CHAPTER 7

SUSTENANCE

Together with senescence, childbirth, and pathogens, another mean trick has been played on us by evolution and entropy: our ceaseless need for energy. Famine has long been part of the human condition. The Hebrew Bible tells of seven lean years in Egypt; the Christian Bible has Famine as one of the four horsemen of the apocalypse. Well into the 19th century a crop failure could bring sudden misery even to privileged parts of the world. Johan Norberg quotes the childhood reminiscence of a contemporary of one of his ancestors in Sweden in the winter of 1868:

> We often saw mother weeping to herself, and it was hard on a mother, not having any food to put on the table for her hungry children. Emaciated, starving children were often seen going from farm to farm, begging for a few crumbs of bread. One day three children came to us, crying and begging for something to still the pangs of hunger. Sadly, her eyes brimming with tears, our mother was forced to tell them that we had nothing but a few crumbs of bread which we ourselves needed. When we children saw the anguish in the unknown children's supplicatory eyes, we burst into tears and begged mother to share with them what crumbs we had. Hesitantly she acceded to our request, and the unknown children wolfed down the food before going on to the next farm, which was a good way off from our home. The following day all three were found dead between our farm and the next.[1]

The historian Fernand Braudel has documented that premodern Europe suffered from famines every few decades.[2] Desperate peasants would harvest grain before it was ripe, eat grass or human flesh, and pour into cities to beg. Even in good times, many would get the bulk of their calories from bread or gruel, and not many at that: in *The Escape from Hunger and Premature Death, 1700–2100,* the economist Robert Fogel noted that "the energy value of the typical diet in France at the start of the eighteenth century was as low as that of Rwanda in 1965, the most malnourished nation for that year."[3] Many of those who were not starving were too weak to work, which locked them into poverty. Hungry Europeans titillated themselves with food pornography, such as tales of Cockaigne, a country where pancakes grew on trees, the streets were paved with pastry, roasted pigs wandered around with knives in their backs for easy carving, and cooked fish jumped out of the water and landed at one's feet.

Today we live in Cockaigne, and our problem is not too few calories but too many. As the comedian Chris Rock observed, "This is the first society in history where the poor people are fat." With the usual first-world ingratitude, modern social critics rail against the obesity epidemic with a level of outrage that might be appropriate for a famine (that is, when they are not railing at fat-shaming, slender fashion models, or eating disorders). Though obesity surely is a public health problem, by the standards of history it's a good problem to have.

What about the rest of the world? The hunger that many Westerners associate with Africa and Asia is by no means a modern phenomenon. India and China have always been vulnerable to famine, because millions of people subsisted on rice that was watered by erratic monsoons or fragile irrigation systems and had to be transported across great distances. Braudel recounts the testimony of a Dutch merchant who was in India during a famine in 1630–31:

> "Men abandoned towns and villages and wandered helplessly. It was easy to recognize their condition: eyes sunk deep in the head, lips pale and covered with slime, the skin hard, with the bones showing through, the belly nothing but a pouch hanging

> down empty. . . . One would cry and howl for hunger, while another lay stretched on the ground dying in misery." The familiar human dramas followed: wives and children abandoned, children sold by parents, who either abandoned them or sold themselves in order to survive, collective suicides. . . . Then came the stage when the starving split open the stomachs of the dead or dying and "drew at the entrails to fill their own bellies." "Many hundred thousands of men died of hunger, so that the whole country was covered with corpses lying unburied, which caused such a stench that the whole air was filled and infected with it. . . . In the village of Susuntra . . . human flesh was sold in open market."[4]

But in recent times the world has been blessed with another remarkable and little-noticed advance: in spite of burgeoning numbers, the developing world is feeding itself. This is most obvious in China, whose 1.3 billion people now have access to an average of 3,100 calories per person per day, which, according to US government guidelines, is the number needed by a highly active young man.[5] India's billion people get an average of 2,400 calories a day, the number recommended for a highly active young woman or an active middle-aged man. The figure for the continent of Africa comes in between the two at 2,600.[6] Figure 7-1, which plots available calories for a representative sample of developed and developing nations and for the world as a whole, shows a pattern familiar from earlier graphs: hardship everywhere before the 19th century, rapid improvement in Europe and the United States over the next two centuries, and, in recent decades, the developing world catching up.

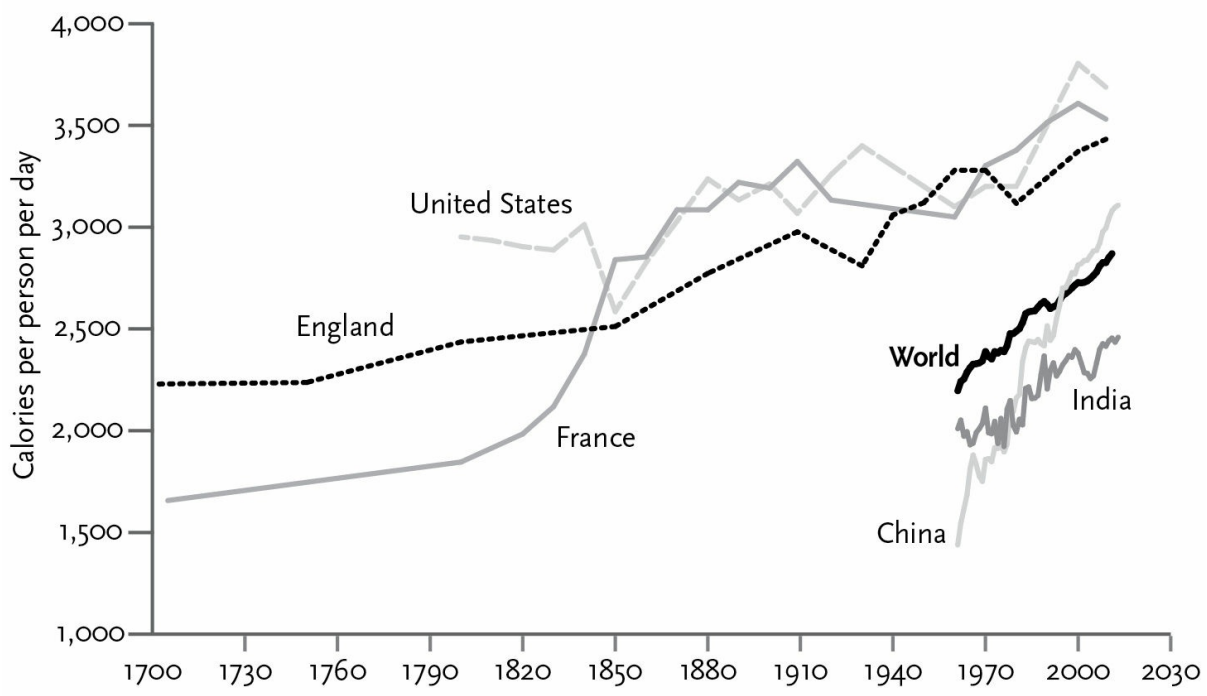


Figure 7-1: Calories, 1700–2013

Sources: United States, England, and France: *Our World in Data*, Roser 2016d, based on data from Fogel 2004. **China, India, and the World:** Food and Agriculture Organization of the United Nations, http://www.fao.org/faostat/en/#data.

The numbers plotted in figure 7-1 are averages, and they would be a misleading index of well-being if they were just lifted by rich people scarfing down more calories (if no one was getting fat except Mama Cass). Fortunately, the numbers reflect an increase in the availability of calories throughout the range, including the bottom. When children are underfed, their growth is stunted, and throughout their lives they have a higher risk of getting sick and dying. Figure 7-2 shows the proportion of children who are stunted in a representative sample of countries which have data for the longest spans of time. Though the proportion of stunted children in poor countries like Kenya and Bangladesh is deplorable, we see that in just two decades the rate of stunting has been cut in half. Countries like Colombia and China also had high rates of stunting not long ago and have managed to bring them even lower.

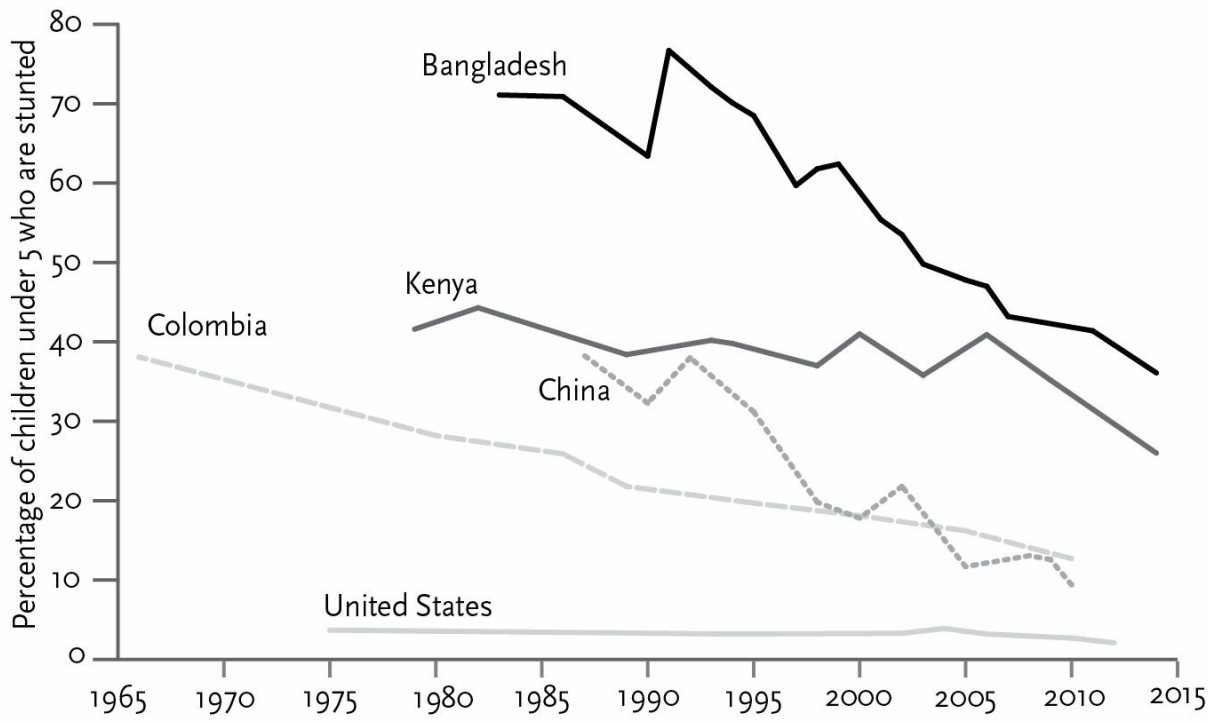


Figure 7-2: Childhood stunting, 1966–2014

Source: *Our World in Data,* Roser 2016j, based on data from the World Health Organization's *Nutrition Landscape Information System*, http://www.who.int/nutrition/nlis/en/.

Figure 7-3 offers another look at how the world has been feeding the hungry. It shows the rate of undernourishment (a year or more of insufficient food) for developing countries in five regions and for the world as a whole. In developed countries, which are not included in the estimates, the rate of undernourishment was less than 5 percent during the entire period, statistically indistinguishable from zero. Though 13 percent of people in the developing world being undernourished is far too much, it's better than 35 percent, which was the level forty-five years earlier, or for that matter 50 percent, an estimate for the entire world in 1947 (not shown on the graph).[7] Remember that these figures are proportions. The world added almost *five billion* people in those seventy years, which means that as the world was reducing the rate of hunger it was also feeding billions of additional mouths.

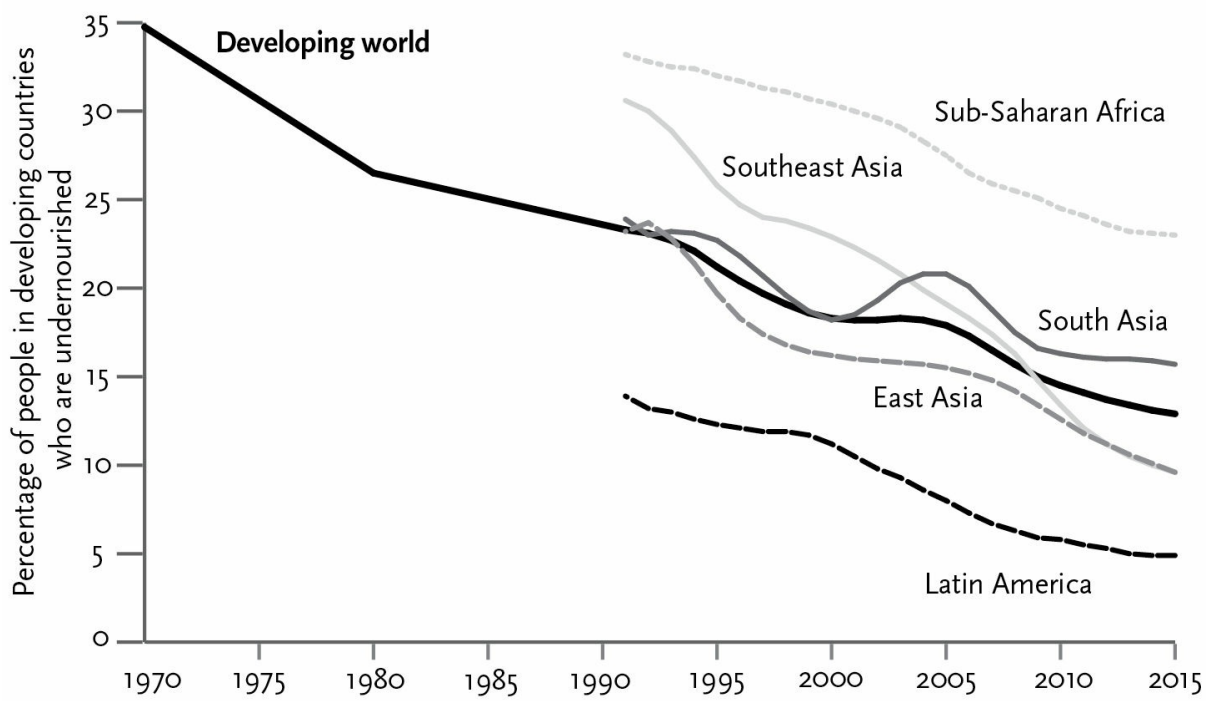


Figure 7-3: Undernourishment, 1970–2015

Source: *Our World in Data,* Roser 2016j, based on data from the Food and Agriculture Organization 2014, also reported in http://www.fao.org/economic/ess/ess-fs/ess-fadata/en/.

Not only has chronic undernourishment been in decline, but so have catastrophic famines—the crises that kill people in large numbers and cause widespread wasting (the condition of being two standard deviations below one's expected weight) and kwashiorkor (the protein deficiency which causes the swollen bellies of the children in photographs that have become icons of famine).[8] Figure 7-4 shows the number of deaths in major famines in each decade for the past 150 years, scaled by world population at the time.

Writing in 2000, the economist Stephen Devereux summarized the world's progress in the 20th century:

> Vulnerability to famine appears to have been virtually eradicated from all regions outside Africa. . . . Famine as an endemic problem in Asia and Europe seems to have been consigned to history. The grim label "land of famine" has left China, Russia, India and Bangladesh, and since the 1970s has resided only in Ethiopia and Sudan.

[In addition,] the link from crop failure to famine has been broken. Most recent drought- or flood-triggered food crises have been adequately met by a combination of local and international humanitarian response. . . .

If this trend continues, the 20th century should go down as the last during which tens of millions of people died for lack of access to food.[9]



Figure 7-4: Famine deaths, 1860–2016

Sources: *Our World in Data,* Hasell & Roser 2017, based on data from Devereux 2000; Ó Gráda 2009; White 2011, and EM-DAT, *The International Disaster Database*, http://www.emdat.be/; and other sources. "Famine" is defined as in Ó Gráda 2009.

So far, the trend *has* continued. There is still hunger (including among the poor in developed countries), and there were famines in East Africa in 2011, the Sahel in 2012, and South Sudan in 2016, together with near-famines in Somalia, Nigeria, and Yemen. But they did not kill on the scale of the catastrophes that were regular occurrences in earlier centuries.

None of this was supposed to happen. In 1798 Thomas Malthus explained that the frequent famines of his era were unavoidable and

would only get worse, because "population, when unchecked, increases in a geometrical ratio. Subsistence increases only in an arithmetic ratio. A slight acquaintance with numbers will show the immensity of the first power in comparison with the second." The implication was that efforts to feed the hungry would only lead to more misery, because they would breed more children who were doomed to hunger in their turn.

Not long ago, Malthusian thinking was revived with a vengeance. In 1967 William and Paul Paddock wrote *Famine 1975!,* and in 1968 the biologist Paul R. Ehrlich wrote *The Population Bomb,* in which he proclaimed that "the battle to feed all of humanity is over" and predicted that by the 1980s sixty-five million Americans and four billion other people would starve to death. *New York Times Magazine* readers were introduced to the battlefield term *triage* (the emergency practice of separating wounded soldiers into the savable and the doomed) and to philosophy-seminar arguments about whether it is morally permissible to throw someone overboard from a crowded lifeboat to prevent it from capsizing and drowning everyone.[10] Ehrlich and other environmentalists argued for cutting off food aid to countries they deemed basket cases.[11] Robert McNamara, president of the World Bank from 1968 to 1981, discouraged financing of health care "unless it was very strictly related to population control, because usually health facilities contributed to the decline of the death rate, and thereby to the population explosion." Population-control programs in India and China (especially under China's one-child policy) coerced women into sterilizations, abortions, and being implanted with painful and septic IUDs.[12]

Where did Malthus's math go wrong? Looking at the first of his curves, we already saw that population growth needn't increase in a geometric ratio indefinitely, because when people get richer and more of their babies survive, they have fewer babies (see also figure 10-1). Conversely, famines don't reduce population growth for long. They disproportionately kill children and the elderly, and when conditions improve, the survivors quickly replenish the population.[13] As Hans Rosling put it, "You can't stop population growth by letting poor children die."[14]

Looking at the second curve, we discover that the food supply *can* grow geometrically when *knowledge* is applied to increase the amount of food that can be coaxed out of a patch of land. Since the birth of agriculture ten thousand years ago, humans have been genetically engineering plants and animals by selectively breeding the ones that had the most calories and fewest toxins and that were the easiest to plant and harvest. The wild ancestor of corn was a grass with a few tough seeds; the ancestor of carrots looked and tasted like a dandelion root; the ancestors of many wild fruits were bitter, astringent, and more stone than flesh. Clever farmers also tinkered with irrigation, plows, and organic fertilizers, but Malthus always had the last word.

It was only at the time of the Enlightenment and the Industrial Revolution that people figured out how to bend the curve upward.[15] In Jonathan Swift's 1726 novel, the moral imperative was explained to Gulliver by the King of Brobdingnag: "Whoever makes two ears of corn, or two blades of grass to grow where only one grew before, deserves better of humanity, and does more essential service to his country than the whole race of politicians put together." Soon after that, as figure 7-1 shows, more ears of corn were indeed made to grow, in what has been called the British Agricultural Revolution.[16] Crop rotation and improvements to plows and seed drills were followed by mechanization, with fossil fuels replacing human and animal muscle. In the mid-19th century it took twenty-five men a full day to harvest and thresh a ton of grain; today one person operating a combine harvester can do it in six minutes.[17]

Machines also solve an inherent problem with food. As any zucchini gardener in August knows, a lot becomes available all at once, and then it quickly rots or gets eaten by vermin. Railroads, canals, trucks, granaries, and refrigeration evened out the peaks and troughs in the supply and matched it with demand, coordinated by the information carried in prices. But the truly gargantuan boost would come from chemistry. The *N* in SPONCH, the acronym taught to schoolchildren for the chemical elements that make up the bulk of our bodies, stands for nitrogen, a major ingredient of protein, DNA, chlorophyll, and the energy carrier ATP. Nitrogen atoms are plentiful in the air but bound in pairs (hence the chemical formula N_2), which are hard to split apart so that plants can use

them. In 1909 Carl Bosch perfected a process invented by Fritz Haber which used methane and steam to pull nitrogen out of the air and turn it into fertilizer on an industrial scale, replacing the massive quantities of bird poop that had previously been needed to return nitrogen to depleted soils. Those two chemists top the list of the 20th-century scientists who saved the greatest number of lives in history, with 2.7 billion.[18]

So forget arithmetic ratios: over the past century, grain yields per hectare have swooped upward while real prices have plunged. The savings are mind-boggling. If the food grown today had to be grown with pre-nitrogen-farming techniques, an area the size of Russia would go under the plow.[19] In the United States in 1901, an hour's wages could buy around three quarts of milk; a century later, the same wages would buy *sixteen* quarts. The amount of every other foodstuff that can be bought with an hour of labor has multiplied as well: from a pound of butter to five pounds, a dozen eggs to twelve dozen, two pounds of pork chops to five pounds, and nine pounds of flour to forty-nine pounds.[20]

In the 1950s and '60s, another giga-lifesaver, Norman Borlaug, outsmarted evolution to foment the Green Revolution in the developing world.[21] Plants in nature invest a lot of energy and nutrients in woody stalks that raise their leaves and blossoms above the shade of neighboring weeds and of each other. Like fans at a rock concert, everyone stands up, but no one gets a better view. That's the way evolution works: it myopically selects for individual advantage, not the greater good of the species, let alone the good of some other species. From a farmer's perspective, not only do tall wheat plants waste energy in inedible stalks, but when they are enriched with fertilizer they collapse under the weight of the heavy seedhead. Borlaug took evolution into his own hands, crossing thousands of strains of wheat and then selecting the offspring with dwarfed stalks, high yields, resistance to rust, and an insensitivity to day length. After several years of this "mind-warpingly tedious work," Borlaug evolved strains of wheat (and then corn and rice) with many times the yield of their ancestors. By combining these strains with modern techniques of irrigation, fertilization, and crop management, Borlaug turned Mexico and then India, Pakistan, and other famine-prone countries into grain exporters almost overnight.

The Green Revolution continues—it has been called "Africa's best-kept secret"—driven by improvements in sorghum, millet, cassava, and tubers.[22]

Thanks to the Green Revolution, the world needs less than a third of the land it used to need to produce a given amount of food.[23] Another way of stating the bounty is that between 1961 and 2009 the amount of land used to grow food increased by 12 percent, but the amount of food that was grown increased by 300 percent.[24] In addition to beating back hunger, the ability to grow more food from less land has been, on the whole, good for the planet. Despite their bucolic charm, farms are biological deserts which sprawl over the landscape at the expense of forests and grasslands. Now that farms have receded in some parts of the world, temperate forests have been bouncing back, a phenomenon we will return to in chapter 10.[25] If agricultural efficiency had remained the same over the past fifty years while the world grew the same amount of food, an area the size of the United States, Canada, and China combined would have had to be cleared and plowed.[26] The environmental scientist Jesse Ausubel has estimated that the world has reached Peak Farmland: we may never again need as much as we use today.[27]

Like all advances, the Green Revolution came under attack as soon as it began. High-tech agriculture, the critics said, consumes fossil fuels and groundwater, uses herbicides and pesticides, disrupts traditional subsistence agriculture, is biologically unnatural, and generates profits for corporations. Given that it saved a billion lives and helped consign major famines to the dustbin of history, this seems to me like a reasonable price to pay. More important, the price need not be with us forever. The beauty of scientific progress is that it never locks us into a technology but can develop new ones with fewer problems than the old ones (a dynamic we will return to here).

