidarity, or engaged in unclean sexual or dietary practices. People see violence as moral, not immoral: across the world and throughout history, more people have been murdered to mete out justice than to satisfy greed.<sup>28</sup>

But we're not all bad. Human cognition comes with two features that give it the means to transcend its limitations.<sup>29</sup> The first is abstraction. People can co-opt their concept of an object at a place and use it to conceptualize an entity in a circumstance, as when we take the pattern of a thought like *The deer ran from the pond to the hill* and apply it to *The child went from sick to well*. They can co-opt the concept of an agent exerting physical force and use it to conceptualize other kinds of causation, as when we extend the image in *She forced the door to open* to *She forced Lisa to join her* or *She forced herself to be polite*. These formulas give people the means to think about a variable with a value and about a cause and its effect—just the conceptual machinery one needs to frame theories and

laws. They can do this not just with the elements of thought but with more complex assemblies, allowing them to think in metaphors and analogies: heat is a fluid, a message is a container, a society is a family, obligations are bonds.

The second stepladder of cognition is its combinatorial, recursive power. The mind can entertain an explosive variety of ideas by assembling basic concepts like thing, place, path, actor, cause, and goal into propositions. And it can entertain not only propositions, but propositions about the propositions, and propositions about the propositions about the propositions. Bodies contain humors; illness is an imbalance in the humors that bodies contain; I no longer believe the theory that illness is an imbalance in the humors that bodies contain.

Thanks to language, ideas are not just abstracted and combined inside the head of a single thinker but can be pooled across a community of thinkers. Thomas Jefferson explained the power of language with the help of an analogy: "He who receives an idea from me, receives instruction himself without lessening mine; as he who lights his taper at mine, receives light without darkening me."<sup>30</sup> The potency of language as the original sharing app was multiplied by the invention of writing (and again in later epochs by the printing press, the spread of literacy, and electronic media). The networks of communicating thinkers expanded over time as populations grew, mixed, and became concentrated in cities. And the availability of energy beyond the minimum needed for survival gave more of them the luxury to think and talk.

When large and connected communities take shape, they can come up with ways of organizing their affairs that work to their members' mutual advantage. Though everyone wants to be right, as soon as people start to air their incompatible views it becomes clear that not everyone can be right about everything. Also, the desire to be right can collide with a second desire, to know the truth, which is uppermost in the minds of bystanders to an argument who are not invested in which side wins. Communities can thereby come up with rules that allow true beliefs to emerge from the rough-and-tumble of argument, such as that you have to provide reasons for your beliefs, you're allowed to point out flaws in the beliefs of others, and you're not allowed to forcibly shut people up who disagree with you. Add in the rule that you should allow the world to show you whether your beliefs are true or false, and we can call the rules science. With the right rules, a community of less than fully rational thinkers can cultivate rational thoughts.<sup>31</sup>

The wisdom of crowds can also elevate our moral sentiments. When



a wide enough circle of people confer on how best to treat each other, the conversation is bound to go in certain directions. If my starting offer is "I get to rob, beat, enslave, and kill you and your kind, but you don't get to rob, beat, enslave, or kill me or my kind," I can't expect you to agree to the deal or third parties to ratify it, because there's no good reason that I should get privileges just because I'm me and you're not.<sup>12</sup> Nor are we likely to agree to the deal "I get to rob, beat, enslave, and kill you and your kind, and you get to rob, beat, enslave, and kill me and my kind," despite its symmetry, because the advantages either of us might get in harming the other are massively outweighed by the disadvantages we would suffer in being harmed (yet another implication of the Law of Entropy: harms are easier to inflict and have larger effects than benefits). We'd be wiser to negotiate a social contract that puts us in a positive-sum game: neither gets to harm the other, and both are encouraged to help the other.

So for all the flaws in human nature, it contains the seeds of its own improvement, as long as it comes up with norms and institutions that channel parochial interests into universal benefits. Among those norms are free speech, nonviolence, cooperation, cosmopolitanism, human rights, and an acknowledgment of human fallibility, and among the institutions are science, education, media, democratic government, international organizations, and markets. Not coincidentally, these were the major brainchildren of the Enlightenment.

## CHAPTER 3

# COUNTER-ENLIGHTENMENTS

**W**ho could be against reason, science, humanism, or progress? The words seem saccharine, the ideals unexceptionable. They define the missions of all the institutions of modernity—schools, hospitals, charities, news agencies, democratic governments, international organizations. Do these ideals really need a defense?