Genetic engineering can now accomplish in days what traditional farmers accomplished in millennia and Borlaug accomplished in his years of "mind-warping tedium." Transgenic crops are being developed with high yields, lifesaving vitamins, tolerance of drought and salinity, resistance to disease, pests, and spoilage, and reduced need for land, fertilizer, and plowing. Hundreds of studies, every major health and science organization, and more than a hundred

Nobel laureates have testified to their safety (unsurprisingly, since there is no such thing as a genetically unmodified crop).[28] Yet traditional environmentalist groups, with what the ecology writer Stewart Brand has called their "customary indifference to starvation," have prosecuted a fanatical crusade to keep transgenic crops from people—not just from whole-food gourmets in rich countries but from poor farmers in developing ones.[29] Their opposition begins with a commitment to the sacred yet meaningless value of "naturalness," which leads them to decry "genetic pollution" and "playing with nature" and to promote "real food" based on "ecological agriculture." From there they capitalize on primitive intuitions of essentialism and contamination among the scientifically illiterate public. Depressing studies have shown that about half of the populace believes that ordinary tomatoes don't have genes but genetically modified ones do, that a gene inserted into a food might migrate into the genomes of people who eat it, and that a spinach gene inserted into an orange would make it taste like spinach. Eighty percent favored a law that would mandate labels on all foods "containing DNA."[30] As Brand put it, "I daresay the environmental movement has done more harm with its opposition to genetic engineering than with any other thing we've been wrong about. We've starved people, hindered science, hurt the natural environment, and denied our own practitioners a crucial tool."[31]

One reason for Brand's harsh judgment is that opposition to transgenic crops has been perniciously effective in the part of the world that could most benefit from it. Sub-Saharan Africa has been cursed by nature with thin soil, capricious rainfall, and a paucity of harbors and navigable rivers, and it never developed an extensive network of roads, rails, or canals.[32] Like all farmed land, its soils have been depleted, but unlike those in the rest of the world, Africa's have not been replenished with synthetic fertilizer. Adoption of transgenic crops, both those already in use and ones customized for Africa, grown with other modern practices such as no-till farming and drip irrigation, could allow Africa to leapfrog the more invasive practices of the first Green Revolution and eliminate its remaining undernourishment.

For all the importance of agronomy, food security is not just about farming. Famines are caused not only when food is scarce but

when people can't afford it, when armies prevent them from getting it, or when their governments don't care how much of it they have.[33] The pinnacles and valleys in figure 7-4 show that the conquest of famine was not a story of steady gains in agricultural efficiency. In the 19th century, famines were triggered by the usual droughts and blights, but they were exacerbated in colonial India and Africa by the callousness, bungling, and sometimes deliberate policies of administrators who had no benevolent interest in their subjects' welfare.[34] By the early 20th century, colonial policies had become more responsive to food crises, and advances in agriculture had taken a bite out of hunger.[35] But then a horror show of political catastrophes triggered sporadic famines for the rest of the century.

Of the seventy million people who died in major 20th-century famines, 80 percent were victims of Communist regimes' forced collectivization, punitive confiscation, and totalitarian central planning.[36] These included famines in the Soviet Union in the aftermaths of the Russian Revolution, the Russian Civil War, and World War II; Stalin's Holodomor (terror-famine) in Ukraine in 1932–33; Mao's Great Leap Forward in 1958–61; Pol Pot's Year Zero in 1975–79; and Kim Jong-il's Arduous March in North Korea as recently as the late 1990s. The first governments in postcolonial Africa and Asia often implemented ideologically fashionable but economically disastrous policies such as the mass collectivization of farming, import restrictions to promote "self-sufficiency," and artificially low food prices which benefited politically influential city-dwellers at the expense of farmers.[37] When the countries fell into civil war, as they so often did, not only was food distribution disrupted, but both sides could use hunger as a weapon, sometimes with the complicity of their Cold War patrons.

Fortunately, since the 1990s the prerequisites to plenty have been falling into place in more of the world. Once the secrets to growing food in abundance are unlocked and the infrastructure to move it around is in place, the decline of famine depends on the decline of poverty, war, and autocracy. Let's turn to the progress that has been made against each of these scourges.

CHAPTER 8

WEALTH

Poverty has no causes," wrote the economist Peter Bauer. "Wealth has causes." In a world governed by entropy and evolution, the streets are not paved with pastry, and cooked fish do not land at our feet. But it's easy to forget this truism and think that wealth has always been with us. History is written not so much by the victors as by the affluent, the sliver of humanity with the leisure and education to write about it. As the economist Nathan Rosenberg and the legal scholar L. E. Birdzell Jr. point out, "We are led to forget the dominating misery of other times in part by the grace of literature, poetry, romance, and legend, which celebrate those who lived well and forget those who lived in the silence of poverty. The eras of misery have been mythologized and may even be remembered as golden ages of pastoral simplicity. They were not."[1]

Norberg, drawing on Braudel, offers vignettes of this era of misery, when the definition of poverty was simple: "if you could afford to buy bread to survive another day, you were not poor."

> In wealthy Genoa, poor people sold themselves as galley slaves every winter. In Paris the very poor were chained together in pairs and forced to do the hard work of cleaning the drains. In England, the poor had to work in workhouses to get relief, where they worked long hours for almost no pay. Some were instructed to crush dog, horse and cattle bones for use as fertilizer, until an inspection of a workhouse in 1845 showed that hungry paupers were fighting over the rotting bones to suck out the marrow.[2]

Another historian, Carlo Cipolla, noted:

> In preindustrial Europe, the purchase of a garment or of the cloth for a garment remained a luxury the common people could only afford a few times in their lives. One of the main preoccupations of hospital administration was to ensure that the clothes of the deceased should not be usurped but should be given to lawful inheritors. During epidemics of plague, the town authorities had to struggle to confiscate the clothes of the dead and to burn them: people waited for others to die so as to take over their clothes—which generally had the effect of spreading the epidemic.[3]

The need to explain the creation of wealth is obscured yet again by political debates within modern societies on how wealth ought to be distributed, which presuppose that wealth worth distributing exists in the first place. Economists speak of a "lump fallacy" or "physical fallacy" in which a finite amount of wealth has existed since the beginning of time, like a lode of gold, and people have been fighting over how to divide it up ever since.[4] Among the brainchildren of the Enlightenment is the realization that *wealth is created*.[5] It is created primarily by knowledge and cooperation: networks of people arrange matter into improbable but useful configurations and combine the fruits of their ingenuity and labor. The corollary, just as radical, is that we can figure out how to make more of it.

The endurance of poverty and the transition to modern affluence can be shown in a simple but stunning graph. It plots, for the past two thousand years, a standard measure of wealth creation, the Gross World Product, measured in 2011 international dollars. (An international dollar is a hypothetical unit of currency equivalent to a US dollar in a particular reference year, adjusted for inflation and for purchasing-power parity. The latter compensates for differences in the prices of comparable goods and services in different places—the fact that a haircut, for example, is cheaper in Dhaka than in London.)

The story of the growth of prosperity in human history depicted in figure 8-1 is close to: nothing . . . nothing . . . nothing . . . (repeat

for a few thousand years) . . . *boom!* A millennium after the year 1 CE, the world was barely richer than it was at the time of Jesus. It took another half-millennium for income to double. Some regions enjoyed spurts now and again, but they did not lead to sustained, cumulative growth. Starting in the 19th century, the increments turned into leaps and bounds. Between 1820 and 1900, the world's income tripled. It tripled again in a bit more than fifty years. It took only twenty-five years for it to triple again, and another thirty-three years to triple yet another time. The Gross World Product today has grown almost a hundredfold since the Industrial Revolution was in place in 1820, and almost two hundredfold from the start of the Enlightenment in the 18th century. Debates on economic distribution and growth often contrast dividing a pie with baking a larger one (or as George W. Bush mangled it, "making the pie higher"). If the pie we were dividing in 1700 was baked in a standard nine-inch pan, then the one we have today would be more than ten feet in diameter. If we were to surgically carve out the teensiest slice imaginable—say, one that was two inches at its widest point—it would be the size of the entire pie in 1700.

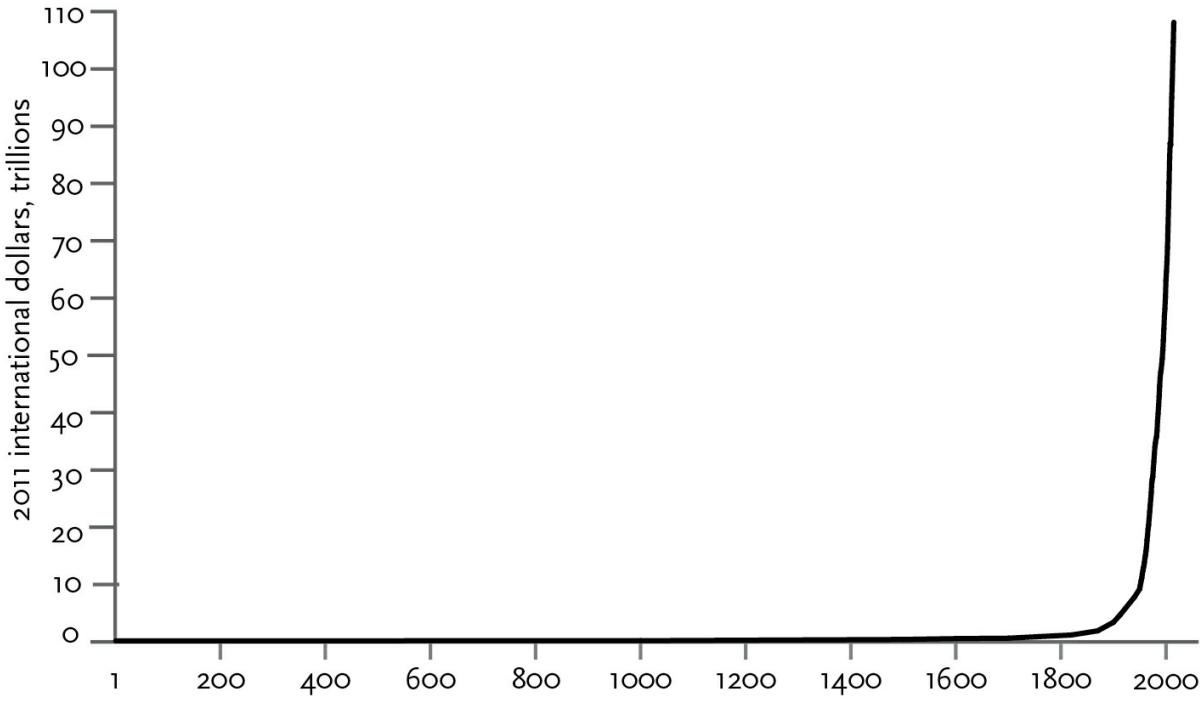


Figure 8-1: Gross World Product, 1–2015

Source: *Our World in Data,* Roser 2016c, based on data from the World Bank and from Angus Maddison and Maddison Project 2014.

Indeed, the Gross World Product is a gross *underestimate* of the expansion of prosperity.[6] How does one count units of currency, like pounds or dollars, across the centuries, so they can be plotted in a single line? Is one hundred dollars in the year 2000 more or less than one dollar in 1800? They're just pieces of paper with numbers on them; their value depends on what people can buy with them at the time, which changes with inflation and revaluations. The only way to compare a dollar in 1800 with a dollar in 2000 is to look up how many one would have to fork over to buy a standard market basket of goods: a fixed amount of food, clothing, health care, fuel, and so on. That's how the numbers in figure 8-1, and in other graphs denominated in dollars or pounds, are converted into a single scale such as "2011 international dollars."

The problem is that the advance of technology confounds the very idea of an unchanging market basket. To start with, the quality of the goods in the basket improves over time. An item of "clothing" in 1800 might be a rain cape made of stiff, heavy, and leaky oilcloth; in 2000 it would be a zippered raincoat made of a light, breathable synthetic. "Dental care" in 1800 meant pliers and wooden dentures; in 2000 it meant Novocain and implants. It's misleading, then, to say that the $300 it would take to buy a certain amount of clothing and medical care in 2000 can be equated with the $10 it would take to buy "the same amount" in 1800.

Also, technology doesn't just improve old things; it invents new ones. How much did it cost in 1800 to purchase a refrigerator, a musical recording, a bicycle, a cell phone, *Wikipedia,* a photo of your child, a laptop and printer, a contraceptive pill, a dose of antibiotics? The answer is: no amount of money in the world. The combination of better products and new products makes it almost impossible to track material well-being across the decades and centuries.

Plunging prices add yet another complication. A refrigerator today costs around $500. How much would someone have to pay you to give up refrigeration? Surely far more than $500! Adam Smith called it the paradox of value: when an important good becomes plentiful, it costs far less than what people are willing to pay for it. The difference is called consumer surplus, and the explosion of this surplus over time is impossible to tabulate.

Economists are the first to point out that their measures, like Oscar Wilde's cynic, capture the price of everything but the value of nothing.[7]

This doesn't mean that comparisons of wealth across times and places in currency adjusted for inflation and purchasing power are meaningless—they are better than ignorance, or guesstimates—but it does mean that they shortchange our accounting of progress. A person whose wallet contains the cash equivalent of a hundred 2011 international dollars today is fantastically richer than her ancestor with the equivalent wallet's worth two hundred years ago. As we'll see, this also affects our assessment of prosperity in the developing world (this chapter), of income inequality in the developed world (next chapter), and of the future of economic growth (chapter 20).



What launched the Great Escape? The most obvious cause was the application of science to the improvement of material life, leading to what the economic historian Joel Mokyr calls "the enlightened economy."[8] The machines and factories of the Industrial Revolution, the productive farms of the Agricultural Revolution, and the water pipes of the Public Health Revolution could deliver more clothes, tools, vehicles, books, furniture, calories, clean water, and other things that people want than the craftsmen and farmers of a century before. Many early innovations, such as in steam engines, looms, spinning frames, foundries, and mills, came out of the workshops and backyards of atheoretical tinkerers.[9] But trial and error is a profusely branching tree of possibilities, most of which lead nowhere, and the tree can be pruned by the application of science, accelerating the rate of discovery. As Mokyr notes, "After 1750 the epistemic base of technology slowly began to expand. Not only did new products and techniques emerge; it became better understood why and how the old ones worked, and thus they could be refined, debugged, improved, combined with others in novel ways and adapted to new uses."[10] The invention of the barometer in 1643, which proved the existence of atmospheric pressure, eventually led to the invention of steam engines, known at the time as "atmospheric engines." Other two-way streets between science and technology included the application of chemistry, facilitated by the invention of the battery, to synthesize fertilizer, and the application

of the germ theory of disease, made possible by the microscope, to keep pathogens out of drinking water and off doctors' hands and instruments.

The applied scientists would not have been motivated to apply their ingenuity to ease the pains of everyday life, and their gadgets would have remained in their labs and garages, were it not for two other innovations.

One was the development of *institutions* that lubricated the exchange of goods, services, and ideas—the dynamic singled out by Adam Smith as the generator of wealth. The economists Douglass North, John Wallis, and Barry Weingast argue that the most natural way for states to function, both in history and in many parts of the world today, is for elites to agree not to plunder and kill each other, in exchange for which they are awarded a fief, franchise, charter, monopoly, turf, or patronage network that allows them to control some sector of the economy and live off the rents (in the economist's sense of income extracted from exclusive access to a resource).[11] In 18th-century England this cronyism gave way to *open* economies in which anyone could sell anything to anyone, and their transactions were protected by the rule of law, property rights, enforceable contracts, and institutions like banks, corporations, and government agencies that run by fiduciary duties rather than personal connections. Now an enterprising person could introduce a new kind of product to the market, or undersell other merchants if he could provide a product at lower cost, or accept money now for something he would not deliver until later, or invest in equipment or land that might not return a profit for years. Today I take it for granted that if I want some milk, I can walk into a convenience store and a quart will be on the shelves, the milk won't be diluted or tainted, it will be for sale at a price I can afford, and the owner will let me walk out with it after a swipe of a card, even though we have never met, may never see each other again, and have no friends in common who can testify to our bona fides. A few doors down and I could do the same with a pair of jeans, a power drill, a computer, or a car. A lot of institutions have to be in place for these and the millions of other anonymous transactions that make up a modern economy to be consummated so easily.

The third innovation, after science and institutions, was a change in values: an endorsement of what the economic historian Deirdre McCloskey calls bourgeois virtue.[12] Aristocratic, religious, and martial cultures have always looked down on commerce as tawdry and venal. But in 18th-century England and the Netherlands, commerce came to be seen as moral and uplifting. Voltaire and other Enlightenment *philosophes* valorized the spirit of commerce for its ability to dissolve sectarian hatreds:

> Take a view of the *Royal Exchange in London*, a place more venerable than many courts of justice, where the representatives of all nations meet for the benefit of mankind. There the Jew, the Mahometan, and the Christian transact together as tho' they all profess'd the same religion, and give the name of Infidel to none but bankrupts. There the Presbyterian confides in the Anabaptist, and the Churchman depends on the Quaker's word. And all are satisfied.[13]

Commenting on this passage, the historian Roy Porter noted that "by depicting men content, and content to be content—differing, but agreeing to differ—the *philosophe* pointed towards a rethinking of the *summum bonum,* a shift from God-fearingness to a selfhood more psychologically oriented. The Enlightenment thus translated the ultimate question 'How can I be saved?' into the pragmatic 'How can I be happy?'—thereby heralding a new praxis of personal and social adjustment."[14] This praxis included norms of propriety, thrift, and self-restraint, an orientation toward the future rather than the past, and a conferral of dignity and prestige upon merchants and inventors rather than just on soldiers, priests, and courtiers. Napoleon, that exponent of martial glory, sniffed at England as "a nation of shopkeepers." But at the time Britons earned 83 percent more than Frenchmen and enjoyed a third more calories, and we all know what happened at Waterloo.[15]

The Great Escape in Britain and the Netherlands was quickly followed by escapes in the Germanic states, the Nordic countries, and Britain's colonial offshoots in Australia, New Zealand, Canada, and the United States. In 1905 the sociologist Max Weber proposed that capitalism depended on a "Protestant ethic" (a hypothesis with

the intriguing prediction that Jews should fare poorly in capitalist societies, particularly in business and finance). In any case the Catholic countries of Europe soon zoomed out of poverty too, and a succession of other escapes shown in figure 8-2 have put the lie to various theories explaining why Buddhism, Confucianism, Hinduism, or generic "Asian" or "Latin" values were incompatible with dynamic market economies.

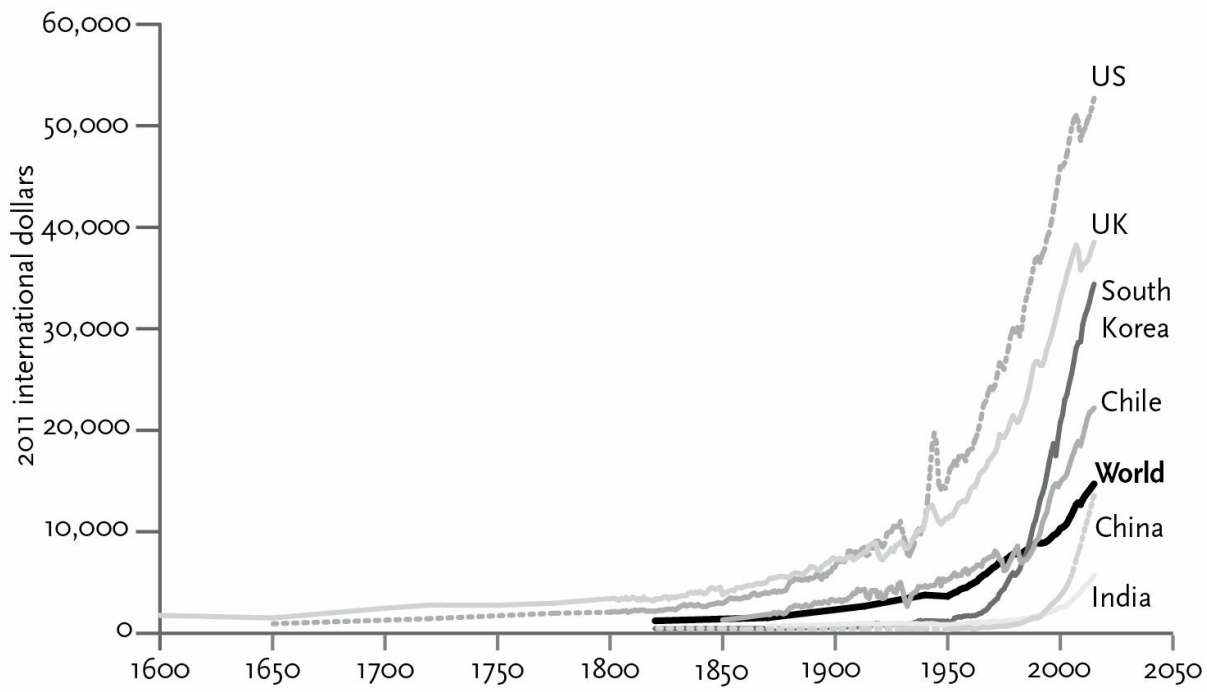


Figure 8-2: GDP per capita, 1600–2015

Source: *Our World in Data,* Roser 2016c, based on data from the World Bank and from Maddison Project 2014.

The non-British curves in figure 8-2 tell of a second astonishing chapter in the story of prosperity: starting in the late 20th century, poor countries have been escaping from poverty in their turn. The Great Escape is becoming the Great Convergence.[16] Countries that until recently were miserably poor have become comfortably rich, such as South Korea, Taiwan, and Singapore. (My Singaporean former mother-in-law recalls a childhood dinner at which her family split an egg four ways.) Since 1995, 30 of the world's 109 developing countries, including countries as diverse as Bangladesh, El Salvador, Ethiopia, Georgia, Mongolia, Mozambique, Panama, Rwanda, Uzbekistan, and Vietnam, have enjoyed economic growth

rates that amount to a doubling of income every eighteen years. Another 40 countries have had rates that would double income every thirty-five years, which is comparable to the historical growth rate of the United States.[17] It's remarkable enough to see that by 2008 China and India had the same per capita income that Sweden had in 1950 and 1920, respectively, but more remarkable still when we remember how many capitas this income was per: 1.3 and 1.2 billion people. By 2008 the world's population, all 6.7 billion of them, had an average income equivalent to that of Western Europe in 1964. And no, it's not just because the rich are getting even richer (though of course they are, a topic we will examine in the next chapter). Extreme poverty is being eradicated, and the world is becoming middle class.[18]

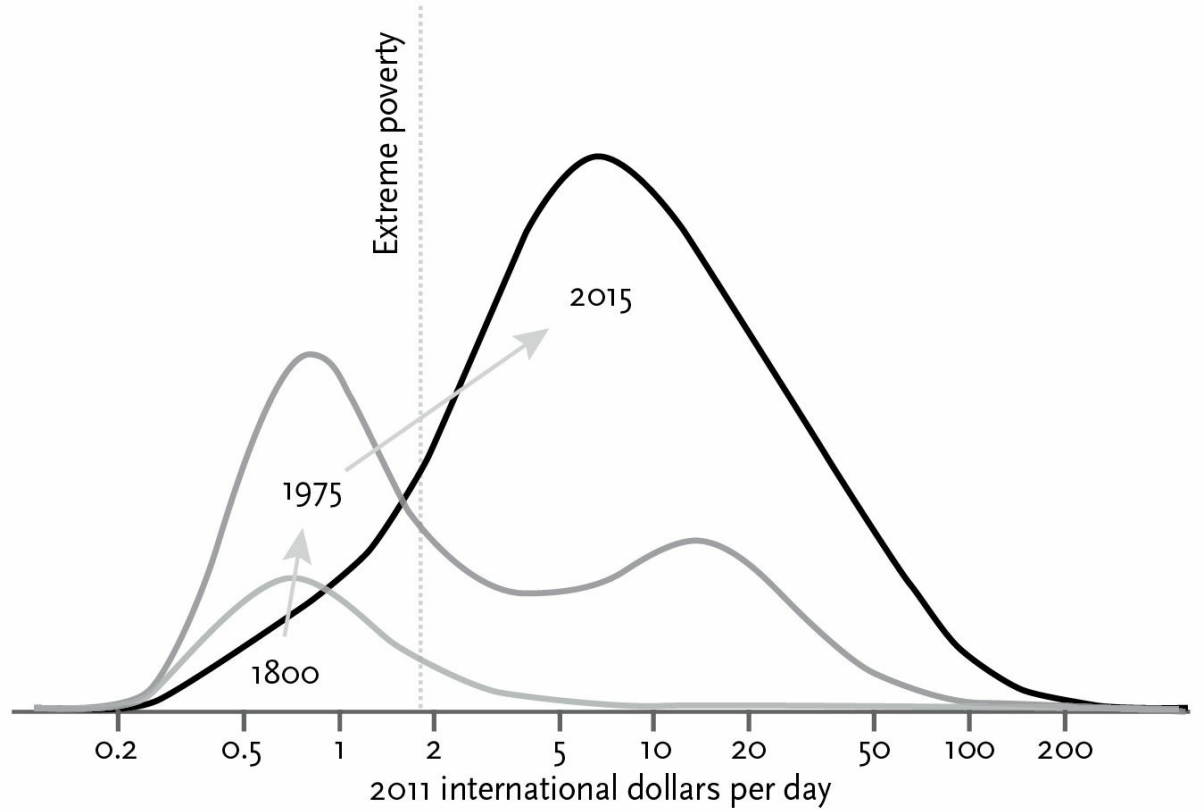


Figure 8-3: World income distribution, 1800, 1975, and 2015

Source: *Gapminder,* via Ola Rosling, http://www.gapminder.org/tools/mountain. The scale is in 2011 international dollars.