They absolutely do. Since the 1960s, trust in the institutions of modernity has sunk, and the second decade of the 21st century saw the rise of populist movements that blatantly repudiate the ideals of the Enlightenment.<sup>1</sup> They are tribalist rather than cosmopolitan, authoritarian rather than democratic, contemptuous of experts rather than respectful of knowledge, and nostalgic for an idyllic past rather than hopeful for a better future. But these reactions are by no means confined to 21st-century political populism (a movement we will examine in chapters 20 and 23). Far from sprouting from the grass roots or channeling the anger of know-nothings, the disdain for reason, science, humanism, and progress has a long pedigree in elite intellectual and artistic culture.

Indeed, a common criticism of the Enlightenment project—that it is a Western invention, unsuited to the world in all its diversity—is doubly wrongheaded. For one thing, all ideas have to come from somewhere, and their birthplace has no bearing on their merit. Though many Enlightenment ideas were articulated in their clearest and most influential form in 18th-century Europe and America, they are rooted in reason and human nature, so any reasoning human can engage with them. That's why Enlightenment ideals have been articulated in non-Western civilizations at many times in history.<sup>2</sup>

But my main reaction to the claim that the Enlightenment is the guiding ideal of the West is: If only! The Enlightenment was swiftly followed by a counter-Enlightenment, and the West has been divided ever since.<sup>3</sup>

No sooner did people step into the light than they were advised that darkness wasn't so bad after all, that they should stop daring to understand so much, that dogmas and formulas deserved another chance, and that human nature's destiny was not progress but decline.

The Romantic movement pushed back particularly hard against Enlightenment ideals. Rousseau, Johann Herder, Friedrich Schelling, and others denied that reason could be separated from emotion, that individuals could be considered apart from their culture, that people should provide reasons for their acts, that values applied across times and places, and that peace and prosperity were desirable ends. A human is a part of an organic whole—a culture, race, nation, religion, spirit, or historical force—and people should creatively channel the transcendent unity of which they are a part. Heroic struggle, not the solving of problems, is the greatest good, and violence is inherent to nature and cannot be stifled without draining life of its vitality. "There are but three groups worthy of respect," wrote Charles Baudelaire, "the priest, the warrior, and the poet. To know, to kill, and to create."

It sounds mad, but in the 21st century those counter-Enlightenment ideals continue to be found across a surprising range of elite cultural and intellectual movements. The notion that we should apply our collective reason to enhance flourishing and reduce suffering is considered crass, naïve, wimpy, square. Let me introduce some of the popular alternatives to reason, science, humanism, and progress; they will reappear in other chapters, and in part III of the book I will confront them head on.

The most obvious is religious faith. To take something on faith means to believe it without good reason, so by definition a faith in the existence of supernatural entities clashes with reason. Religions also commonly clash with humanism whenever they elevate some moral good above the well-being of humans, such as accepting a divine savior, ratifying a sacred narrative, enforcing rituals and taboos, proselytizing other people to do the same, and punishing or demonizing those who don't. Religions can also clash with humanism by valuing *souls* above *lives*, which is not as uplifting as it sounds. Belief in an afterlife implies that health and happiness are not such a big deal, because life on earth is an infinitesimal portion of one's existence; that coercing people into accepting salvation is doing them a favor; and that martyrdom may be the best thing that can ever happen to you. As for incompatibilities with science, these are the stuff of legend and current events, from Galileo and the Scopes Monkey Trial to stem-cell research and climate change.

A second counter-Enlightenment idea is that people are the expend-

able cells of a superorganism—a clan, tribe, ethnic group, religion, race, class, or nation—and that the supreme good is the glory of this collectivity rather than the well-being of the people who make it up. An obvious example is nationalism, in which the superorganism is the nation-state, namely an ethnic group with a government. We see the clash between nationalism and humanism in morbid patriotic slogans like "Dulce et decorum est pro patria mori" (Sweet and right it is to die for your country) and "Happy those who with a glowing faith in one embrace clasped death and victory."<sup>4</sup> Even John F. Kennedy's less gruesome "Ask not what your country can do for you; ask what you can do for your country" makes the tension clear.