The statistician Ola Rosling (Hans's son) has displayed the worldwide distribution of income as histograms, in which the height of the curve indicates the proportion of people at a given income

level, for three historical periods (figure 8-3).[19] In 1800, at the dawn of the Industrial Revolution, most people everywhere were poor. The average income was equivalent to that in the poorest countries in Africa today (about $500 a year in international dollars), and almost 95 percent of the world lived in what counts today as "extreme poverty" (less than $1.90 a day). By 1975, Europe and its offshoots had completed the Great Escape, leaving the rest of the world behind, with one-tenth their income, in the lower hump of a camel-shaped curve.[20] In the 21st century the camel has become a dromedary, with a single hump shifted to the right and a much lower tail on the left: the world had become richer and more equal.[21]

The slices to the left of the dotted line deserve their own picture. Figure 8-4 shows the percentage of the world's population that lives in "extreme poverty." Admittedly, any cutoff for that condition must be arbitrary, but the United Nations and the World Bank do their best by combining the national poverty lines from a sample of developing countries, which are in turn based on the income of a typical family that manages to feed itself. In 1996 it was the alliterative "a dollar a day" per person; currently it's set at $1.90 a day in 2011 international dollars.[22] (Curves with more generous cutoffs are higher and shallower but also skitter downward.)[23] Notice not just the shape of the curve but how low it has sunk—to 10 percent. In two hundred years the rate of extreme poverty in the world has tanked from 90 percent to 10, with almost half that decline occurring in the last thirty-five years.

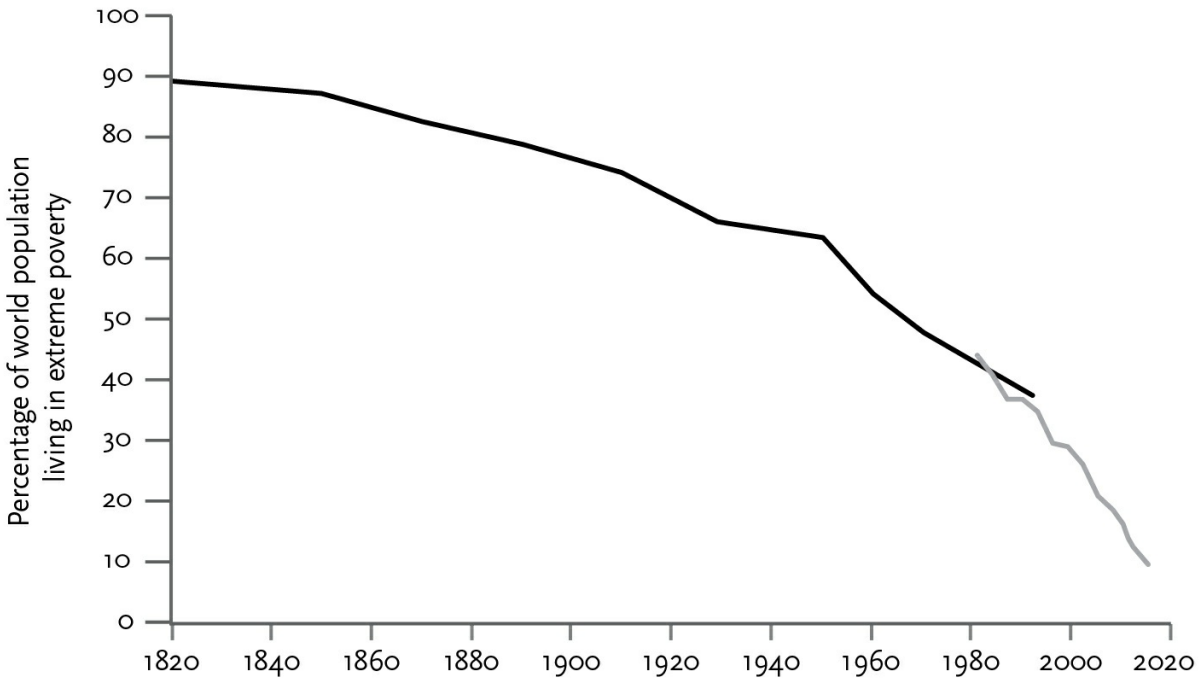


Figure 8-4: Extreme poverty (proportion), 1820–2015

Sources: *Our World in Data,* Roser & Ortiz-Ospina 2017, based on data from Bourguignon & Morrisson 2002 (1820–1992), averaging their "Extreme poverty" and "Poverty" percentages for commensurability with data on "Extreme poverty" for 1981–2015 from the World Bank 2016g.

The world's progress can be appreciated in two ways. By one reckoning, the proportions and per capita rates I have been plotting are the morally relevant measure of progress, because they fit with John Rawls's thought experiment for defining a just society: specify a world in which you would agree to be incarnated as a random citizen from behind a veil of ignorance as to that citizen's circumstances.[24] A world with a higher percentage of long-lived, healthy, well-fed, well-off people is a world in which one would prefer to play the lottery of birth. But by another reckoning, absolute numbers matter, too. Every additional long-lived, healthy, well-fed, well-off person is a sentient being capable of happiness, and the world is a better place for having more of them. Also, an increase in the number of people who can withstand the grind of entropy and the struggle of evolution is a testimonial to the sheer magnitude of the benevolent powers of science, markets, good government, and other modern institutions. In the stacked layer graph in figure 8-5, the thickness of the bottom slab represents the number of people living in extreme poverty, the thickness of the top

slab represents the number not living in poverty, and the height of the stack represents the population of the world. It shows that the number of poor people declined just as the number of all people exploded, from 3.7 billion in 1970 to 7.3 billion in 2015. (Max Roser points out that if news outlets truly reported the changing state of the world, they could have run the headline NUMBER OF PEOPLE IN EXTREME POVERTY FELL BY 137,000 SINCE YESTERDAY every day for the last twenty-five years.) We live in a world not just with a smaller proportion of extremely poor people but with a smaller number of them, and with 6.6 billion people who are not extremely poor.

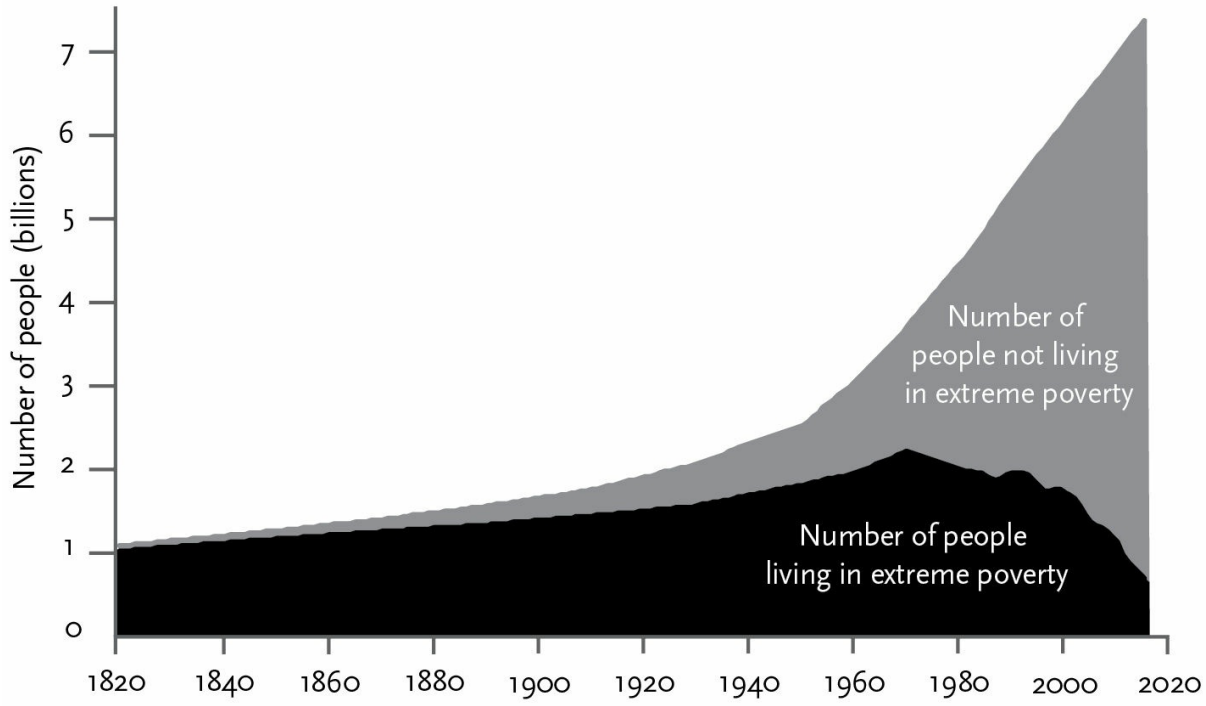


Figure 8-5: Extreme poverty (number), 1820–2015

Sources: *Our World in Data,* Roser & Ortiz-Ospina 2017, based on data from Bourguignon & Morrisson 2002 (1820–1992) and the World Bank 2016g (1981–2015).

Most surprises in history are unpleasant surprises, but this news came as a pleasant shock even to the optimists. In 2000 the United Nations laid out eight Millennium Development Goals, their starting lines backdated to 1990.[25] At the time, cynical observers of that underperforming organization dismissed the targets as aspirational boilerplate. Cut the global poverty rate in half, lifting a billion people out of poverty, in twenty-five years? Yeah, yeah. But the world reached the goal *five years ahead of schedule*.

Development experts are still rubbing their eyes. Deaton writes, "This is perhaps the most important fact about wellbeing in the world since World War II."[26] The economist Robert Lucas (like Deaton, a Nobel laureate) said, "The consequences for human welfare involved [in understanding rapid economic development] are simply staggering: once one starts to think about them, it is hard to think about anything else."[27]

Let's not stop thinking about tomorrow. Though it's always dangerous to extrapolate a historical curve, what happens when we try? If we align a ruler with the World Bank data in figure 8-4, we find that it crosses the *x*-axis (indicating a poverty rate of 0) in 2026. The UN gave itself a cushion in its 2015 Sustainable Development Goals (the successor to its Millennium Development Goals) and set a target of "ending extreme poverty for all people everywhere" by 2030.[28] Ending extreme poverty for all people everywhere! May I live to see the day. (Not even Jesus was that optimistic: he told a supplicant, "The poor you will always have with you.")

Of course that day is a ways off. Hundreds of millions of people remain in extreme poverty, and getting to zero will require a greater effort than just extrapolating along a ruler. Though the numbers are dwindling in countries like India and Indonesia, they are increasing in the poorest of the poor countries, like Congo, Haiti, and Sudan, and the last pockets of poverty will be the hardest to eliminate.[29] Also, as we approach the goal we should move the goalposts, since not-so-extreme poverty is still poverty. In introducing the concept of progress I warned against confusing hard-won headway with a process that magically takes place by itself. The point of calling attention to progress is not self-congratulation but identifying the causes so we can do more of what works. And since we know that something has worked, it's unnecessary to keep depicting the developing world as a basket case to shake people out of their apathy—with the danger that they will think that additional support would just be throwing money down a rat hole.[30]

So what *is* the world doing right? As with most forms of progress, a lot of good things happen at once and reinforce one another, so it's hard to identify a first domino. Cynical explanations, such as that the enrichment is a one-time dividend of a surge in the price of oil

and other commodities, or that the statistics are inflated by the rise of populous China, have been examined and dismissed. Radelet and other development experts point to five causes.[31]

"In 1976," Radelet writes, "Mao single-handedly and dramatically changed the direction of global poverty with one simple act: he died."[32] Though China's rise is not exclusively responsible for the Great Convergence, the country's sheer bulk is bound to move the totals around, and the explanations for its progress apply elsewhere. The death of Mao Zedong is emblematic of three of the major causes of the Great Convergence.

The first is the decline of communism (together with intrusive socialism). For reasons we have seen, market economies can generate wealth prodigiously while totalitarian planned economies impose scarcity, stagnation, and often famine. Market economies, in addition to reaping the benefits of specialization and providing incentives for people to produce things that other people want, solve the problem of coordinating the efforts of hundreds of millions of people by using prices to propagate information about need and availability far and wide, a computational problem that no planner is brilliant enough to solve from a central bureau.[33] A shift from collectivization, centralized control, government monopolies, and suffocating permit bureaucracies (what in India was called "the license raj") to open economies took place on a number of fronts beginning in the 1980s. They included Deng Xiaoping's embrace of capitalism in China, the collapse of the Soviet Union and its domination of Eastern Europe, and the liberalization of the economies of India, Brazil, Vietnam, and other countries.

Though intellectuals are apt to do a spit take when they read a defense of capitalism, its economic benefits are so obvious that they don't need to be shown with numbers. They can literally be seen from space. A satellite photograph of Korea showing the capitalist South aglow in light and the Communist North a pit of darkness vividly illustrates the contrast in the wealth-generating capability between the two economic systems, holding geography, history, and culture constant. Other matched pairs with an experimental group and a control group lead to the same conclusion: West and East Germany when they were divided by the Iron Curtain; Botswana versus Zimbabwe under Robert Mugabe; Chile versus Venezuela

under Hugo Chávez and Nicolás Maduro—the latter a once-wealthy, oil-rich country now suffering from widespread hunger and a critical shortage of medical care.[34] It's important to add that the market economies which blossomed in the more fortunate parts of the developing world were not the laissez-faire anarchies of right-wing fantasies and left-wing nightmares. To varying degrees, their governments invested in education, public health, infrastructure, and agricultural and job training, together with social insurance and poverty-reduction programs.[35]

Radelet's second explanation of the Great Convergence is leadership. Mao imposed more than communism on China. He was a mercurial megalomaniac who foisted crackbrained schemes on the country, such as the Great Leap Forward (with its gargantuan communes, useless backyard smelters, and screwball agronomic practices) and the Cultural Revolution (which turned the younger generation into gangs of thugs who terrorized teachers, managers, and descendants of "rich peasants").[36] During the decades of stagnation from the 1970s to the early 1990s, many other developing countries were commandeered by psychopathic strongmen with ideological, religious, tribal, paranoid, or self-aggrandizing agendas rather than a mandate to enhance the well-being of their citizens. Depending on their sympathy or antipathy for communism, they were propped up by the Soviet Union or the United States under the principle "He may be a son of a bitch, but he's *our* son of a bitch."[37] The 1990s and 2000s saw a spread of democracy (chapter 14) and the rise of levelheaded, humanistic leaders—not just national statesmen like Nelson Mandela, Corazon Aquino, and Ellen Johnson Sirleaf but local religious and civil-society leaders acting to improve the lives of their compatriots.[38]

A third cause was the end of the Cold War. It not only pulled the rug out from under a number of tinpot dictators but snuffed out many of the civil wars that had racked developing countries since they attained independence in the 1960s. Civil war is both a humanitarian disaster and an economic one, as facilities are destroyed, resources are diverted, children are kept out of school, and managers and workers are pulled away from work or killed. The economist Paul Collier, who calls war "development in reverse," has estimated that a typical civil war costs a country $50 billion.[39]

A fourth cause is globalization, in particular the explosion in trade made possible by container ships and jet airplanes and by the liberalization of tariffs and other barriers to investment and trade. Classical economics and common sense agree that a larger trading network should make everyone, on average, better off. As countries specialize in different goods and services, they can produce them more efficiently, and it doesn't cost them much more to offer their wares to billions of people than to thousands. At the same time buyers, shopping for the best price in a global bazaar, can get more of what they want. (Common sense is less likely to appreciate a corollary called comparative advantage, which predicts that, on average, everyone is better off when each country sells the goods and services that it can produce most efficiently *even if* the buyers could produce them still more efficiently themselves.) Notwithstanding the horror that the word elicits in many parts of the political spectrum, globalization, development analysts agree, has been a bonanza for the poor. Deaton notes, "Some argue that globalization is a neoliberal conspiracy designed to enrich a very few at the expense of many. If so, that conspiracy was a disastrous failure—or at least, it helped more than a billion people as an unintended consequence. If only unintended consequences always worked so favorably."[40]

To be sure, the industrialization of the developing world, like the Industrial Revolution two centuries before it, has produced working conditions that are harsh by the standards of modern rich countries and have elicited bitter condemnation. The Romantic movement in the 19th century was partly a reaction to the "dark satanic mills" (as William Blake called them), and since that time a loathing of industry has been a sacred value of C. P. Snow's Second Culture of literary intellectuals.[41] Nothing in Snow's essay enraged his assailant F. R. Leavis as much as this passage:

> It is all very well for us, sitting pretty, to think that material standards of living don't matter all that much. It is all very well for one, as a personal choice, to reject industrialisation—do a modern Walden if you like, and if you go without much food, see most of your children die in infancy, despise the comforts of literacy, accept twenty years off your own life, then

> I respect you for the strength of your aesthetic revulsion. But I don't respect you in the slightest if, even passively, you try to impose the same choice on others who are not free to choose. In fact, we know what their choice would be. For, with singular unanimity, in any country where they have had the chance, the poor have walked off the land into the factories as fast as the factories could take them.[42]

As we have seen, Snow was accurate in his claims about advances in life and health, and he was also right that the appropriate standard in considering the plight of the poor in industrializing countries is the set of alternatives available to them where and when they live. Snow's argument is being echoed fifty years later by development experts such as Radelet, who observes that "while working on the factory floor is often referred to as sweatshop labor, it is often better than the granddaddy of all sweatshops: working in the fields as an agricultural day laborer."

> When I lived in Indonesia in the early 1990s, I arrived with a somewhat romanticized view of the beauty of people working in rice paddies, together with reservations about the rapidly growing factory jobs. The longer I was there, the more I recognized how incredibly difficult it is to work in the rice fields. It's a backbreaking grind, with people eking out the barest of livings by bending over for hours in the hot sun to terrace the fields, plant the seeds, pull the weeds, transplant the seedlings, chase the pests, and harvest the grain. Standing in the pools of water brings leeches and the constant risk of malaria, encephalitis, and other diseases. And, of course, it is hot, all the time. So, it was not too much of a surprise that when factory jobs opened offering wages of $2 a day, hundreds of people lined up just to get a shot at applying.[43]

The benefits of industrial employment can go beyond material living standards. For the women who get these jobs, it can be a liberation. In her article "The Feminist Side of Sweatshops," Chelsea Follett (the managing editor of *HumanProgress*) recounts that factory work in the 19th century offered women an escape from the

traditional gender roles of farm and village life, and so was held by some men at the time "sufficient to damn to infamy the most worthy and virtuous girl." The girls themselves did not always see it that way. A textile mill worker in Lowell, Massachusetts, wrote in 1840:

> We are collected . . . to get money, as much of it and as fast as we can. . . . Strange would it be, if in money-loving New England, one of the most lucrative female employments should be rejected because it is toilsome, or because some people are prejudiced against it. Yankee girls have too much *independence* for *that*.[44]

Here again, experiences during the Industrial Revolution prefigure those in the developing world today. Kavita Ramdas, the head of the Global Fund for Women, said in 2001 that in an Indian village "all there is for a woman is to obey her husband and relatives, pound millet, and sing. If she moves to town, she can get a job, start a business, and get education for her children."[45] An analysis in Bangladesh confirmed that the women who worked in the garment industry (as my grandparents did in 1930s Canada) enjoyed rising wages, later marriage, and fewer and better-educated children.[46] Over the course of a generation, slums, barrios, and favelas can morph into suburbs, and the working class can become middle class.[47]

To appreciate the long-term benefits of industrialization one does not have to accept its cruelties. One can imagine an alternative history of the Industrial Revolution in which modern sensibilities applied earlier and the factories operated without children and with better working conditions for the adults. Today there are doubtless factories in the developing world that could offer as many jobs and still turn a profit while treating their workers more humanely. Pressure from trade negotiators and consumer protests has measurably improved working conditions in many places, and it is a natural progression as countries get richer and more integrated into the global community (as we will see in chapters 12 and 17 when we look at the history of working conditions in our own society).[48] Progress consists not in accepting every change as part of an indivisible package—as if we had to make a yes-or-no decision on

whether the Industrial Revolution, or globalization, is a good thing or bad thing, exactly as each has unfolded in every detail. Progress consists of unbundling the features of a social process as much as we can to maximize the human benefits while minimizing the harms.

The last, and in many analyses the most important, contributor to the Great Convergence is science and technology.[49] Life is getting cheaper, in a good way. Thanks to advances in know-how, an hour of labor can buy more food, health, education, clothing, building materials, and small necessities and luxuries than it used to. Not only can people eat cheaper food and take cheaper medicines, but children can wear cheap plastic sandals instead of going barefoot, and adults can hang out together getting their hair done or watching a soccer game using cheap solar panels and appliances. As for good advice on health, farming, and business: it's better than cheap; it's free.

Today about half the adults in the world own a smartphone, and there are as many subscriptions as people. In parts of the world without roads, landlines, postal service, newspapers, or banks, mobile phones are more than a way to share gossip and cat photos; they are a major generator of wealth. They allow people to transfer money, order supplies, track the weather and markets, find day labor, get advice on health and farming practices, even obtain a primary education.[50] An analysis by the economist Robert Jensen subtitled "The Micro and Mackerel Economics of Information" showed how South Indian small fishermen increased their income and lowered the local price of fish by using their mobile phones at sea to find the market which offered the best price that day, sparing them from having to unload their perishable catch on fish-glutted towns while other towns went fishless.[51] In this way mobile phones are allowing hundreds of millions of small farmers and fishers to become the omniscient rational actors in the ideal frictionless markets of economics textbooks. According to one estimate, every cell phone adds $3,000 to the annual GDP of a developing country.[52]

The beneficent power of knowledge has rewritten the rules of global development. Development experts differ on the wisdom of foreign aid. Some argue that it does more harm than good by

enriching corrupt governments and competing with local commerce.[53] Others cite recent numbers which suggest that intelligently allocated aid has in fact done tremendous good.[54] But while they disagree on the effects of donated food and dollars, all agree that donated technology—medicines, electronics, crop varieties, and best practices in agriculture, business, and public health—has been an unalloyed boon. (As Jefferson noted, he who receives an idea from me receives instruction without lessening mine.) And for all the emphasis I've placed on GDP per capita, the value of knowledge has made that measure less relevant to what we really care about, quality of life. If I had squeezed a line for Africa into the lower right corner of figure 8-3, it would look unimpressive: the line would curve upward, to be sure, but without the exponential blastoff of the lines for Europe and Asia. Charles Kenny emphasizes that the actual progress of Africa belies the shallow slope, because health, longevity, and education are so much more affordable than they used to be. Though in general people in richer countries live longer (a relationship called the Preston curve, after the economist who discovered it), the whole curve is being pushed upward, as everyone is living longer regardless of income.[55] In the richest country two centuries ago (the Netherlands), life expectancy was just forty, and in no country was it above forty-five. Today, life expectancy in the *poorest* country in the world (the Central African Republic) is fifty-four, and in no country is it *below* forty-five.[56]

Though it's easy to sneer at national income as a shallow and materialistic measure, it correlates with every indicator of human flourishing, as we will repeatedly see in the chapters to come. Most obviously, GDP per capita correlates with longevity, health, and nutrition.[57] Less obviously, it correlates with higher ethical values like peace, freedom, human rights, and tolerance.[58] Richer countries, on average, fight fewer wars with each other (chapter 11), are less likely to be riven by civil wars (chapter 11), are more likely to become and stay democratic (chapter 14), and have greater respect for human rights (chapter 14—on average, that is; Arab oil states are rich but repressive). The citizens of richer countries have greater respect for "emancipative" or liberal values such as women's equality, free speech, gay rights, participatory democracy, and protection of the environment (chapters 10 and 15). Not

surprisingly, as countries get richer they get happier (chapter 18); more surprisingly, as countries get richer they get smarter (chapter 16).[59]

In explaining this Somalia-to-Sweden continuum, with poor violent repressive unhappy countries at one end and rich peaceful liberal happy ones at the other, correlation is not causation, and other factors like education, geography, history, and culture may play roles.[60] But when the quants try to tease them apart, they find that economic development does seem to be a major mover of human welfare.[61] In an old academic joke, a dean is presiding over a faculty meeting when a genie appears and offers him one of three wishes—money, fame, or wisdom. The dean replies, "That's easy. I'm a scholar. I've devoted my life to understanding. Of course I'll take wisdom." The genie waves his hand and vanishes in a puff of smoke. The smoke clears to reveal the dean with his head in his hands, lost in thought. A minute elapses. Ten minutes. Fifteen. Finally a professor calls out, "Well? Well?" The dean mutters, "I should have taken the money."

CHAPTER 9

INEQUALITY

But is it all going to the rich?" That's a natural question to ask in developed countries in the second decade of the 21st century, when economic inequality has become an obsession. Pope Francis called it "the root of social evil"; Barack Obama, "the defining challenge of our time." Between 2009 and 2016, the proportion of articles in the *New York Times* containing the word *inequality* soared tenfold, reaching 1 in 73.[1] The new conventional wisdom is that the richest one percent have skimmed off all the economic growth of recent decades, and everyone else is treading water or slowly sinking. If so, the explosion of wealth documented in the previous chapter would no longer be worth celebrating, since it would have ceased contributing to overall human welfare.

Economic inequality has long been a signature issue of the left, and it rose in prominence after the Great Recession began in 2007. It ignited the Occupy Wall Street movement in 2011 and the presidential candidacy of the self-described socialist Bernie Sanders in 2016, who proclaimed that "a nation will not survive morally or economically when so few have so much, while so many have so little."[2] But in that year the revolution devoured its children and propelled the candidacy of Donald Trump, who claimed that the United States had become "a third-world country" and blamed the declining fortunes of the working class not on Wall Street and the one percent but on immigration and foreign trade. The left and right ends of the political spectrum, incensed by economic inequality for their different reasons, curled around to meet each other, and their shared cynicism about the modern economy helped elect the most radical American president in recent times.

Has rising inequality really immiserated the majority of citizens? Economic inequality undoubtedly has increased in most Western countries since its low point around 1980, particularly in the United States and other English-speaking countries, and especially in the contrast between the very richest and everyone else.[3] Economic inequality is usually measured by the Gini coefficient, a number that can vary between 0, when everyone has the same as everyone else, and 1, when one person has everything and everyone else has nothing. (Gini values generally range from .25 for the most egalitarian income distributions, such as in Scandinavia after taxes and benefits, to .7 for a highly unequal distribution such as the one in South Africa.) In the United States, the Gini index for market income (before taxes and benefits) rose from .44 in 1984 to .51 in 2012. Inequality can also be measured by the proportion of total income that is earned by a given fraction (quantile) of the population. In the United States, the share of income going to the richest one percent grew from 8 percent in 1980 to 18 percent in 2015, while the share going to the richest *tenth* of one percent grew from 2 percent to 8 percent.[4]

There's no question that some of the phenomena falling under the inequality rubric (there are many) are serious and must be addressed, if only to defuse the destructive agendas they have incited, such as abandoning market economies, technological progress, and foreign trade. Inequality is devilishly complicated to analyze (in a population of one million, there are 999,999 ways in which they can be unequal), and the subject has filled many books. I need a chapter on the topic because so many people have been swept up in the dystopian rhetoric and see inequality as a sign that modernity has failed to improve the human condition. As we will see, this is wrong, and for many reasons.



The starting point for understanding inequality in the context of human progress is to recognize that income inequality is not a fundamental component of well-being. It is not like health, prosperity, knowledge, safety, peace, and the other areas of progress I examine in these chapters. The reason is captured in an old joke from the Soviet Union. Igor and Boris are dirt-poor peasants, barely scratching enough crops from their small plots of land to feed their

families. The only difference between them is that Boris owns a scrawny goat. One day a fairy appears to Igor and grants him a wish. Igor says, "I wish that Boris's goat should die."

The point of the joke, of course, is that the two peasants have become more equal but that neither is better off, aside from Igor's indulging his spiteful envy. The point is made with greater nuance by the philosopher Harry Frankfurt in his 2015 book *On Inequality*.[5] Frankfurt argues that inequality itself is not morally objectionable; what is objectionable is *poverty*. If a person lives a long, healthy, pleasurable, and stimulating life, then how much money the Joneses earn, how big their house is, and how many cars they drive are morally irrelevant. Frankfurt writes, "From the point of view of morality, it is not important everyone should have *the same*. What is morally important is that each should have *enough*."[6] Indeed, a narrow focus on economic inequality can be destructive if it distracts us into killing Boris's goat instead of figuring out how Igor can get one.

The confusion of inequality with poverty comes straight out of the lump fallacy—the mindset in which wealth is a finite resource, like an antelope carcass, which has to be divvied up in zero-sum fashion, so that if some people end up with more, others must have less. As we just saw, wealth is not like that: since the Industrial Revolution, it has expanded exponentially.[7] That means that when the rich get richer, the poor can get richer, too. Even experts repeat the lump fallacy, presumably out of rhetorical zeal rather than conceptual confusion. Thomas Piketty, whose 2014 bestseller *Capital in the Twenty-First Century* became a talisman in the uproar over inequality, wrote, "The poorer half of the population are as poor today as they were in the past, with barely 5 percent of total wealth in 2010, just as in 1910."[8] But total wealth today is vastly greater than it was in 1910, so if the poorer half own the same proportion, they are far richer, not "as poor."

A more damaging consequence of the lump fallacy is the belief that if some people get richer, they must have stolen more than their share from everyone else. A famous illustration by the philosopher Robert Nozick, updated for the 21st century, shows why this is wrong.[9] Among the world's billionaires is J. K. Rowling, author of the *Harry Potter* novels, which have sold more than 400

million copies and have been adapted into a series of films seen by a similar number of people.[10] Suppose that a billion people have handed over $10 each for the pleasure of a *Harry Potter* paperback or movie ticket, with a tenth of the proceeds going to Rowling. She has become a billionaire, increasing inequality, but she has made people better off, not worse off (which is not to say that every rich person has made people better off). This doesn't mean that Rowling's wealth is just deserts for her effort or skill, or a reward for the literacy and happiness she added to the world; no committee ever judged that she deserved to be that rich. Her wealth arose as a by-product of the voluntary decisions of billions of book buyers and moviegoers.

To be sure, there may be reasons to worry about inequality itself, not just poverty. Perhaps most people are like Igor and their happiness is determined by how they compare with their fellow citizens rather than how well-off they are in absolute terms. When the rich get too rich, everyone else feels poor, so inequality lowers well-being even if everyone gets richer. This is an old idea in social psychology, variously called the theory of social comparison, reference groups, status anxiety, or relative deprivation.[11] But the idea must be kept in perspective. Imagine Seema, an illiterate woman in a poor country who is village-bound, has lost half her children to disease, and will die at fifty, as do most of the people she knows. Now imagine Sally, an educated person in a rich country who has visited several cities and national parks, has seen her children grow up, and will live to eighty, but is stuck in the lower middle class. It's conceivable that Sally, demoralized by the conspicuous wealth she will never attain, is not particularly happy, and she might even be unhappier than Seema, who is grateful for small mercies. Yet it would be mad to suppose that Sally is not better off, and positively depraved to conclude that one may as well not try to improve Seema's life because it might improve her neighbors' lives even more and leave her no happier.[12]

In any case, the thought experiment is moot, because in real life Sally almost certainly *is* happier. Contrary to an earlier belief that people are so mindful of their richer compatriots that they keep resetting their internal happiness meter to the baseline no matter how well they are doing, we will see in chapter 18 that richer people

and people in richer countries are (on average) happier than poorer people and people in poorer countries.[13]

But even if people are happier when they and their countries get richer, might they become more miserable if others around them are still richer than they are—that is, as economic inequality increases? In their well-known book *The Spirit Level,* the epidemiologists Richard Wilkinson and Kate Pickett claim that countries with greater income inequality also have higher rates of homicide, imprisonment, teen pregnancy, infant mortality, physical and mental illness, social distrust, obesity, and substance abuse.[14] The economic inequality *causes* the ills, they argue: unequal societies make people feel that they are pitted in a winner-take-all competition for dominance, and the stress makes them sick and self-destructive.

The Spirit Level theory has been called "the left's new theory of everything," and it is as problematic as any other theory that leaps from a tangle of correlations to a single-cause explanation. For one thing, it's not obvious that people are whipped into competitive anxiety by the existence of J. K. Rowling and Sergey Brin as opposed to their own, local rivals for professional, romantic, and social success. Worse, economically egalitarian countries like Sweden and France differ from lopsided countries like Brazil and South Africa in many ways other than their income distribution. The egalitarian countries are, among other things, richer, better educated, better governed, and more culturally homogeneous, so a raw correlation between inequality and happiness (or any other social good) may show only that there are many reasons why it's better to live in Denmark than in Uganda. Wilkinson and Pickett's sample was restricted to developed countries, but even within that sample the correlations are evanescent, coming and going with choices about which countries to include.[15] Wealthy but unequal countries, such as Singapore and Hong Kong, are often socially healthier than poorer but more equal countries, such as those of ex-Communist Eastern Europe.

Most damagingly, the sociologists Jonathan Kelley and Mariah Evans have snipped the causal link joining inequality to happiness in a study of two hundred thousand people in sixty-eight societies over three decades.[16] (We will examine how happiness and life

satisfaction are measured in chapter 18.) Kelley and Evans held constant the major factors that are known to affect happiness, including GDP per capita, age, sex, education, marital status, and religious attendance, and found that the theory that inequality causes unhappiness "comes to shipwreck on the rock of the facts." In developing countries, inequality is not dispiriting but heartening: people in the more unequal societies are *happier*. The authors suggest that whatever envy, status anxiety, or relative deprivation people may feel in poor, unequal countries is swamped by *hope*. Inequality is seen as a harbinger of opportunity, a sign that education and other routes to upward mobility might pay off for them and their children. Among developed countries (other than formerly Communist ones), inequality made no difference one way or another. (In formerly Communist countries, the effects were also equivocal: inequality hurt the aging generation that grew up under communism, but helped or made no difference to the younger generations.)

The fickle effects of inequality on well-being bring up another common confusion in these discussions: the conflation of inequality with *unfairness*. Many studies in psychology have shown that people, including young children, prefer windfalls to be split evenly among participants, even if everyone ends up with less overall. That led some psychologists to posit a syndrome called inequity aversion: an apparent desire to spread the wealth. But in their recent article "Why People Prefer Unequal Societies," the psychologists Christina Starmans, Mark Sheskin, and Paul Bloom took another look at the studies and found that people prefer *unequal* distributions, both among fellow participants in the lab and among citizens in their country, as long as they sense that the allocation is *fair:* that the bonuses go to harder workers, more generous helpers, or even the lucky winners of an impartial lottery.[17] "There is no evidence so far," the authors conclude, "that children or adults possess any general aversion to inequality." People are content with economic inequality as long as they feel that the country is meritocratic, and they get angry when they feel it isn't. Narratives about the *causes* of inequality loom larger in people's minds than the *existence* of inequality. That creates an opening for politicians to rouse the rabble by singling out cheaters who take more than their fair share:

welfare queens, immigrants, foreign countries, bankers, or the rich, sometimes identified with ethnic minorities.[18]

In addition to effects on individual psychology, inequality has been linked to several kinds of society-wide dysfunction, including economic stagnation, financial instability, intergenerational immobility, and political influence-peddling. These harms must be taken seriously, but here too the leap from correlation to causation has been contested.[19] Either way, I suspect that it's less effective to aim at the Gini index as a deeply buried root cause of many social ills than to zero in on solutions to each problem: investment in research and infrastructure to escape economic stagnation, regulation of the finance sector to reduce instability, broader access to education and job training to facilitate economic mobility, electoral transparency and finance reform to eliminate illicit influence, and so on. The influence of money on politics is particularly pernicious because it can distort every government policy, but it's not the same issue as income inequality. After all, in the absence of electoral reform the richest donors can get the ear of politicians whether they earn 2 percent of national income or 8 percent of it.[20]

Economic inequality, then, is not itself a dimension of human well-being, and it should not be confused with unfairness or with poverty. Let's now turn from the moral significance of inequality to the question of why it has changed over time.



The simplest narrative of the history of inequality is that it comes with modernity. We must have begun in a state of original equality, because when there is no wealth, everyone has equal shares of nothing, and then, when wealth is created, some can have more of it than others. Inequality, in this story, started at zero, and as wealth increased over time, inequality grew with it. But the story is not quite right.

Hunter-gatherers are by all appearances highly egalitarian, a fact that inspired Marx and Engels's theory of "primitive communism." But ethnographers point out that the image of forager egalitarianism is misleading. For one thing, the hunter-gatherer bands that are still around for us to study are not representative of an ancestral way of life, because they have been pushed into

marginal lands and lead nomadic lives that make the accumulation of wealth impossible, if for no other reason than that it would be a nuisance to carry around. But sedentary hunter-gatherers, such as the natives of the Pacific Northwest, which is flush with salmon, berries, and fur-bearing animals, were florid inegalitarians, and developed a hereditary nobility who kept slaves, hoarded luxuries, and flaunted their wealth in gaudy potlatches. Also, while nomadic hunter-gatherers share meat, since hunting is largely a matter of luck and sharing a windfall insures everyone against days in which they come home empty-handed, they are less likely to share plant foods, since gathering is a matter of effort, and indiscriminate sharing would allow free-riding.[21] Some degree of inequality is universal across societies, as is an awareness of inequality.[22] A recent survey of inequality in the forms of wealth that are possible for hunter-gatherers (houses, boats, and hunting and foraging returns) found that they were "far from a state of 'primitive communism'": the Ginis averaged .33, close to the value for disposable income in the United States in 2012.[23]

What happens when a society starts to generate substantial wealth? An increase in *absolute* inequality (the difference between the richest and poorest) is almost a mathematical necessity. In the absence of an Income Distribution Authority that parcels out identical shares, some people are bound to take greater advantage of the new opportunities than others, whether by luck, skill, or effort, and they will reap disproportionate rewards.

An increase in *relative* inequality (measured by the Gini or income shares) is not mathematically necessary, but it is highly likely. According to a famous conjecture by the economist Simon Kuznets, as countries get richer they should get less equal, because some people leave farming for higher-paying lines of work while the rest stay in rural squalor. But eventually a rising tide lifts all the boats. As more of the population gets swept into the modern economy, inequality should decline, tracing out an inverted U. This hypothetical arc of inequality over time is called the Kuznets curve.[24]

In the preceding chapter we saw hints of a Kuznets curve for inequality between countries. As the Industrial Revolution gathered steam, European countries made a Great Escape from universal

poverty, leaving the other countries behind. As Deaton observes, “A better world makes for a world of differences; escapes make for inequality.”[25] Then, as globalization proceeded and wealth-generating know-how spread, poor countries started catching up in a Great Convergence. We saw hints of a drop in global inequality in the blastoff of GDP in Asian countries (figure 8-2), in the morphing of the world income distribution from snail to two-humped camel to one-humped dromedary (figure 8-3), and in the plunging proportion (figure 8-4) and number (figure 8-5) of people living in extreme poverty.

To confirm that these gains really constitute a decline in inequality—that poor countries are getting richer faster than the rich countries are getting richer—we need a single measure that combines them, an international Gini, which treats each country like a person. Figure 9-1 shows that the international Gini rose from a low of .16 in 1820, when all countries were poor, to a high of .56 in 1970, when some were rich, and then, as Kuznets predicted, it plateaued and began to droop in the 1980s.[26] But an international Gini is a bit misleading, because it counts an improvement in the living standards of a billion Chinese as equivalent to an improvement in the standards of, say, four million Panamanians. Figure 9-1 also shows an international Gini calculated by the economist Branko Milanović in which every country counts in proportion to its population, making the human impact of the drop in inequality more apparent.

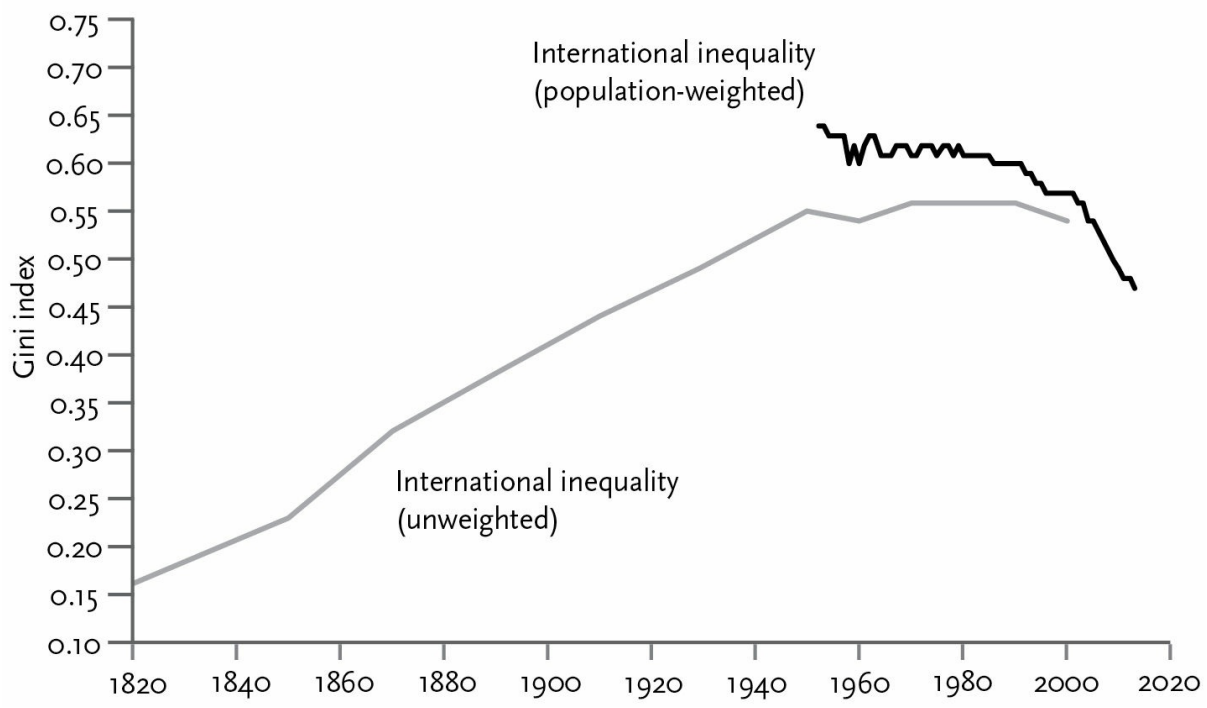


Figure 9-1: International inequality, 1820–2013

Sources: International inequality: OECD Clio Infra Project, Moatsos et al. 2014; data are for market household income across countries. **Population-weighted international inequality:** Milanović 2012; data for 2012 and 2013 provided by Branko Milanović, personal communication.

Still, an international Gini treats all the Chinese as if they earned the same amount, all the Americans as if they earned the American average, and so on, and as a result it underestimates inequality across the human race. A global Gini, in which every *person* counts the same, regardless of country, is harder to calculate, because it requires mixing the incomes from disparate countries into a single bowl, but two estimates are shown in figure 9-2. The lines float at different heights because they were calibrated in dollars adjusted for purchasing parity in different years, but their slopes trace out a kind of Kuznets curve: after the Industrial Revolution, global inequality rose steadily until around 1980, then started to fall. The international and global Gini curves show that despite the anxiety about rising inequality within Western countries, *inequality in the world is declining*. That's a circuitous way to state the progress, though: what's significant about the decline in inequality is that it's a decline in poverty.

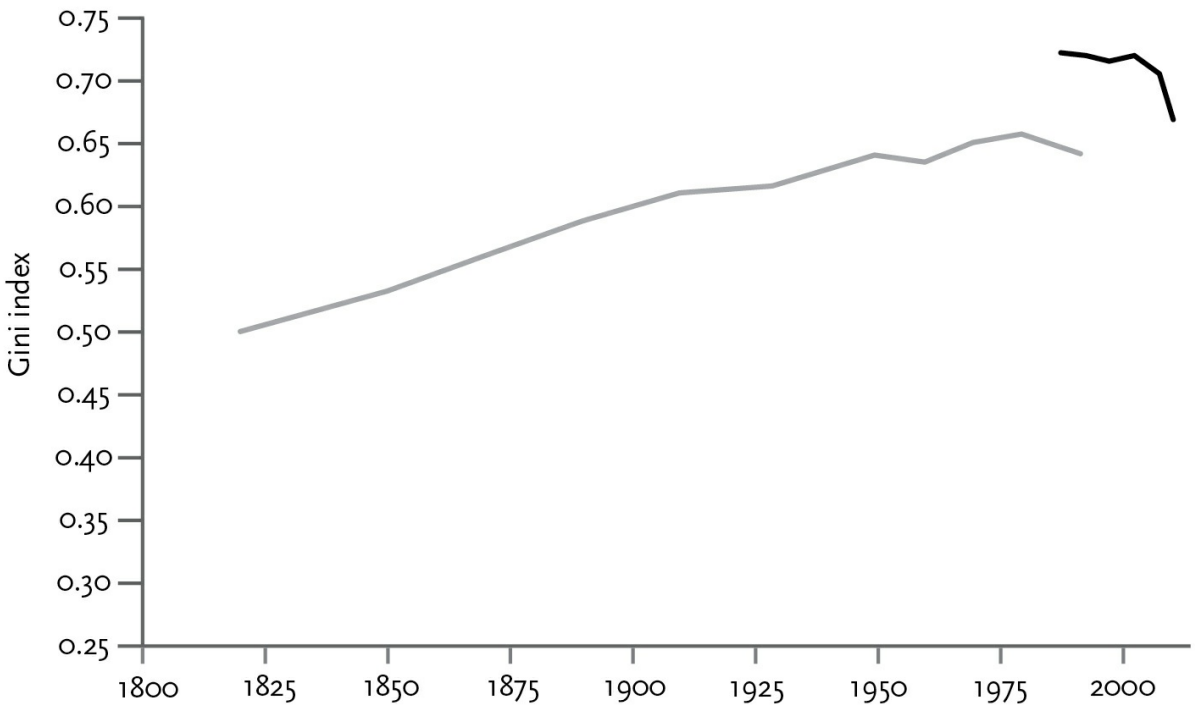


Figure 9-2: Global inequality, 1820–2011

Source: Milanović 2016, fig. 3.1. The left-hand curve shows 1990 international dollars of disposable income per capita; the right-hand curve shows 2005 international dollars, and combines household surveys of per capita disposable income and consumption.