Nationalism should not be confused with civic values, public spirit, social responsibility, or cultural pride. Humans are a social species, and the well-being of every individual depends on patterns of cooperation and harmony that span a community. When a "nation" is conceived as a tacit social contract among people sharing a territory, like a condominium association, it is an essential means for advancing its members' flourishing. And of course it is genuinely admirable for one individual to sacrifice his or her interests for those of many individuals. It's quite another thing when a person is forced to make the supreme sacrifice for the benefit of a charismatic leader, a square of cloth, or colors on a map. Nor is it sweet and right to clasp death in order to prevent a province from seceding, expand a sphere of influence, or carry out an irredentist crusade.

Religion and nationalism are signature causes of political conservatism, and continue to affect the fate of billions of people in the countries under their influence. Many left-wing colleagues who learned that I was writing a book on reason and humanism egged me on, relishing the prospect of an arsenal of talking points against the right. But not so long ago the left was sympathetic to nationalism when it was fused with Marxist liberation movements. And many on the left encourage identity politicians and social justice warriors who downplay individual rights in favor of equalizing the standing of races, classes, and genders, which they see as being pitted in zero-sum competition.

Religion, too, has defenders on both halves of the political spectrum. Even writers who are unwilling to defend the literal content of religious beliefs may be fiercely defensive of religion and hostile to the idea that science and reason have anything to say about morality (most of them show little awareness that humanism even exists).<sup>5</sup> Defenders of the faith insist that religion has the exclusive franchise for questions about what

matters. Or that even if we sophisticated people don't need religion to be moral, the teeming masses do. Or that even if everyone would be better off without religious faith, it's pointless to talk about the place of religion in the world because religion is a part of human nature, which is why, mocking Enlightenment hopes, it is more tenacious than ever. In chapter 23 I will examine all these claims.

The left tends to be sympathetic to yet another movement that subordinates human interests to a transcendent entity, the ecosystem. The romantic Green movement sees the human capture of energy not as a way of resisting entropy and enhancing human flourishing but as a heinous crime against nature, which will exact a dreadful justice in the form of resource wars, poisoned air and water, and civilization-ending climate change. Our only salvation is to repent, repudiate technology and economic growth, and revert to a simpler and more natural way of life. Of course, no informed person can deny that damage to natural systems from human activity has been harmful and that if we do nothing about it the damage could become catastrophic. The question is whether a complex, technologically advanced society is condemned to do nothing about it. In chapter 10 we will explore a humanistic environmentalism, more Enlightened than Romantic, sometimes called ecomodernism or ecopragmatism.<sup>6</sup>

Left-wing and right-wing political ideologies have themselves become secular religions, providing people with a community of like-minded brethren, a catechism of sacred beliefs, a well-populated demonology, and a beatific confidence in the righteousness of their cause. In chapter 21 we will see how political ideology undermines reason and science.<sup>7</sup> It scrambles people's judgment, inflames a primitive tribal mindset, and distracts them from a sounder understanding of how to improve the world. Our greatest enemies are ultimately not our political adversaries but entropy, evolution (in the form of pestilence and the flaws in human nature), and most of all ignorance—a shortfall of knowledge of how best to solve our problems.

The last two counter-Enlightenment movements cut across the left-right divide. For almost two centuries, a diverse array of writers has proclaimed that modern civilization, far from enjoying progress, is in steady decline and on the verge of collapse. In *The Idea of Decline in Western History*, the historian Arthur Herman recounts two centuries of doomsayers who have sounded the alarm of racial, cultural, political, or ecological degeneration. Apparently the world has been coming to an end for a long time indeed.<sup>8</sup>

One form of declinism bemoans our Promethean dabbling with technology.<sup>9</sup> By wresting fire from the gods, we have only given our species the means to end its own existence, if not by poisoning our environment then by loosing nuclear weapons, nanotechnology, cyberterror, bioterror, artificial intelligence, and other existential threats upon the world (chapter 19). And even if our technological civilization manages to escape outright annihilation, it is spiraling into a dystopia of violence and injustice: a brave new world of terrorism, drones, sweatshops, gangs, trafficking, refugees, inequality, cyberbullying, sexual assault, and hate crimes.