The version of inequality that has generated the recent alarm is the inequality within developed countries like the United States and the United Kingdom. The long view of these countries is shown in figure 9-3. Until recently, both countries traveled a Kuznets arc. Inequality rose during the Industrial Revolution and then began to fall, first gradually in the late 19th century, then steeply in the middle decades of the 20th. But then, starting around 1980, inequality bounced into a decidedly un-Kuznetsian rise. Let's examine each segment in turn.



Figure 9-3: Inequality, UK and US, 1688–2013

Source: Milanović 2016, fig. 2.1, disposable income per capita.

The rise and fall in inequality in the 19th century reflects Kuznets's expanding economy, which gradually pulls more people into urban, skilled, and thus higher-paying occupations. But the 20th-century plunge—which has been called the Great Leveling or the Great Compression—had more sudden causes. The plunge overlaps the two world wars, and that is no coincidence: major wars often level the income distribution.[27] Wars destroy wealth-generating capital, inflate away the assets of creditors, and induce the rich to put up with higher taxes, which the government redistributes into the paychecks of soldiers and munition workers, in turn increasing the demand for labor in the rest of the economy.

Wars are just one kind of catastrophe that can generate equality by the logic of Igor and Boris. The historian Walter Scheidel identifies "Four Horsemen of Leveling": mass-mobilization warfare, transformative revolution, state collapse, and lethal pandemics. In addition to obliterating wealth (and, in the communist revolutions, the people who owned it), the four horsemen reduce inequality by killing large numbers of workers, driving up the wages of those who survive. Scheidel concludes, "All of us who prize greater economic equality would do well to remember that with the rarest of

exceptions it was only ever brought forth in sorrow. Be careful what you wish for."[28]

Scheidel's warning applies to the long run of history. But modernity has brought a more benign way to reduce inequality. As we have seen, a market economy is the best poverty-reduction program we know of for an entire country. It is ill-equipped, however, to provide for individuals within that country who have nothing to exchange: the young, the old, the sick, the unlucky, and others whose skills and labor are not valuable enough to others for them to earn a decent living in return. (Another way of putting it is that a market economy maximizes the average, but we also care about the variance and the range.) As the circle of sympathy in a country expands to encompass the poor (and as people want to insure themselves should they ever become poor), they increasingly allocate a portion of their pooled resources—that is, government funds—to alleviating that poverty. Those resources have to come from somewhere. They may come from a corporate or sales tax, or a sovereign wealth fund, but in most countries they largely come from a graduated income tax, in which richer citizens pay at a higher rate because they don't feel the loss as sharply. The net result is "redistribution," but that is something of a misnomer, because the goal is to raise the bottom, not lower the top, even if in practice the top is lowered.

Those who condemn modern capitalist societies for callousness toward the poor are probably unaware of how little the pre-capitalist societies of the past spent on poor relief. It's not just that they had less to spend in absolute terms; they spent a smaller proportion of their wealth. A *much* smaller proportion: from the Renaissance through the early 20th century, European countries spent an average of 1.5 percent of their GDP on poor relief, education, and other social transfers. In many countries and periods, they spent nothing at all.[29]

In another example of progress, sometimes called the Egalitarian Revolution, modern societies now devote a substantial chunk of their wealth to health, education, pensions, and income support.[30] Figure 9-4 shows that social spending took off in the middle decades of the 20th century (in the United States, with the New Deal in the 1930s; in other developed countries, with the rise of the welfare

state after World War II). Social spending now takes up a median of 22 percent of their GDP.[31]

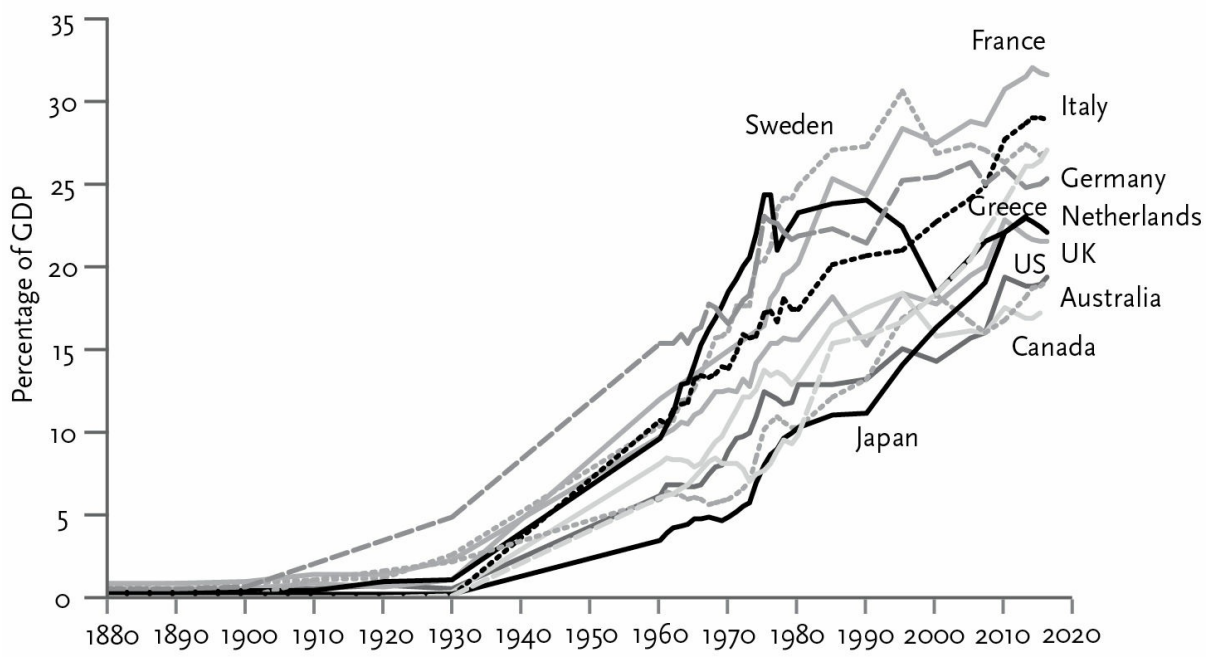


Figure 9-4: Social spending, OECD countries, 1880–2016

Source: *Our World in Data,* Ortiz-Ospina & Roser 2016b, based on data from Lindert 2004 and OECD 1985, 2014, 2017. The Organisation for Economic Co-operation and Development includes thirty-five democratic states with market economies.

The explosion in social spending has redefined the mission of government: from warring and policing to also nurturing.[32] Governments underwent this transformation for several reasons. Social spending inoculates citizens against the appeal of communism and fascism. Some of the benefits, like universal education and public health, are public goods that accrue to everyone, not just the direct beneficiaries. Many of the programs indemnify citizens against misfortunes for which they can't or won't insure themselves (hence the euphemism "social safety net"). And assistance to the needy assuages the modern conscience, which cannot bear the thought of the Little Match Girl freezing to death, Jean Valjean imprisoned for stealing bread to save his starving sister, or the Joads burying Grampa by the side of Route 66.

Since there's no point in everyone sending money to the government and getting it right back (minus the bureaucracy's cut), social spending is designed to help people who have less money,

with the bill footed by people who have more money. This is the principle known as redistribution, the welfare state, social democracy, or socialism (misleadingly, because free-market capitalism is compatible with any amount of social spending). Whether or not the social spending is *designed* to reduce inequality, that is one of its effects, and the rise in social expenditures from the 1930s through the 1970s explains part of the decline in the Gini.

Social spending demonstrates an uncanny aspect of progress that we'll encounter again in subsequent chapters.[33] Though I am skittish about any notion of historical inevitability, cosmic forces, or mystical arcs of justice, some kinds of social change really do seem to be carried along by an inexorable tectonic force. As they proceed, certain factions oppose them hammer and tongs, but resistance turns out to be futile. Social spending is an example. The United States is famously resistant to anything smacking of redistribution. Yet it allocates 19 percent of its GDP to social services, and despite the best efforts of conservatives and libertarians the spending has continued to grow. The most recent expansions are a prescription drug benefit introduced by George W. Bush and the eponymous health insurance plan known as Obamacare introduced by his successor.

Indeed, social spending in the United States is even higher than it appears, because many Americans are forced to pay for health, retirement, and disability benefits through their employers rather than the government. When this privately administered social spending is added to the public portion, the United States vaults from twenty-fourth into second place among the thirty-five OECD countries, just behind France.[34]

For all their protestations against big government and high taxes, people *like* social spending. Social Security has been called the third rail of American politics, because if politicians touch it they die. According to legend, an irate constituent at a town-hall meeting warned his representative, "Keep your government hands off my Medicare" (referring to the government health insurance program for seniors).[35] No sooner did Obamacare pass than the Republican Party made it a sacred cause to repeal it, but each of their assaults on it after gaining control of the presidency in 2017 was beaten back by angry citizens at town-hall meetings and

legislators afraid of their ire. In Canada the top two national pastimes (after hockey) are complaining about their health care system and boasting about their health care system.

Developing countries today, like developed countries a century ago, stint on social spending. Indonesia, for example, spends 2 percent of its GDP, India 2.5 percent, and China 7 percent. But as they get richer they become more munificent, a phenomenon called Wagner's Law.[36] Between 1985 and 2012 Mexico quintupled its proportion of social spending, and Brazil's now stands at 16 percent.[37] Wagner's Law appears to be not a cautionary tale about overweening government and bureaucratic bloat but a manifestation of progress. The economist Leandro Prados de la Escosura found a strong correlation between the percentage of GDP that an OECD country allocated to social transfers as it developed between 1880 and 2000 and its score on a composite measure of prosperity, health, and education.[38] And tellingly, the number of libertarian paradises in the world—developed countries without substantial social spending—is zero.[39]

The correlation between social spending and social well-being holds only up to a point: the curve levels off starting at around 25 percent and may even drop off at higher proportions. Social spending, like everything, has downsides. As with all insurance, it can create a "moral hazard" in which the insured slack off or take foolish risks, counting on the insurer to bail them out if they fail. And since the premiums have to cover the payouts, if the actuaries get the numbers wrong or the numbers change so that more money is taken out than put in, the system can collapse. In reality social spending is never exactly like insurance but is a combination of insurance, investment, and charity. Its success thus depends on the degree to which the citizens of a country sense they are part of one community, and that fellow feeling can be strained when the beneficiaries are disproportionately immigrants or ethnic minorities.[40] These tensions are inherent to social spending and will always be politically contentious. Though there is no "correct amount," all developed states have decided that the benefits of social transfers outweigh the costs and have settled on moderately large amounts, cushioned by their massive wealth.



Let's complete our tour of the history of inequality by turning to the final segment in figure 9-3, the rise of inequality in wealthy nations that began around 1980. This is the development that inspired the claim that life has gotten worse for everyone but the richest. The rebound defies the Kuznets curve, in which inequality was supposed to have settled into a low equilibrium. Many explanations have been proffered for this surprise.[41] Wartime restrictions on economic competition may have been sticky, outlasting World War II, but they finally dissipated, freeing the rich to get richer from their investment income and opening up an arena of dynamic economic competition with winner-take-all payoffs. The ideological shift associated with Ronald Reagan and Margaret Thatcher slowed the movement toward greater social spending financed by taxes on the rich while eroding social norms against extravagant salaries and conspicuous wealth. As more people stayed single or got divorced, and at the same time more power couples pooled two fat paychecks, the variance in income from household to household was bound to increase, even if the paychecks had stayed the same. A "second industrial revolution" driven by electronic technologies replayed the Kuznets rise by creating a demand for highly skilled professionals, who pulled away from the less educated at the same time that the jobs requiring less education were eliminated by automation. Globalization allowed workers in China, India, and elsewhere to underbid their American competitors in a worldwide labor market, and the domestic companies that failed to take advantage of these offshoring opportunities were outcompeted on price. At the same time, the intellectual output of the most successful analysts, entrepreneurs, investors, and creators was increasingly available to a gargantuan worldwide market. The Pontiac worker is laid off, while J. K. Rowling becomes a billionaire.

Milanović has combined the two inequality trends of the past thirty years—declining inequality worldwide, increasing inequality within rich countries—into a single graph which pleasingly takes the shape of an elephant (figure 9-5). This "growth incidence curve" sorts the world's population into twenty numerical bins or quantiles, from poorest to richest, and plots how much each bin gained or lost in real income per capita between 1988 (just before

the fall of the Berlin Wall) and 2008 (just before the Great Recession).



Figure 9-5: Income gains, 1988–2008

Source: Milanović 2016, fig. 1.3.

The cliché about globalization is that it creates winners and losers, and the elephant curve displays them as peaks and valleys. It reveals that the winners include most of humanity. The elephant's bulk (its body and head), which includes about seven-tenths of the world's population, consists of the "emerging global middle class," mainly in Asia. Over this period they saw cumulative gains of 40 to 60 percent in their real incomes. The nostrils at the tip of the trunk consist of the world's richest one percent, who also saw their incomes soar. The rest of the trunk tip, which includes the next 4 percent down, didn't do badly either. Where the bend of the trunk hovers over the floor around the 85th percentile we see globalization's "losers": the lower middle classes of the rich world, who gained less than 10 percent. These are the focus of the new concern about inequality: the "hollowed-out middle class," the Trump supporters, the people globalization left behind.

I couldn't resist plotting the most recognizable elephant in Milanović's herd, because it serves as a vivid mnemonic for the effects of globalization (and it rounds out a nice menagerie with the camel and dromedary in figure 8-3). But the curve makes the world look more unequal than it really is, for two reasons. One is that the financial crisis of 2008, which postdated the graph, had a strangely equalizing effect on the world. The Great Recession, Milanović points out, was really a recession in North Atlantic countries. The incomes of the world's richest one percent were trimmed, but the incomes of workers elsewhere soared (in China, they doubled). Three years after the crisis we still see an elephant, but it has lowered the tip of its trunk while arching its back twice as high.[42]

The other elephant-distorter is a conceptual point that bedevils many discussions of inequality. Whom are we talking about when we say "the bottom fifth" or "the top one percent"? Most income distributions use what economists call anonymous data: they track statistical ranges, not actual people.[43] Suppose I told you that the age of the median American declined from thirty in 1950 to twenty-eight in 1970. If your first thought is "Wow, how did that guy get two years younger?" then you have confused the two: the "median" is a rank, not a person. Readers commit the same fallacy when they read that "the top one percent in 2008" had incomes that were 50 percent higher than "the top one percent in 1988" and conclude that a bunch of rich people got half again richer. People move in and out of income brackets, shuffling the order, so we're not necessarily talking about the same individuals. The same is true for "the bottom fifth" and every other statistical bin.

Nonanonymous or longitudinal data, which track people over time, are unavailable in most countries, so Milanović did the next best thing and tracked individual quantiles in particular countries, so that, say, poor Indians in 1988 were no longer being compared with poor Ghanaians in 2008.[44] He still got an elephantoid, but with a much higher tail and haunches, because the poorer classes of so many countries rose out of extreme poverty. The pattern remains—globalization helped the lower and middle classes of poor countries, and the upper class of rich countries, much more than it helped the lower middle class of rich countries—but the differences are less extreme.

~

Now that we have run through the history of inequality and seen the forces that push it around, we can evaluate the claim that the growing inequality of the past three decades means that the world is getting worse—that only the rich have prospered, while everyone else is stagnating or suffering. The rich certainly have prospered more than anyone else, perhaps more than they should have, but the claim about everyone else is not accurate, for a number of reasons.

Most obviously, it's false for the world as a whole: the majority of the human race has become much better off. The two-humped camel has become a one-humped dromedary; the elephant has a body the size of, well, an elephant; extreme poverty has plummeted and may disappear; and both international and global inequality coefficients are in decline. Now, it's true that the world's poor have gotten richer in part at the expense of the American lower middle class, and if I were an American politician I would not publicly say that the tradeoff was worth it. But as citizens of the world considering humanity as a whole, we have to say that the tradeoff is worth it.

But even in the lower and lower middle classes of rich countries, moderate income gains are not the same as a decline in living standards. Today's discussions of inequality often compare the present era unfavorably with a golden age of well-paying, dignified, blue-collar jobs that have been made obsolete by automation and globalization. This idyllic image is belied by contemporary depictions of the harshness of working-class life in that era, both in journalistic exposés (such as Michael Harrington's 1962 *The Other America*) and in realistic films (such as *On the Waterfront, Blue Collar, Coal Miner's Daughter,* and *Norma Rae*). The historian Stephanie Coontz, a debunker of 1950s nostalgia, puts some numbers to the depictions:

> A full 25 percent of Americans, 40 to 50 million people, were poor in the mid-1950s, and in the absence of food stamps and housing programs, this poverty was searing. Even at the end of the 1950s, a third of American children were poor. Sixty percent of Americans over sixty-five had incomes below

> $1,000 in 1958, considerably below the $3,000 to $10,000 level considered to represent middle-class status. A majority of elders also lacked medical insurance. Only half the population had savings in 1959; one-quarter of the population had no liquid assets at all. Even when we consider only native-born, white families, one-third could not get by on the income of the household head.[45]

How do we reconcile the obvious improvements in living standards in recent decades with the conventional wisdom of economic stagnation? Economists point to four ways in which inequality statistics can paint a misleading picture of the way people live their lives, each depending on a distinction we have examined.

The first is the difference between relative and absolute prosperity. Just as not all children can be above average, it's not a sign of stagnation if the proportion of income earned by the bottom fifth does not increase over time. What's relevant to well-being is how much people earn, not how high they rank. A recent study by the economist Stephen Rose divided the American population into classes using fixed milestones rather than quantiles. "Poor" was defined as an income of $0–$30,000 (in 2014 dollars) for a family of three, "lower middle class" as $30,000–$50,000, and so on.[46] The study found that in absolute terms, Americans have been moving on up. Between 1979 and 2014, the percentage of poor Americans dropped from 24 to 20, the percentage in the lower middle class dropped from 24 to 17, and the percentage in the middle class shrank from 32 to 30. Where did they go? Many ended up in the upper middle class ($100,000–$350,000), which grew from 13 to 30 percent of the population, and in the upper class, which grew from 0.1 percent to 2 percent. The middle class is being hollowed out in part because so many Americans are becoming affluent. Inequality undoubtedly increased—the rich got richer faster than the poor and middle class got richer—but everyone (on average) got richer.

The second confusion is the one between anonymous and longitudinal data. If (say) the bottom fifth of the American population gained no ground in twenty years, it does not mean that Joe the Plumber got the same paycheck in 1988 that he did in 2008

(or one that's a bit higher, owing to cost-of-living increases). People earn more as they get older and gain experience, or switch from a lower-paying job to a higher-paying one, so Joe may have moved from the bottom fifth into, say, the middle fifth, while a younger man or woman or an immigrant took his place at the bottom. The turnover is by no means small. A recent study using longitudinal data showed that half of Americans will find themselves among the top tenth of income earners for at least one year of their working lives, and that one in nine will find themselves in the top one percent (though most don't stay there for long).[47] This may be one of the reasons that economic opinions are subject to the Optimism Gap (the "I'm OK, They're Not" bias): a majority of Americans believe that the standard of living of the middle class has declined in recent years but that their own standard of living has improved.[48]

A third reason that rising inequality has not made the lower classes worse off is that low incomes have been mitigated by social transfers. For all its individualist ideology, the United States has a lot of redistribution. The income tax is still graduated, and low incomes are buffered by a "hidden welfare state" that includes unemployment insurance, Social Security, Medicare, Medicaid, Temporary Assistance for Needy Families, food stamps, and the Earned Income Tax Credit, a kind of negative income tax in which the government boosts the income of low earners. Put them together and America becomes far less unequal. In 2013 the Gini index for American market income (before taxes and transfers) was a high .53; for disposable income (after taxes and transfers) it was a moderate .38.[49] The United States has not gone as far as countries like Germany and Finland, which start off with a similar market income distribution but level it more aggressively, pushing their Ginis down into the high .2s and sidestepping most of the post-1980s inequality rise. Whether or not the generous European welfare state is sustainable over the long run and transplantable to the United States, some kind of welfare state may be found in all developed countries, and it reduces inequality even when it is hidden.[50]

These transfers have not just reduced income inequality (in itself a dubious accomplishment) but boosted the incomes of the nonrich (a real one). An analysis by the economist Gary Burtless has shown

that between 1979 and 2010 the disposable incomes of the lowest four income quintiles grew by 49, 37, 36, and 45 percent, respectively.[51] And that was before the long-delayed recovery from the Great Recession: between 2014 and 2016, median wages leapt to an all-time high.[52]

Even more significant is what has happened at the bottom of the scale. Both the left and the right have long expressed cynicism about antipoverty programs, as in Ronald Reagan's famous quip, "Some years ago, the federal government declared war on poverty, and poverty won." In reality, poverty is losing. The sociologist Christopher Jencks has calculated that when the benefits from the hidden welfare state are added up, and the cost of living is estimated in a way that takes into account the improving quality and falling price of consumer goods, the poverty rate has fallen in the past fifty years by more than three-quarters, and in 2013 stood at 4.8 percent.[53] Three other analyses have come to the same conclusion; data from one of them, by the economists Bruce Meyer and James Sullivan, are shown in the upper line in figure 9-6. The progress stagnated around the time of the Great Recession, but it picked up in 2015 and 2016 (not shown in the graph), when middle-class income reached a record high and the poverty rate showed its largest drop since 1999.[54] And in yet another unsung accomplishment, the poorest of the poor—the unsheltered homeless—fell in number between 2007 and 2015 by almost a third, despite the Great Recession.[55]

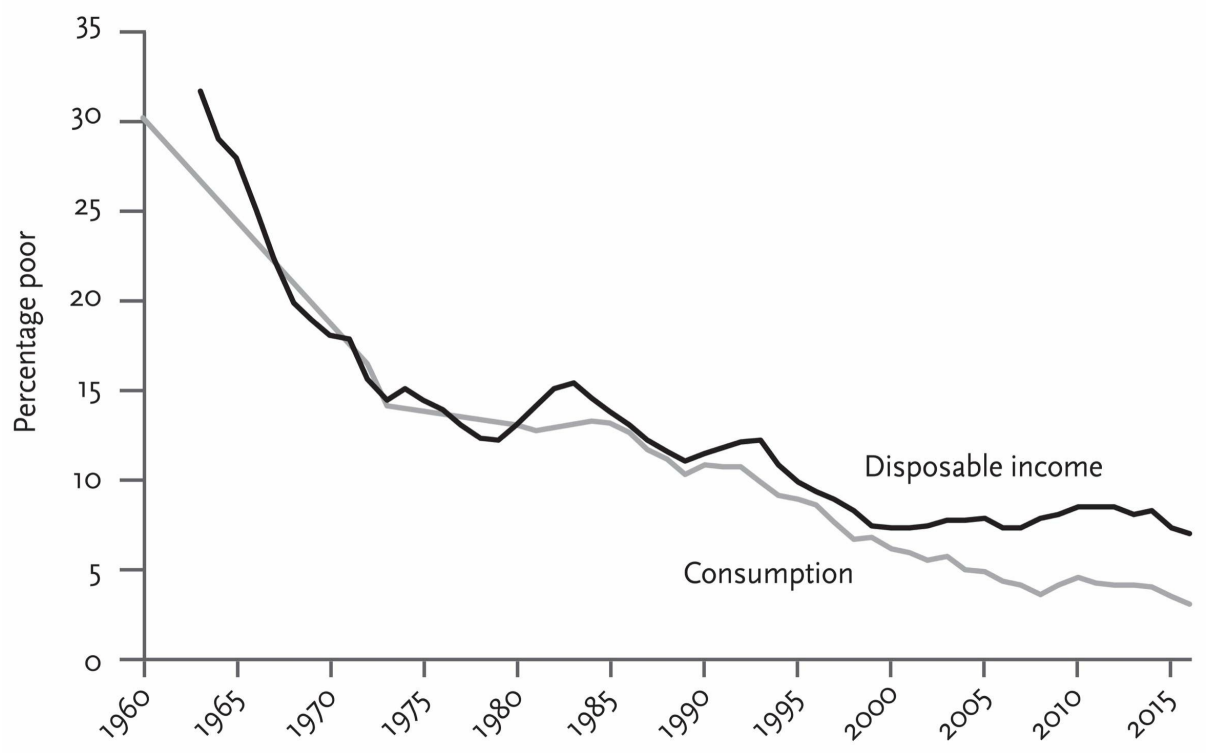


Figure 9-6: Poverty, US, 1960–2016

Sources: Meyer & Sullivan 2017a, b. "Disposable income" refers to their "After-tax money income," including credits, adjusted for inflation using the bias-corrected CPI-U-RS, and representing a family with two adults and two children. "Consumption" refers to data from the BLS Consumer Expenditure Survey on food, housing, vehicles, appliances, furnishings, clothing, jewelry, insurance, and other expenses. "Poverty" corresponds to the US Census definition for 1980, adjusted for inflation; anchoring the poverty line in other years would result in different absolute numbers but the same trends. See Meyer & Sullivan 2011, 2012, and 2017a, b for details.

The lower line in figure 9-6 highlights the fourth way in which inequality measures understate the progress of the lower and middle classes in rich countries.[56] Income is just a means to an end: a way of paying for things that people need, want, and like, or as economists gracelessly call it, consumption. When poverty is defined in terms of what people consume rather than what they earn, we find that the American poverty rate has declined by *ninety percent* since 1960, from 30 percent of the population to just 3 percent. The two forces that have famously increased inequality in income have at the same time decreased inequality in what matters. The first, globalization, may produce winners and losers in income, but in consumption it makes almost everyone a winner. Asian factories, container ships, and efficient retailing bring goods to the masses that were formerly luxuries for the rich. (In 2005 the

economist Jason Furman estimated that Walmart saved the typical American family $2,300 a year.)[57] The second force, technology, continually revolutionizes the meaning of income (as we saw in the discussion of the paradox of value in chapter 8). A dollar today, no matter how heroically adjusted for inflation, buys far more betterment of life than a dollar yesterday. It buys things that didn't exist, like refrigeration, electricity, toilets, vaccinations, telephones, contraception, and air travel, and it transforms things that do exist, such as a party line patched by a switchboard operator to a smartphone with unlimited talk time.

Together, technology and globalization have transformed what it means to be a poor person, at least in developed countries. The old stereotype of poverty was an emaciated pauper in rags. Today, the poor are likely to be as overweight as their employers, and dressed in the same fleece, sneakers, and jeans. The poor used to be called the have-nots. In 2011, more than 95 percent of American households below the poverty line had electricity, running water, flush toilets, a refrigerator, a stove, and a color TV.[58] (A century and a half before, the Rothschilds, Astors, and Vanderbilts had none of these things.) Almost half of the households below the poverty line had a dishwasher, 60 percent had a computer, around two-thirds had a washing machine and a clothes dryer, and more than 80 percent had an air conditioner, a video recorder, and a cell phone. In the golden age of economic equality in which I grew up, middle-class "haves" had few or none of these things. As a result, the most precious resources of all—time, freedom, and worthy experiences—are rising across the board, a topic we will explore in chapter 17.

The rich have gotten richer, but their lives haven't gotten *that* much better. Warren Buffett may have more air conditioners than most people, or better ones, but by historical standards the fact that a majority of poor Americans even *have* an air conditioner is astonishing. When the Gini index is calculated over consumption rather than income, it has remained shallow or flat.[59] Inequality in self-reported happiness in the American population has actually declined.[60] And though I find it distasteful, even grotesque, to celebrate declining Ginis for life, health, and education (as if killing off the healthiest and keeping the smartest out of school would be good for humanity), they have in fact declined for the right reasons:

the lives of the poor are improving more rapidly than the lives of the rich.[61]



To acknowledge that the lives of the lower and middle classes of developed countries have improved in recent decades is not to deny the formidable problems facing 21st-century economies. Though disposable income has increased, the pace of the increase is slow, and the resulting lack of consumer demand may be dragging down the economy as a whole.[62] The hardships faced by one sector of the population—middle-aged, less-educated, non-urban white Americans—are real and tragic, manifested in higher rates of drug overdose (chapter 12) and suicide (chapter 18). Advances in robotics threaten to make millions of additional jobs obsolete. Truck drivers, for example, make up the most common occupation in a majority of states, and self-driving vehicles may send them the way of scriveners, wheelwrights, and switchboard operators. Education, a major driver of economic mobility, is not keeping up with the demands of modern economies: tertiary education has soared in cost (defying the inexpensification of almost every other good), and in poor American neighborhoods, primary and secondary education are unconscionably substandard. Many parts of the American tax system are regressive, and money buys too much political influence. Perhaps most damaging, the impression that the modern economy has left most people behind encourages Luddite and beggar-thy-neighbor policies that would make everyone worse off.

Still, a narrow focus on income inequality and a nostalgia for the mid-20th-century Great Compression are misplaced. The modern world can continue to improve even if the Gini index or top income shares stay high, as they may well do, because the forces that lifted them are not going away. Americans cannot be forced to buy Pontiacs instead of Priuses. The *Harry Potter* books will not be kept out of the hands of the world's children just because they turn J. K. Rowling into a billionaire. It makes little sense to make tens of millions of poor Americans pay more for clothing to save tens of thousands of jobs in the apparel industry.[63] Nor does it make sense, in the long term, to have people do boring and dangerous jobs that could be carried out more effectively by machines just to give them remunerable work.[64]

Rather than tilting at inequality per se it may be more constructive to target the specific problems lumped with it.[65] An obvious priority is to boost the rate of economic growth, since it would increase everyone's slice of the pie and provide more pie to redistribute.[66] The trends of the past century, and a survey of the world's countries, point to governments playing an increasing role in both. They are uniquely suited to invest in education, basic research, and infrastructure, to underwrite health and retirement benefits (relieving American corporations of their enervating mandate to provide social services), and to supplement incomes to a level above their market price, which for millions of people may decline even as overall wealth rises.[67]

The next step in the historic trend toward greater social spending may be a universal basic income (or its close relative, a negative income tax). The idea has been bruited for decades, and its day may be coming.[68] Despite its socialist aroma, the idea has been championed by economists (such as Milton Friedman), politicians (such as Richard Nixon), and states (such as Alaska) that are associated with the political right, and today analysts across the political spectrum are toying with it. Though implementing a universal basic income is far from easy (the numbers have to add up, and incentives for education, work, and risk-taking have to be maintained), its promise cannot be ignored. It could rationalize the kludgy patchwork of the hidden welfare state, and it could turn the slow-motion disaster of robots replacing workers into a horn of plenty. Many of the jobs that robots will take over are jobs that people don't particularly enjoy, and the dividend in productivity, safety, and leisure could be a boon to humanity as long as it is widely shared. The specter of anomie and meaninglessness is probably exaggerated (according to studies of regions that have experimented with a guaranteed income), and it could be met with public jobs that markets won't support and robots can't do, or with new opportunities in meaningful volunteering and other forms of effective altruism.[69] The net effect might be to reduce inequality, but that would be a side effect of raising everyone's standard of living, particularly that of the economically vulnerable.



Income inequality, in sum, is not a counterexample to human

progress, and we are not living in a dystopia of falling incomes that has reversed the centuries-long rise in prosperity. Nor does it call for smashing the robots, raising the drawbridge, switching to socialism, or bringing back the 50s. Let me sum up my complicated story on a complicated topic.

Inequality is not the same as poverty, and it is not a fundamental dimension of human flourishing. In comparisons of well-being across countries, it pales in importance next to overall wealth. An increase in inequality is not necessarily bad: as societies escape from universal poverty, they are bound to become more unequal, and the uneven surge may be repeated when a society discovers new sources of wealth. Nor is a decrease in inequality always good: the most effective levelers of economic disparities are epidemics, massive wars, violent revolutions, and state collapse.

For all that, the long-term trend in history since the Enlightenment is for everyone's fortunes to rise. In addition to generating massive amounts of wealth, modern societies have devoted an increasing proportion of that wealth to benefiting the less well-off.

As globalization and technology have lifted billions out of poverty and created a global middle class, international and global inequality have decreased, at the same time that they enrich elites whose analytical, creative, or financial impact has global reach. The fortunes of the lower classes in developed countries have not improved nearly as much, but they have improved, often because their members rise into the upper classes. The improvements are enhanced by social spending, and by the falling cost and rising quality of the things people want. In some ways the world has become less equal, but in more ways the world's people have become better off.

CHAPTER 10

THE ENVIRONMENT

But is progress sustainable? A common response to the good news about our health, wealth, and sustenance is that it cannot continue. As we infest the world with our teeming numbers, guzzle the earth's bounty heedless of its finitude, and foul our nests with pollution and waste, we are hastening an environmental day of reckoning. If overpopulation, resource depletion, and pollution don't finish us off, then climate change will.

As in the chapter on inequality, I won't pretend that all the trends are positive or that the problems facing us are minor. But I will present a way of thinking about these problems that differs from the lugubrious conventional wisdom and offers a constructive alternative to the radicalism or fatalism it encourages. The key idea is that environmental problems, like other problems, are solvable, given the right knowledge.

To be sure, the very idea that there *are* environmental problems cannot be taken for granted. From the vantage point of an individual, the Earth seems infinite, and our effects on it inconsequential. From the vantage points of science, the view is more troubling. The microscopic vantage point reveals pollutants that insidiously poison us and the species we admire and depend on; the macroscopic one reveals effects on ecosystems that may be imperceptible one action at a time but add up to tragic despoliation. Beginning in the 1960s, the environmental movement grew out of scientific knowledge (from ecology, public health, and earth and atmospheric sciences) and a Romantic reverence for nature. The movement made the health of the planet a permanent priority on humanity's agenda, and as we shall see, it deserves credit for substantial achievements—another form of human progress.

Ironically, many voices in the traditional environmental movement refuse to acknowledge that progress, or even that human progress is a worthy aspiration. In this chapter I will present a newer conception of environmentalism which shares the goal of protecting the air and water, species, and ecosystems but is grounded in Enlightenment optimism rather than Romantic declinism.



Starting in the 1970s, the mainstream environmental movement latched onto a quasi-religious ideology, greenism, which can be found in the manifestoes of activists as diverse as Al Gore, the Unabomber, and Pope Francis.[1] Green ideology begins with an image of the Earth as a pristine ingénue which has been defiled by human rapacity. As Francis put it in his 2015 encyclical *Laudato Si'* (Praise be to you), "Our common home is like a sister with whom we share our life . . . [who] now cries out to us because of the harm we have inflicted on her." The harm, according to this narrative, has been inexorably worsening: "The earth, our home, is beginning to look more and more like an immense pile of filth." The root cause is the Enlightenment commitment to reason, science, and progress: "Scientific and technological progress cannot be equated with the progress of humanity and history," wrote Francis. "The way to a better future lies elsewhere," namely in an appreciation of "the mysterious network of relations between things" and (of course) "the treasure of Christian spiritual experience." Unless we repent our sins by degrowth, deindustrialization, and a rejection of the false gods of science, technology, and progress, humanity will face a ghastly reckoning in an environmental Judgment Day.

As with many apocalyptic movements, greenism is laced with misanthropy, including an indifference to starvation, an indulgence in ghoulish fantasies of a depopulated planet, and Nazi-like comparisons of human beings to vermin, pathogens, and cancer. For example, Paul Watson of the Sea Shepherd Conservation Society wrote, "We need to radically and intelligently reduce human populations to fewer than one billion. . . . Curing a body of cancer requires radical and invasive therapy, and therefore, curing the biosphere of the human virus will also require a radical and invasive approach."[2]

Recently an alternative approach to environmental protection has been championed by John Asafu-Adjaye, Jesse Ausubel, Andrew Balmford, Stewart Brand, Ruth DeFries, Nancy Knowlton, Ted Nordhaus, Michael Shellenberger, and others. It has been called Ecomodernism, Ecopragmatism, Earth Optimism, and the Blue-Green or Turquoise movement, though we can also think of it as Enlightenment Environmentalism or Humanistic Environmentalism.[3]

Ecomodernism begins with the realization that some degree of pollution is an inescapable consequence of the Second Law of Thermodynamics. When people use energy to create a zone of structure in their bodies and homes, they must increase entropy elsewhere in the environment in the form of waste, pollution, and other forms of disorder. The human species has always been ingenious at doing this—that's what differentiates us from other mammals—and it has never lived in harmony with the environment. When native peoples first set foot in an ecosystem, they typically hunted large animals to extinction, and often burned and cleared vast swaths of forest.[4] A dirty secret of the conservation movement is that wilderness preserves are set up only after indigenous peoples have been decimated or forcibly removed from them, including the national parks in the United States and the Serengeti in East Africa.[5] As the environmental historian William Cronon writes, "wilderness" is not a pristine sanctuary; it is itself a product of civilization.

When humans took up farming, they became more disruptive still. According to the paleoclimatologist William Ruddiman, the adoption of wet rice cultivation in Asia some five thousand years ago may have released so much methane into the atmosphere from rotting vegetation as to have changed the climate. "A good case can be made," he suggests, that "the people in the Iron Age and even the late Stone Age had a much greater per-capita impact on the earth's landscape than the average modern-day person."[6] And as Brand has pointed out (chapter 7), "natural farming" is a contradiction in terms. Whenever he hears the words *natural food,* he is tempted to rail:

> No product of agriculture is the slightest bit natural to an ecologist! You take a nice complex ecosystem, chop it into

> rectangles, clear it to the ground, and hammer it into perpetual early succession! You bust its sod, flatten it flat, and drench it with vast quantities of constant water! Then you populate it with uniform monocrops of profoundly damaged plants incapable of living on their own! Every food plant is a pathetic narrow specialist in one skill, inbred for thousands of years to a state of genetic idiocy! Those plants are so fragile, they had to domesticate humans just to take endless care of them![7]

A second realization of the ecomodernist movement is that industrialization has been good for humanity.[8] It has fed billions, doubled life spans, slashed extreme poverty, and, by replacing muscle with machinery, made it easier to end slavery, emancipate women, and educate children (chapters 7, 15, and 17). It has allowed people to read at night, live where they want, stay warm in winter, see the world, and multiply human contact. Any costs in pollution and habitat loss have to be weighed against these gifts. As the economist Robert Frank has put it, there is an optimal amount of pollution in the environment, just as there is an optimal amount of dirt in your house. Cleaner is better, but not at the expense of everything else in life.

The third premise is that the tradeoff that pits human well-being against environmental damage can be renegotiated by technology. How to enjoy more calories, lumens, BTUs, bits, and miles with less pollution and land is itself a technological problem, and one that the world is increasingly solving. Economists speak of the environmental Kuznets curve, a counterpart to the U-shaped arc for inequality as a function of economic growth. As countries first develop, they prioritize growth over environmental purity. But as they get richer, their thoughts turn to the environment.[9] If people can afford electricity only at the cost of some smog, they'll live with the smog, but when they can afford both electricity *and* clean air, they'll spring for the clean air. This can happen all the faster as technology makes cars and factories and power plants cleaner and thus makes clean air more affordable.

Economic growth bends the environmental Kuznets curve by advances not just in technology but in values. Some environmental

concerns are entirely practical: people complain about smog in their city, or green space getting paved over. But other concerns are more spiritual. The fate of the black rhinoceros and the well-being of our descendants in the year 2525 are significant moral concerns, but worrying about them now is something of a luxury. As societies get richer and people no longer think about putting food on the table or a roof over their heads, their values climb a hierarchy of needs, and the scope of their concern expands in space and time. Ronald Inglehart and Christian Welzel, using data from the World Values Survey, have found that people with stronger emancipative values—tolerance, equality, freedom of thought and speech—which tend to go with affluence and education, are also more likely to recycle and to pressure governments and businesses into protecting the environment.[10]



Ecopessimists commonly dismiss this entire way of thinking as the "faith that technology will save us." In fact it is a skepticism that the status quo will doom us—that knowledge will be frozen in its current state and people will robotically persist in their current behavior regardless of circumstances. Indeed, a naïve faith in stasis has repeatedly led to prophecies of environmental doomsdays that never happened.

The first is the "population bomb," which (as we saw in chapter 7) defused itself. When countries get richer and better educated, they pass through what demographers call the demographic transition.[11] First, death rates decline as nutrition and health improve. This does swell the population, but that is hardly something to bewail: as Johan Norberg notes, it happens not because people in poor countries start breeding like rabbits but because they stop dying like flies. In any case, the increase is temporary: birth rates peak and then decline, for at least two reasons. Parents no longer breed large broods as insurance against some of their children dying, and women, when they become better educated, marry later and delay having children. Figure 10-1 shows that the world population growth rate peaked at 2.1 percent a year in 1962, fell to 1.2 percent by 2010, and will probably fall to less than 0.5 percent by 2050 and be close to zero around 2070, when the population is projected to level off and then decline. Fertility

rates have fallen most noticeably in developed regions like Europe and Japan, but they can suddenly collapse, often to demographers' surprise, in other parts of the world. Despite the widespread belief that Muslim societies are resistant to the social changes that have transformed the West and will be indefinitely rocked by youthquakes, Muslim countries have seen a 40 percent decline in fertility over the past three decades, including a 70 percent drop in Iran and 60 percent drops in Bangladesh and in seven Arab countries.[12]

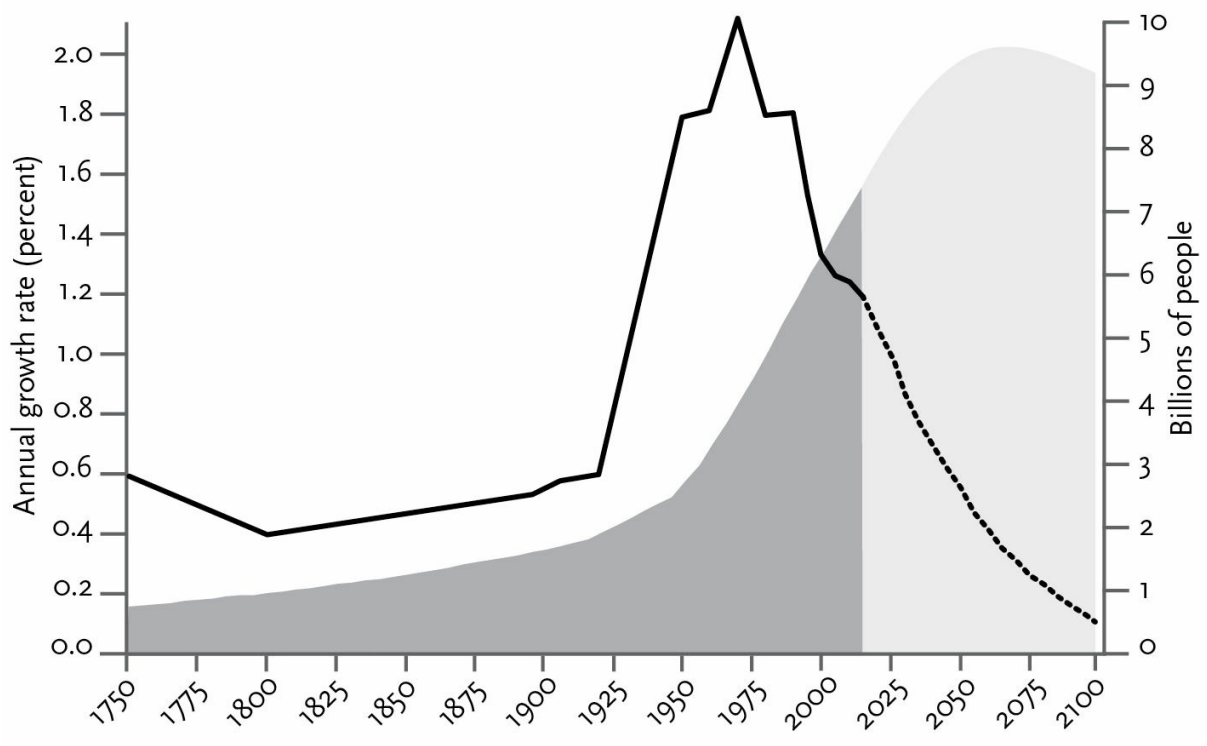


Figure 10-1: Population and population growth, 1750–2015 and projected to 2100

Sources: *Our World in Data,* Ortiz-Ospina & Roser 2016d. **1750–2015:** United Nations Population Division and *History Database of the Global Environment* (HYDE), PBL Netherlands Environmental Assessment Agency (undated). **Post-2015 projections:** Annual growth rate, same as for 1750–2015. Billions of people, International Institute for Applied Systems Analysis, Medium Projection (aggregate of country-specific estimates, taking education into account), Lutz, Butz, & Samir 2014.

The other scare from the 1960s was that the world would run out of resources. But resources just refuse to run out. The 1980s came and went without the famines that were supposed to starve tens of millions of Americans and billions of people worldwide. Then the year 1992 passed and, contrary to projections from the 1972

bestseller *The Limits to Growth* and similar philippics, the world did not exhaust its aluminum, copper, chromium, gold, nickel, tin, tungsten, or zinc. (In 1980 Paul Ehrlich famously bet the economist Julian Simon that five of these metals would become scarcer and hence more expensive by the end of the decade; he lost all five bets. Indeed, most metals and minerals are cheaper today than they were in 1960.)[13] From the 1970s to the early 2000s newsmagazines periodically illustrated cover stories on the world's oil supply with a gas gauge pointing to Empty. In 2013 *The Atlantic* ran a cover story about the fracking revolution entitled "We Will Never Run Out of Oil."

And then there are rare earths like yttrium, scandium, europium, and lanthanum, which you may remember from the periodic table in your chemistry classroom or from the Tom Lehrer song "The Elements." These metals are a critical component of magnets, fluorescent lights, video screens, catalysts, lasers, capacitors, optical glass, and other high-tech applications. When they started running out, we were warned, there would be critical shortages, a collapse of the technology industry, and perhaps war with China, the source of 95 percent of the world's supply. That's what led to the Great Europium Crisis of the late 20th century, when the world ran out of the critical ingredient in the red phosphor dots in the cathode-ray tubes in color televisions and computer monitors and society was divided between the haves, who hoarded the last working color TVs, and the angry have-nots, who were forced to make do with black-and-white. What, you never heard of it? Among the reasons there was no such crisis was that cathode-ray tubes were superseded by liquid crystal displays made of common elements.[14] And the Rare Earths War? In reality, when China squeezed its exports in 2010 (not because of shortages but as a geopolitical and mercantilist weapon), other countries started extracting rare earths from their own mines, recycling them from industrial waste, and re-engineering products so they no longer needed them.[15]

When predictions of apocalyptic resource shortages repeatedly fail to come true, one has to conclude either that humanity has miraculously escaped from certain death again and again like a Hollywood action hero or that there is a flaw in the thinking that predicts apocalyptic resource shortages. The flaw has been pointed

out many times.[16] Humanity does not suck resources from the earth like a straw in a milkshake until a gurgle tells it that the container is empty. Instead, as the most easily extracted supply of a resource becomes scarcer, its price rises, encouraging people to conserve it, get at the less accessible deposits, or find cheaper and more plentiful substitutes.

Indeed, it's a fallacy to think that people "need resources" in the first place.[17] They need ways of growing food, moving around, lighting their homes, displaying information, and other sources of well-being. They satisfy these needs with *ideas:* with recipes, formulas, techniques, blueprints, and algorithms for manipulating the physical world to give them what they want. The human mind, with its recursive combinatorial power, can explore an infinite space of ideas, and is not limited by the quantity of any particular kind of stuff in the ground. When one idea no longer works, another can take its place. This doesn't defy the laws of probability but obeys them. Why should the laws of nature have allowed *exactly one* physically possible way of satisfying a human desire, no more and no less?[18]

Admittedly, this way of thinking does not sit well with the ethic of "sustainability." In figure 10-2, the cartoonist Randall Munroe illustrates what's wrong with this vogue word and sacred value. The doctrine of sustainability assumes that the current rate of use of a resource may be extrapolated into the future until it rams into a ceiling. The implication is that we must switch to a renewable resource that can be replenished at the rate we use it, indefinitely. In reality, societies have always abandoned a resource for a better one long before the old one was exhausted. It's often said that the Stone Age did not end because the world ran out of stones, and that has been true of energy as well. "Plenty of wood and hay remained to be exploited when the world shifted to coal," Ausubel notes. "Coal abounded when oil rose. Oil abounds now as methane [natural gas] rises."[19] As we will see, gas in turn may be replaced by energy sources still lower in carbon well before the last cubic foot goes up in a blue flame.