Another variety of declinism agonizes about the opposite problem—not that modernity has made life too harsh and dangerous, but that it has made it too pleasant and safe. According to these critics, health, peace, and prosperity are bourgeois diversions from what truly matters in life. In serving up these philistine pleasures, technological capitalism has only damned people to an atomized, conformist, consumerist, materialist, other-directed, rootless, routinized, soul-deadening wilderness. In this absurd existence, people suffer from alienation, angst, anomie, apathy, bad faith, ennui, malaise, and nausea; they are “hollow men eating their naked lunches in the wasteland while waiting for Godot.”<sup>10</sup> (I will examine these claims in chapters 17 and 18.) In the twilight of a decadent, degenerate civilization, true liberation is to be found not in sterile rationality or effete humanism but in an authentic, heroic, holistic, organic, sacred, vital being-in-itself and will to power. In case you are wondering what this sacred heroism consists of, Friedrich Nietzsche, who coined the term *will to power*, recommends the aristocratic violence of the “blond Teuton beasts” and the samurai, Vikings, and Homeric heroes: “hard, cold, terrible, without feelings and without conscience, crushing everything, and bespattering everything with blood.”<sup>11</sup> (We'll take a closer look at this morality in the final chapter.)

Herman notes that the intellectuals and artists who foresee the collapse of civilization react to their prophecy in either of two ways. The historical pessimists dread the downfall but lament that we are powerless to stop it. The cultural pessimists welcome it with a “ghoulish schadenfreude.” Modernity is so bankrupt, they say, that it cannot be improved, only transcended. Out of the rubble of its collapse, a new order will emerge that can only be superior.

A final alternative to Enlightenment humanism condemns its embrace of science. Following C. P. Snow, we can call it the Second Culture, the worldview of many literary intellectuals and cultural critics, as distinguished from the First Culture of science.<sup>12</sup> Snow decried the iron cur-

tain between the two cultures and called for a greater integration of science into intellectual life. It was not just that science was, "in its intellectual depth, complexity, and articulation, the most beautiful and wonderful collective work of the mind of man."<sup>14</sup> Knowledge of science, he argued, was a moral imperative, because it could alleviate suffering on a global scale by curing disease, feeding the hungry, saving the lives of infants and mothers, and allowing women to control their fertility.

Though Snow's argument seems prescient today, a famous 1962 rebuttal from the literary critic F. R. Leavis was so vituperative that *The Spectator* had to ask Snow to promise not to sue for libel before they would publish it.<sup>15</sup> After noting Snow's "utter lack of intellectual distinction and . . . embarrassing vulgarity of style," Leavis scoffed at a value system in which "'standard of living' is the ultimate criterion, its raising an ultimate aim."<sup>16</sup> As an alternative, he suggested that "in coming to terms with great literature we discover what at bottom we really believe. What for—what ultimately for? What do men live by?—the questions work and tell at what I can only call a religious depth of thought and feeling." (Anyone whose "depth of thought and feeling" extends to a woman in a poor country who has lived to see her newborn because her standard of living has risen, and then multiplied that sympathy by a few hundred million, might wonder why "coming to terms with great literature" is morally superior to "raising the standard of living" as a criterion for "what at bottom we really believe"—or why the two should be seen as alternatives in the first place.)

As we shall see in chapter 22, Leavis's outlook may be found in a wide swath of the Second Culture today. Many intellectuals and critics express a disdain for science as anything but a fix for mundane problems. They write as if the consumption of elite art is the ultimate moral good. Their methodology for seeking the truth consists not in framing hypotheses and citing evidence but in issuing pronouncements that draw on their breadth of erudition and lifetime habits of reading. Intellectual magazines regularly denounce "scientism," the intrusion of science into the territory of the humanities such as politics and the arts. In many colleges and universities, science is presented not as the pursuit of true explanations but as just another narrative or myth. Science is commonly blamed for racism, imperialism, world wars, and the Holocaust. And it is accused of robbing life of its enchantment and stripping humans of freedom and dignity.

Enlightenment humanism, then, is far from being a crowd-pleaser. The idea that the ultimate good is to use knowledge to enhance human

welfare leaves people cold. Deep explanations of the universe, the planet, life, the brain? Unless they use magic, we don't want to believe them! Saving the lives of billions, eradicating disease, feeding the hungry? Boring. People extending their compassion to all of humankind? Not good enough—we want *the laws of physics* to care about us! Longevity, health, understanding, beauty, freedom, love? There's got to be more to life than that!

But it's the idea of progress that sticks most firmly in the craw. Even people who think it is a fine idea in theory to use knowledge to improve well-being insist it will never work in practice. And the daily news offers plenty of support for their cynicism: the world is depicted as a vale of tears, a tale of woe, a slough of despond. Since any defense of reason, science, and humanism would count for nothing if, two hundred and fifty years after the Enlightenment, we're no better off than our ancestors in the Dark Ages, an appraisal of human progress is where the case must begin.