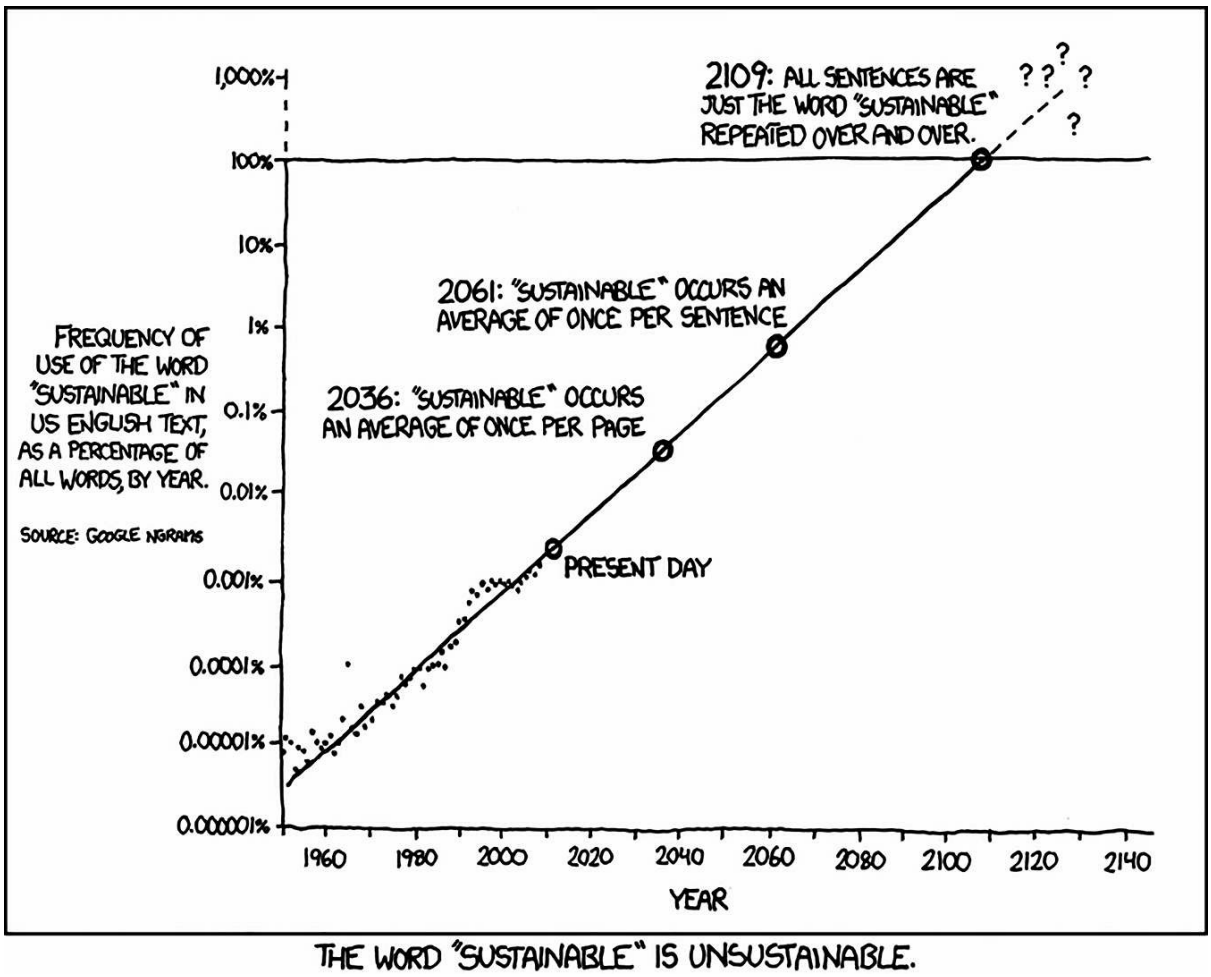


Figure 10-2: Sustainability, 1955–2109

Source: Randall Munroe, *XKCD*, http://xkcd.com/1007/. Credit: Randall Munroe, xkcd.com.

The supply of food, too, has grown exponentially (as we saw in chapter 7), even though no single method of growing it has ever been sustainable. In *The Big Ratchet: How Humanity Thrives in the Face of Natural Crisis,* the geographer Ruth DeFries describes the sequence as "ratchet-hatchet-pivot." People discover a way of growing more food, and the population ratchets upward. The method fails to keep up with the demand or develops unpleasant side effects, and the hatchet falls. People then pivot to a new method. At various times, farmers have pivoted to slash-and-burn horticulture, night soil (a euphemism for human feces), crop rotation, guano, saltpeter, ground-up bison bones, chemical fertilizer, hybrid crops, pesticides, and the Green Revolution.[20] Future pivots may include genetically modified organisms, hydroponics, aeroponics, urban vertical farms, robotic harvesting,

meat cultured in vitro, artificial intelligence algorithms fed by GPS and biosensors, the recovery of energy and fertilizer from sewage, aquaculture with fish that eat tofu instead of other fish, and who knows what else—as long as people are allowed to indulge their ingenuity.[21] Though water is one resource that people will never pivot away from, farmers could save massive amounts if they switched to Israeli-style precision farming. And if the world develops abundant carbon-free energy sources (a topic we will explore later), it could get what it needs by desalinating seawater.[22]



Not only have the disasters prophesied by 1970s greenism failed to take place, but improvements that it deemed impossible *have* taken place. As the world has gotten richer and crested the environmental curve, nature has begun to rebound.[23] Pope Francis's "immense pile of filth" is the vision of someone who has woken up thinking it's 1965, the era of belching smokestacks, waterfalls of sewage, rivers catching fire, and jokes about New Yorkers not liking to breathe air they can't see. Figure 10-3 shows that since 1970, when the Environmental Protection Agency was established, the United States has slashed its emissions of five air pollutants by almost two-thirds. Over the same period, the population grew by more than 40 percent, and those people drove twice as many miles and became two and a half times richer. Energy use has leveled off, and even carbon dioxide emissions have turned a corner, a point to which we will return. The declines don't just reflect an offshoring of heavy industry to the developing world, because the bulk of energy use and emissions comes from transportation, heating, and electricity generation, which cannot be outsourced. Rather, they mainly reflect gains in efficiency and emission control. These diverging curves refute both the orthodox Green claim that only degrowth can curb pollution and the orthodox right-wing claim that environmental protection must sabotage economic growth and people's standard of living.

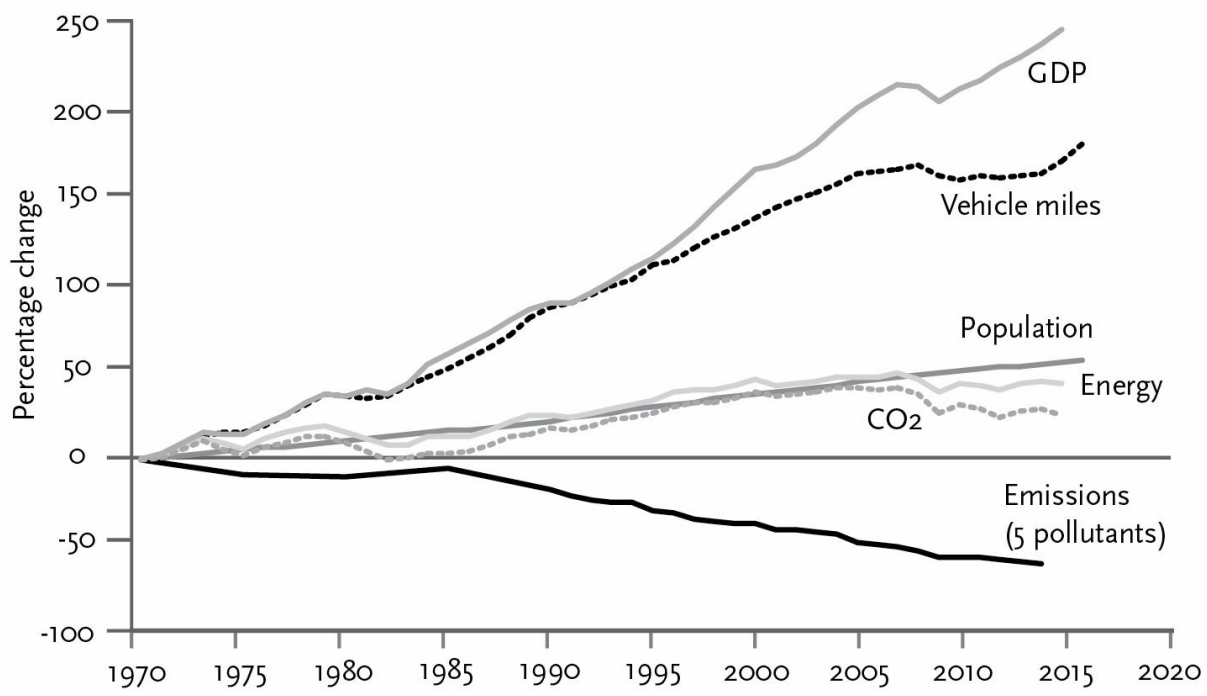


Figure 10-3: Pollution, energy, and growth, US, 1970–2015

Sources: US Environmental Protection Agency 2016, based on the following sources. **GDP**: Bureau of Economic Analysis. **Vehicle miles traveled:** Federal Highway Administration. **Population:** US Census Bureau. **Energy Consumption:** US Department of Energy. **CO_2:** US Greenhouse Gas Inventory Report. **Emissions** (carbon monoxide, oxides of nitrogen, particulate matter smaller than 10 micrometers, sulfur dioxide, and volatile organic compounds): EPA, https://www.epa.gov/air-emissions-inventories/air-pollutant-emissions-trends-data.

Many of the improvements can be seen with the naked eye. Cities are less often shrouded in purple-brown haze, and London no longer has the fog—actually coal smoke—that was immortalized in Impressionist paintings, gothic novels, the Gershwin song, and the brand of raincoats. Urban waterways that had been left for dead—including Puget Sound, Chesapeake Bay, Boston Harbor, Lake Erie, and the Hudson, Potomac, Chicago, Charles, Seine, Rhine, and Thames rivers (the last described by Disraeli as "a Stygian pool reeking with ineffable and intolerable horrors")—have been recolonized by fish, birds, marine mammals, and sometimes swimmers. Suburbanites are seeing wolves, foxes, bears, bobcats, badgers, deer, ospreys, wild turkeys, and bald eagles. As agriculture becomes more efficient (chapter 7), farmland returns to temperate forest, as any hiker knows who has stumbled upon a stone wall incongruously running through a New England woodland. Though tropical forests are still, alarmingly, being cut down, between the

middle of the 20th century and the turn of the 21st the rate fell by two-thirds (figure 10-4).[24] Deforestation of the world's largest tropical forest, the Amazon, peaked in 1995, and from 2004 to 2013 the rate fell by four-fifths.[25]

The time-lagged decline of deforestation in the tropics is one sign that environmental protection is spreading from developed countries to the rest of the world. The world's progress can be tracked in a report card called the Environmental Performance Index, a composite of indicators of the quality of air, water, forests, fisheries, farms, and natural habitats. Out of 180 countries that have been tracked for a decade or more, all but two show an improvement.[26] The wealthier the country, on average, the cleaner its environment: the Nordic countries were cleanest; Afghanistan, Bangladesh, and several sub-Saharan African countries, the most compromised. Two of the deadliest forms of pollution—contaminated drinking water and indoor cooking smoke—are afflictions of poor countries.[27] But as poor countries have gotten richer in recent decades, they are escaping these blights: the proportion of the world's population that drinks tainted water has fallen by five-eighths, the proportion breathing cooking smoke by a third.[28] As Indira Gandhi said, "Poverty is the greatest polluter."[29]

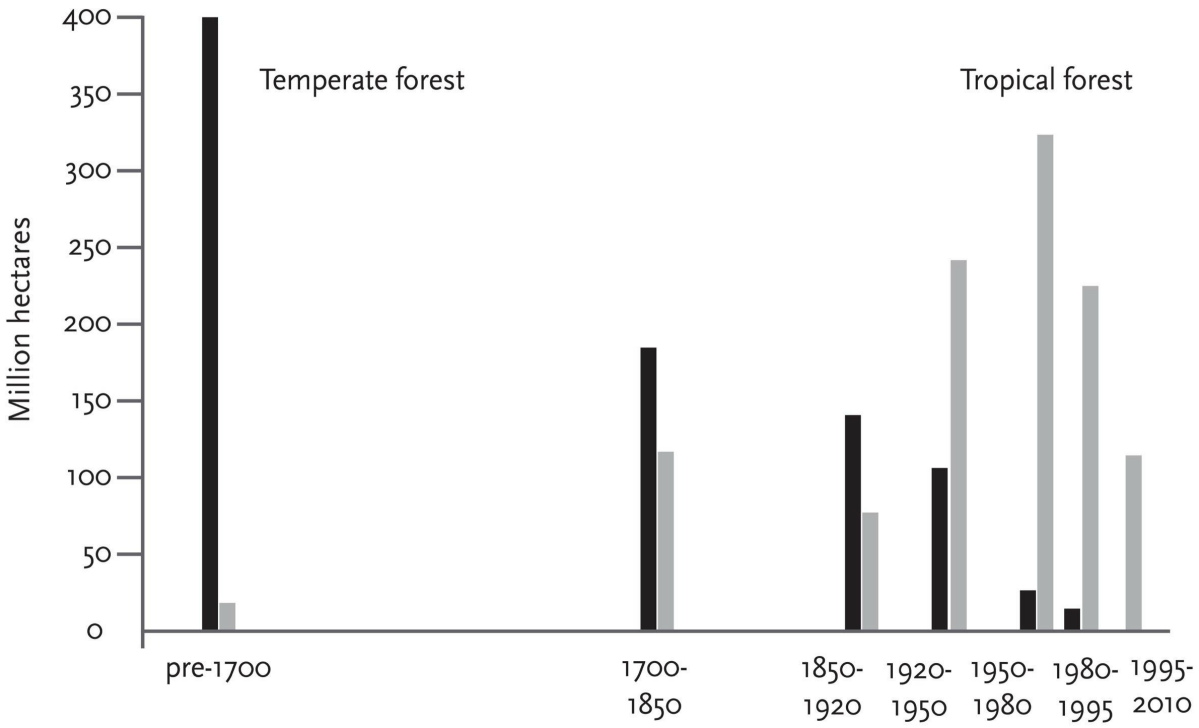


Figure 10-4: Deforestation, 1700–2010

Source: United Nations Food and Agriculture Organization 2012, p. 9. The bars represent totals over intervals of different durations, not annual rates, and thus are not directly commensurable.

The epitome of environmental insults is the oil spill from tanker ships, which coats pristine beaches with toxic black sludge and fouls the plumage of seabirds and the fur of otters and seals. The most notorious accidents, such as the breakup of the *Torrey Canyon* in 1967 and the *Exxon Valdez* in 1989, linger in our collective memory, and few people are aware that seaborne oil transport has become vastly safer. Figure 10-5 shows that the annual number of oil spills has fallen from more than a hundred in 1973 to just five in 2016 (and the number of *major* spills fell from thirty-two in 1978 to one in 2016). The graph also shows that even as less oil was spilled, more oil was shipped; the crossing curves provide additional evidence that environmental protection is compatible with economic growth. It's no mystery that oil companies should *want* to reduce tanker accidents, because their interests and those of the environment coincide: oil spills are a public-relations disaster (especially when the name of the company is emblazoned on a cracked-up ship), bring on huge fines, and of course waste valuable oil. More interesting is the fact that the companies have largely succeeded. Technologies follow a learning curve and become less hazardous over time as the boffins design out the most dangerous vulnerabilities (a point we'll return to in chapter 12). But people remember the accidents and are unaware of the incremental improvements. The improvements in different technologies unfold on different timetables: in 2010, when seaborne oil spills had fallen to an all-time low, the third-worst spill from stationary rigs took place. The *Deepwater Horizon* accident in the Gulf of Mexico led in turn to new regulations for blowout preventers, well design, monitoring, and containment.[30]

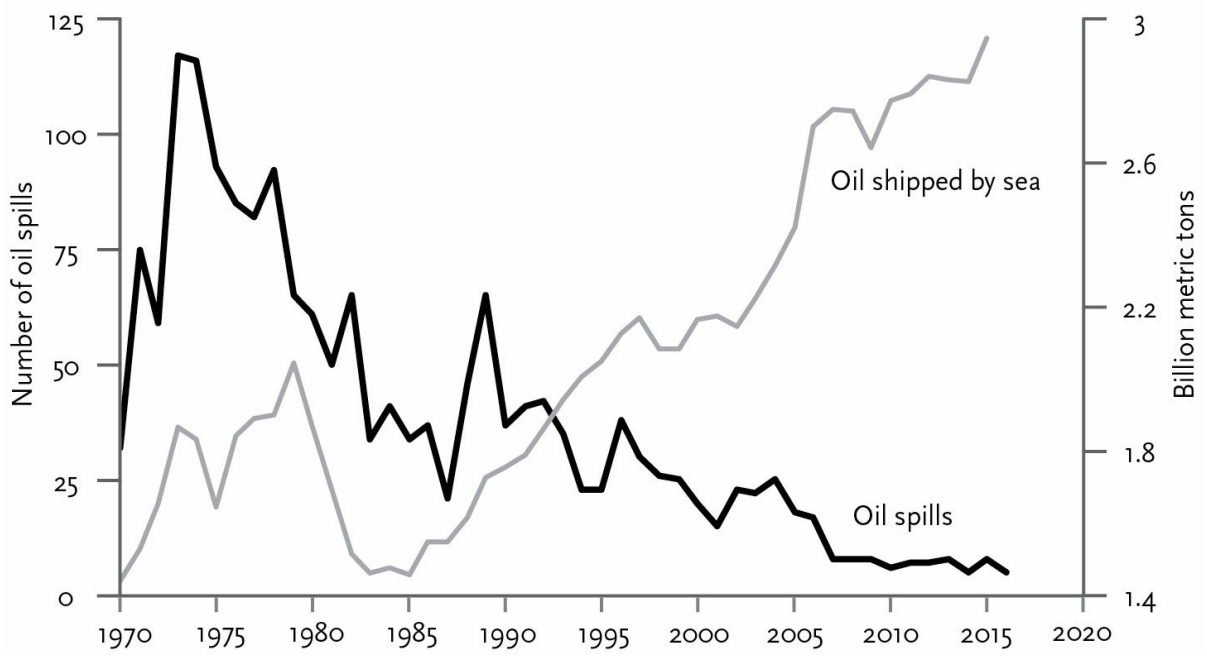


Figure 10-5: Oil spills, 1970–2016

Source: *Our World in Data,* Roser 2016r, based on data (updated) from the International Tanker Owners Pollution Federation, http://www.itopf.com/knowledge-resources/data-statistics/statistics/. Oil spills include all those that result in the loss of at least 7 metric tons of oil. Oil shipped consists of "total crude oil, petroleum product, and gas loaded."

In another advance, entire swaths of land and ocean have been protected from human use altogether. Conservation experts are unanimous in their assessment that the protected areas are still inadequate, but the momentum is impressive. Figure 10-6 shows that the proportion of the Earth's land set aside as national parks, wildlife reserves, and other protected areas has grown from 8.2 percent in 1990 to 14.8 percent in 2014—an area double the size of the United States. Marine conservation areas have grown as well, more than doubling during this period and now protecting more than 12 percent of the world's oceans.

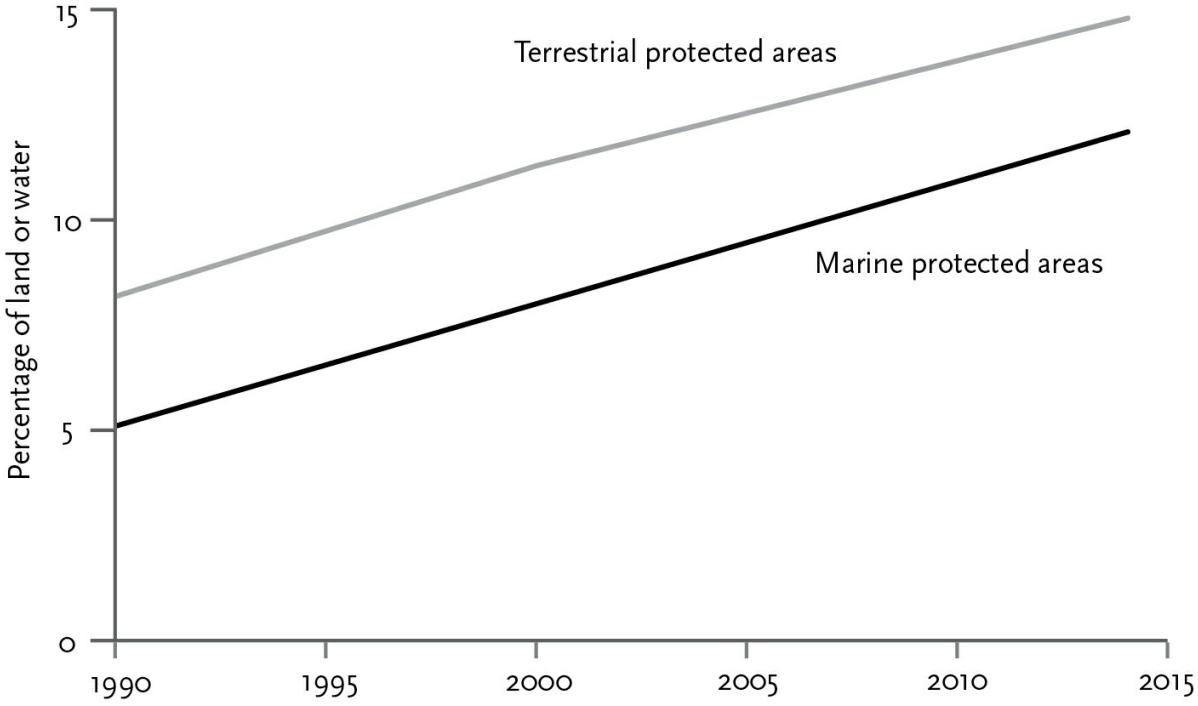


Figure 10-6: Protected areas, 1990–2014

Source: World Bank 2016h and 2017, based on data from the United Nations Environment Programme and the World Conservation Monitoring Centre, compiled by the World Resources Institute.

Thanks to habitat protection and targeted conservation efforts, many beloved species have been pulled from the brink of extinction, including albatrosses, condors, manatees, oryxes, pandas, rhinoceroses, Tasmanian devils, and tigers; according to the ecologist Stuart Pimm, the rate of bird extinctions has been reduced by 75 percent.[31] Though many species remain in precarious straits, a number of ecologists and paleontologists believe that the claim that humans are causing a mass extinction like the Permian and Cretaceous is hyperbolic. As Brand notes, "No end of specific wildlife problems remain to be solved, but describing them too often as extinction crises has led to a general panic that nature is extremely fragile or already hopelessly broken. That is not remotely the case. Nature as a whole is exactly as robust as it ever was—maybe more so. . . . Working with that robustness is how conservation's goals get reached."[32]

Other improvements are global in scope. The 1963 treaty banning atmospheric nuclear testing eliminated the most terrifying form of pollution of all, radioactive fallout, and proved that the

world's nations could agree on measures to protect the planet even in the absence of a world government. Global cooperation has dealt with several other challenges since. International treaties on the reduction of sulfur emissions and other forms of "long-range transboundary air pollution" signed in the 1980s and 1990s have helped to eliminate the scare of acid rain.[33] Thanks to the 1987 ban on chlorofluorocarbons ratified by 197 countries, the ozone layer is expected to heal by the middle of the 21st century.[34] These successes, as we will see, set the stage for the historic Paris Agreement on climate change in 2015.



Like all demonstrations of progress, reports on the improving state of the environment are often met with a combination of anger and illogic. The fact that many measures of environmental quality are improving does *not* mean that everything is OK, that the environment got better by itself, or that we can just sit back and relax. For the cleaner environment we enjoy today we must thank the arguments, activism, legislation, regulations, treaties, and technological ingenuity of the people who sought to improve it in the past.[35] We'll need more of each to sustain the progress we've made, prevent reversals (particularly under the Trump presidency), and extend it to the wicked problems that still face us, such as the health of the oceans and, as we shall see, atmospheric greenhouse gases.

But for many reasons, it's time to retire the morality play in which modern humans are a vile race of despoilers and plunderers who will hasten the apocalypse unless they undo the Industrial Revolution, renounce technology, and return to an ascetic harmony with nature. Instead, we can treat environmental protection as a problem to be solved: how can people live safe, comfortable, and stimulating lives with the least possible pollution and loss of natural habitats? Far from licensing complacency, our progress so far at solving this problem emboldens us to strive for more. It also points to the forces that pushed this progress along.

One key is to decouple productivity from resources: to get more human benefit from less matter and energy. This puts a premium on *density*.[36] As agriculture becomes more intensive by growing crops that are bred or engineered to produce more protein, calories, and

fiber with less land, water, and fertilizer, farmland is spared, and it can morph back to natural habitats. (Ecomodernists point out that organic farming, which needs far more land to produce a kilogram of food, is neither green nor sustainable.) As people move to cities, they not only free up land in the countryside but need fewer resources for commuting, building, and heating, because one man's ceiling is another man's floor. As trees are harvested from dense plantations, which have five to ten times the yield of natural forests, forest land is spared, together with its feathered, furry, and scaly inhabitants.

All these processes are helped along by another friend of the Earth, *dematerialization*. Progress in technology allows us to do more with less. An aluminum soda can used to weigh three ounces; today it weighs less than half an ounce. Mobile phones don't need miles of telephone poles and wires. The digital revolution, by replacing atoms with bits, is dematerializing the world in front of our eyes. The cubic yards of vinyl that used to be my music collection gave way to cubic inches of compact discs and then to the nothingness of MP3s. The river of newsprint flowing through my apartment has been stanched by an iPad. With a terabyte of storage on my laptop I no longer buy paper by the ten-ream box. And just think of all the plastic, metal, and paper that no longer go into the forty-odd consumer products that can be replaced by a single smartphone, including a telephone, answering machine, phone book, camera, camcorder, tape recorder, radio, alarm clock, calculator, dictionary, Rolodex, calendar, street maps, flashlight, fax, and compass—even a metronome, outdoor thermometer, and spirit level.

Digital technology is also dematerializing the world by enabling the sharing economy, so that cars, tools, and bedrooms needn't be made in huge numbers that sit around unused most of the time. The advertising analyst Rory Sutherland has noted that dematerialization is also being helped along by changes in the criteria of social status.[37] The most expensive London real estate today would have seemed impossibly cramped to wealthy Victorians, but the city center is now more fashionable than the suburbs. Social media have encouraged younger people to show off their experiences rather than their cars and wardrobes, and

hipsterization leads them to distinguish themselves by their tastes in beer, coffee, and music. The era of the Beach Boys and *American Graffiti* is over: half of American eighteen-year-olds do not have a driver's license.[38]

The expression "Peak Oil," which became popular after the energy crises of the 1970s, refers to the year that the world would reach its maximum extraction of petroleum. Ausubel notes that because of the demographic transition, densification, and dematerialization, we may have reached Peak Children, Peak Farmland, Peak Timber, Peak Paper, and Peak Car. Indeed, we may be reaching Peak Stuff: of a hundred commodities Ausubel plotted, thirty-six have peaked in absolute use in the United States, and another fifty-three may be poised to drop (including water, nitrogen, and electricity), leaving only eleven that are still growing. Britons, too, have reached Peak Stuff, having reduced their annual use of material from 15.1 metric tons per person in 2001 to 10.3 metric tons in 2013.[39]

These remarkable trends required no coercion, legislation, or moralization; they spontaneously unfolded as people made choices about how to live their lives. The trends certainly don't show that environmental legislation is dispensable—by all accounts, environmental protection agencies, mandated energy standards, endangered species protection, and national and international clean air and water acts have had enormously beneficial effects.[40] But they suggest that the tide of modernity does not sweep humanity headlong toward ever more unsustainable use of resources. Something in the nature of technology, particularly information technology, works to decouple human flourishing from the exploitation of physical stuff.



Just as we must not accept the narrative that humanity inexorably despoils every part of the environment, we must not accept the narrative that every part of the environment will rebound under our current practices. An enlightened environmentalism must face the facts, hopeful or alarming, and one set of facts is unquestionably alarming: the effect of greenhouse gases on the earth's climate.[41]

Whenever we burn wood, coal, oil, or gas, the carbon in the fuel is oxidized to form carbon dioxide (CO_2), which wafts into the atmosphere. Though some of the CO_2 dissolves in the ocean, chemically combines with rocks, or is taken up by photosynthesizing plants, these natural sinks cannot keep up with the 38 billion tons we dump into the atmosphere each year. As gigatons of carbon laid down during the Carboniferous Period have gone up in smoke, the concentration of CO_2 in the atmosphere has risen from about 270 parts per million before the Industrial Revolution to more than 400 parts today. Since CO traps heat radiating from the Earth's surface, the global average temperature has risen as well, by about .8° Celsius (1.4° Fahrenheit), and 2016 was the hottest year on record, with 2015 coming in second and 2014 coming in third. The atmosphere has also been warmed by the clearing of carbon-eating forests and by the release of methane (an even more potent greenhouse gas) from leaky gas wells, melting permafrost, and the orifices at both ends of cattle. It could become warmer still in a runaway feedback loop if white, heat-reflecting snow and ice are replaced by dark, heat-absorbing land and water, if the melting of permafrost accelerates, and if more water vapor (yet another greenhouse gas) is sent into the air.

If the emission of greenhouse gases continues, the Earth's average temperature will rise to at least 1.5°C (2.7°F) above the preindustrial level by the end of the 21st century, and perhaps to 4°C (7.2°F) above that level or more. That will cause more frequent and more severe heat waves, more floods in wet regions, more droughts in dry regions, heavier storms, more severe hurricanes, lower crop yields in warm regions, the extinction of more species, the loss of coral reefs (because the oceans will be both warmer and more acidic), and an average rise in sea level of between 0.7 and 1.2 meters (2 and 4 feet) from both the melting of land ice and the expansion of seawater. (Sea level has already risen almost eight inches since 1870, and the rate of the rise appears to be accelerating.) Low-lying areas would be flooded, island nations would disappear beneath the waves, large stretches of farmland would no longer be arable, and millions of people would be displaced. The effects could get still worse in the 22nd century and beyond, and in theory could trigger upheavals such as a diversion of

the Gulf Stream (which would turn Europe into Siberia) or a collapse of Antarctic ice sheets. A rise of 2°C is considered the most that the world could reasonably adapt to, and a rise of 4°C, in the words of a 2012 World Bank report, "simply must not be allowed to occur."[42]

To keep the rise to 2°C or less, the world would, at a minimum, have to reduce its greenhouse gas emissions by half or more by the middle of the 21st century and eliminate them altogether before the turn of the 22nd.[43] The challenge is daunting. Fossil fuels provide 86 percent of the world's energy, powering almost every car, truck, train, plane, ship, tractor, furnace, and factory on the planet, together with most of its electricity plants.[44] Humanity has never faced a problem like it.

One response to the prospect of climate change is to deny that it is occurring or that human activity is the cause. It's completely appropriate, of course, to challenge the hypothesis of anthropogenic climate change on scientific grounds, particularly given the extreme measures it calls for if it is true. The great virtue of science is that a true hypothesis will, in the long run, withstand attempts to falsify it. Anthropogenic climate change is the most vigorously challenged scientific hypothesis in history. By now, all the major challenges—such as that global temperatures have stopped rising, that they only seem to be rising because they were measured in urban heat islands, or that they really are rising but only because the sun is getting hotter—have been refuted, and even many skeptics have been convinced.[45] A recent survey found that exactly *four* out of 69,406 authors of peer-reviewed articles in the scientific literature rejected the hypothesis of anthropogenic global warming, and that "the peer-reviewed literature contains no convincing evidence against [the hypothesis]."[46]

Nonetheless, a movement within the American political right, heavily underwritten by fossil fuel interests, has prosecuted a fanatical and mendacious campaign to deny that greenhouse gases are warming the planet.[47] In doing so they have advanced the conspiracy theory that the scientific community is fatally infected with political correctness and ideologically committed to a government takeover of the economy. As someone who considers himself something of a watchdog for politically correct dogma in

academia, I can state that this is nonsense: physical scientists have no such agenda, and the evidence speaks for itself.[48] (And it's precisely because of challenges like this that scholars in all fields have a duty to secure the credibility of the academy by *not* enforcing political orthodoxies.)

To be sure, there are judicious climate change skeptics, sometimes called lukewarmers, who accept the mainstream science but accentuate the positive.[49] They favor the fringe of the envelope of possibilities with the slowest temperature rise, note that the worst-case scenarios with runaway feedback are hypothetical, point out that moderately higher temperatures and CO_2 have benefits in crop yields that should be traded off against their costs, and argue that if countries are allowed to get as rich as possible (without growth-sapping restrictions on fossil fuels) they will be better equipped to adapt to the climate change that does occur. But as the economist William Nordhaus points out, this is a rash gamble in what he calls the Climate Casino.[50] If the status quo presents, say, an even chance that the world will get significantly worse, and a 5 percent chance that it will pass a tipping point and face a catastrophe, it would be prudent to take preventive action even if the catastrophic outcome is not certain, just as we buy fire extinguishers and insurance for our houses and don't keep open cans of gasoline in our garages. Since dealing with climate change will be a multidecade effort, there's plenty of time to back off if temperature, sea level, and ocean acidity happily stop rising.

Another response to climate change, from the far left, seems designed to vindicate the conspiracy theories of the far right. According to the "climate justice" movement popularized by the journalist Naomi Klein in her 2014 bestseller *This Changes Everything: Capitalism vs. the Climate,* we should not treat the threat of climate change as a challenge to prevent climate change. No, we should treat it as an opportunity to abolish free markets, restructure the global economy, and remake our political system.[51] In one of the more surreal episodes in the history of environmental politics, Klein joined the infamous David and Charles Koch, the billionaire oil industrialists and bankrollers of climate change denial, in helping to defeat a 2016 Washington state ballot initiative that would have implemented the country's first carbon tax, the

policy measure which almost every analyst endorses as a prerequisite to dealing with climate change.[52] Why? Because the measure was "right-wing friendly," and it did not "make the polluters pay, and put their immoral profits to work repairing the damage they have knowingly created." In a 2015 interview Klein even opposed analyzing climate change quantitatively:

> We're not going to win this as bean counters. We can't beat the bean counters at their own game. We're going to win this because this is an issue of values, human rights, right and wrong. We just have this brief period where we also have to have some nice stats that we can wield, but we shouldn't lose sight of the fact that what actually moves people's hearts are the arguments based on the value of life.[53]

Blowing off quantitative analysis as "bean-counting" is not just anti-intellectual but works *against* "values, human rights, right and wrong." Someone who values human life will favor the policies that have the greatest chance of saving people from being displaced or starved while furnishing them with the means to live healthy and fulfilled lives.[54] In a universe governed by the laws of nature rather than magic and deviltry, that requires "bean-counting." Even when it comes to the purely rhetorical challenge of "moving people's hearts," efficacy matters: people are likelier to accept the fact of global warming when they are told that the problem is solvable by innovations in policy and technology than when they are given dire warnings about how awful it will be.[55]

Another common sentiment about how to prevent climate change is expressed in this letter, of a kind I receive every now and again:

> Dear Professor Pinker
>
> We need to do something about global warming. Why don't the Nobel prize winning scientists sign a petition? Why don't they tell the blunt truth, that the politicians are pigs who don't care how many people get killed in floods and droughts?
>
> Why don't you and some friends start a movement on the Internet to get people to sign a pledge that they will make real

> sacrifices to fight global warming. Because that's the problem. Nobody wants to make any sacrifices. People should pledge to never fly in airplanes except in dire emergencies, because airplanes burn so much fuel. People should pledge to eat no meat on at least three days per week, because meat production adds so much carbon to the atmosphere. People should pledge to buy no jewelry, ever, because refining gold and silver is so energy-intensive. We should abolish artistic pottery, because it burns so much carbon. The potters in university art departments are just going to have to accept the fact that we can't go on like this.

Forgive the bean-counting, but even if everyone gave up their jewelry, it would not make a scratch in the world's emission of greenhouse gases, which are dominated by heavy industry (29 percent), buildings (18 percent), transport (15 percent), land-use change (15 percent), and the energy needed to supply energy (13 percent). (Livestock is responsible for 5.5 percent, mostly methane rather than CO_2, and aviation for 1.5 percent.)[56] Of course my correspondent suggested forgoing jewelry and pottery not because of the *effect* but because of the *sacrifice,* and it's no surprise that she singled out jewelry, the quintessential luxury. I bring up her ingenuous suggestion to illustrate two psychological impediments we face in dealing with climate change.

The first is cognitive. People have trouble thinking in scale: they don't differentiate among actions that would reduce CO_2 emissions by thousands of tons, millions of tons, and billions of tons.[57] Nor do they distinguish among level, rate, acceleration, and higher-order derivatives—between actions that would affect the rate of *increase* in CO_2 emissions, affect the *rate* of CO_2 emissions, affect the *level* of CO_2 in the atmosphere, and affect global *temperatures* (which will rise even if the level of CO_2 remains constant). Only the last of these matters, but if one doesn't think in scale and in orders of change, one can be satisfied with policies that accomplish nothing.

The other impediment is moralistic. As I mentioned in chapter 2, the human moral sense is not particularly moral; it encourages dehumanization ("politicians are pigs") and punitive aggression

("make the polluters pay"). Also, by conflating profligacy with evil and asceticism with virtue, the moral sense can sanctify pointless displays of sacrifice.[58] In many cultures people flaunt their righteousness with vows of fasting, chastity, self-abnegation, bonfires of the vanities, and animal (or sometimes human) sacrifice. Even in modern societies—according to studies I've done with the psychologists Jason Nemirow, Max Krasnow, and Rhea Howard—people esteem others according to how much time or money they forfeit in their altruistic acts rather than by how much good they accomplish.[59]

Much of the public chatter about mitigating climate change involves voluntary sacrifices like recycling, reducing food miles, unplugging chargers, and so on. (I myself have posed for posters in several of these campaigns led by Harvard students.)[60] But however virtuous these displays may feel, they are a distraction from the gargantuan challenge facing us. The problem is that carbon emissions are a classic public goods game, also known as a Tragedy of the Commons. People benefit from everyone else's sacrifices and suffer from their own, so everyone has an incentive to be a free rider and let everyone else make the sacrifice, and everyone suffers. A standard remedy for public goods dilemmas is a coercive authority that can punish free riders. But any government with the totalitarian power to abolish artistic pottery is unlikely to restrict that power to maximizing the common good. One can, alternatively, daydream that moral suasion is potent enough to induce everyone to make the necessary sacrifices. But while humans do have public sentiments, it's unwise to let the fate of the planet hinge on the hope that billions of people will simultaneously volunteer to act against their interests. Most important, the sacrifice needed to bring carbon emissions down by half and then to zero is far greater than forgoing jewelry: it would require forgoing electricity, heating, cement, steel, paper, travel, and affordable food and clothing.

Climate justice warriors, indulging the fantasy that the developing world will do just that, advocate a regime of "sustainable development." As Shellenberger and Ted Nordhaus satirize it, that consists of "small co-ops in the Amazon forest where peasant farmers and Indians would pick nuts and berries to sell to Ben and Jerry's for their 'Rainforest Crunch' flavor."[61] They would be allowed

solar panels that could light an LED or charge a cell phone, but nothing more. Needless to say, the people who actually live in those countries have a different idea. Escaping from poverty requires abundant energy. The proprietor of *HumanProgress,* Marian Tupy, points out that in 1962 Botswana and Burundi were equally destitute, with an annual per capita income of $70, and neither emitted much CO_2. By 2010, Botswanans earned $7,650 a year, 32 times as much as the still-poor Burundians, and they emitted 89 times as much CO_2.[62]

Faced with such facts, climate justice warriors reply that rather than enriching poor nations, we should impoverish rich ones, switching back, for example, to "labor-intensive agriculture" (to which an appropriate reply is: You first). Shellenberger and Nordhaus note how far progressive politics has moved from the days in which rural electrification and economic development were among its signature projects: "In the name of democracy it now offers the global poor not what they want—cheap electricity—but more of what they don't want, namely intermittent and expensive power."[63]

Economic progress is an imperative in rich and poor countries alike precisely because it will be needed to adapt to the climate change that does occur. Thanks in good part to prosperity, humanity has been getting healthier (chapters 5 and 6), better fed (chapter 7), more peaceful (chapter 11), and better protected from natural hazards and disasters (chapter 12). These advances have made humanity more resilient to natural and human-made threats: disease outbreaks don't become pandemics, crop failures in one region are alleviated by surpluses in another, local skirmishes are defused before they erupt into war, populations are better protected against storms, floods, and droughts. Part of our response to climate change must be to ensure that these gains in resilience continue to outpace the threats that a warming planet will throw at it. Every year that developing countries get richer, they will have more resources for building seawalls and reservoirs, improving public health services, and moving people away from rising seas. For that reason they must not be kept in energy poverty—but neither does it make sense for them to raise incomes with massive coal burning that will overwhelm everyone later with weather disasters.[64]

How, then, *should* we deal with climate change? Deal with it we must. I agree with Pope Francis and the climate justice warriors that preventing climate change is a moral issue because it has the potential to harm billions, particularly the world's poor. But morality is different from moralizing, and is often poorly served by it. (The Pope's encyclical backfired, *decreasing* concern about climate change among the conservative Catholics who were aware of it.)[65] It may be satisfying to demonize the fossil fuel corporations that sell us the energy we want, or to signal our virtue by making conspicuous sacrifices, but these indulgences won't prevent destructive climate change.

The enlightened response to climate change is to figure out how to get the most energy with the least emission of greenhouse gases. There is, to be sure, a tragic view of modernity in which this is impossible: industrial society, powered by flaming carbon, contains the fuel of its own destruction. But the tragic view is incorrect. Ausubel notes that the modern world has been progressively *de*carbonizing.

The hydrocarbons in the stuff we burn are composed of hydrogen and carbon, which release energy as they combine with oxygen to form H_2O and CO_2. The oldest hydrocarbon fuel, dry wood, has a ratio of combustible carbon atoms to hydrogen atoms of about 10 to 1.[66] The coal which replaced it during the Industrial Revolution has an average carbon-to-hydrogen ratio of 2 to 1.[67] A petroleum fuel such as kerosene may have a ratio of 1 to 2. Natural gas is composed mainly of methane, whose chemical formula is CH_4, with a ratio of 1 to 4.[68] So as the industrial world climbed an energy ladder from wood to coal to oil to gas (the last transition accelerated in the 21st century by the abundance of shale gas from fracking), the ratio of carbon to hydrogen in its energy source steadily fell, and so did the amount of carbon that had to be burned to release a unit of energy (from 30 kg of carbon per gigajoule in 1850 to about 15 today).[69] Figure 10-7 shows that carbon emissions follow a Kuznets arc: when rich countries such as the United States and the United Kingdom first industrialized, they emitted more and more CO_2 to produce a dollar of GDP, but they turned a corner in the 1950s and since then have been emitting less and less. China

and India are following suit, cresting in the late 1970s and mid-1990s, respectively. (China flew off the charts in the late 1950s because of Mao's boneheaded schemes like backyard iron smelters with copious emissions and zero economic output.) Carbon intensity for the world as a whole has been declining for half a century.[70]

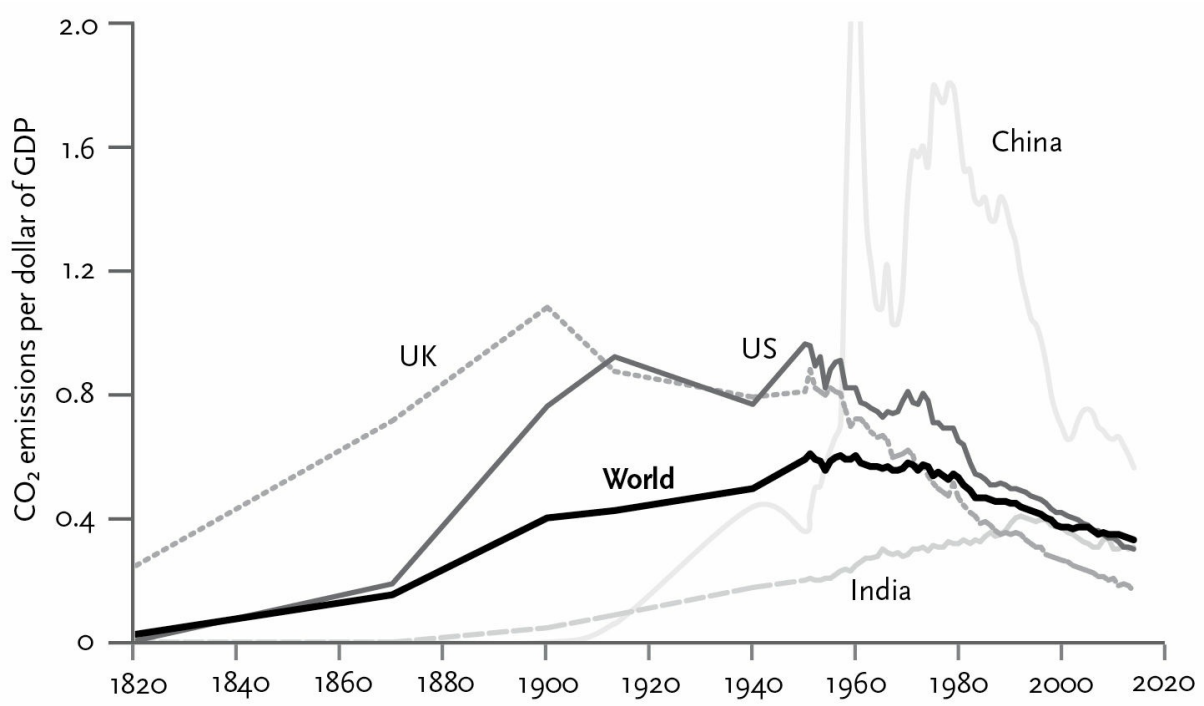


Figure 10-7: Carbon intensity (CO_2 emissions per dollar of GDP), 1820–2014

Source: Ritchie & Roser 2017, based on data from the Carbon Dioxide Information Analysis Center, http://cdiac.ornl.gov/trends/emis/tre_coun.html. GDP is in 2011 international dollars; for the years before 1990, GDP comes from Maddison Project 2014.

Decarbonization is a natural consequence of people's preferences. "Carbon blackens miners' lungs, endangers urban air, and threatens climate change," Ausubel explains. "Hydrogen is as innocent as an element can be, ending combustion as water."[71] People want their energy dense and clean, and as they move into cities, they accept only electricity and gas, delivered right to their bedside and stovetop. Remarkably, this natural development has brought the world to Peak Coal and maybe even Peak Carbon. As figure 10-8 shows, global emissions plateaued from 2014 to 2015 and declined among the top three emitters, namely China, the European Union, and the United States. (As we saw for the United

States in figure 10-3, carbon emissions plateaued while prosperity rose: between 2014 and 2016, the Gross World Product grew by 3 percent annually.)[72] Some of the carbon was reduced by the growth of wind and solar power, but most of it, particularly in the United States, was reduced by the replacement of $C_{137}H_{97}O_9NS$ coal with CH_4 gas.

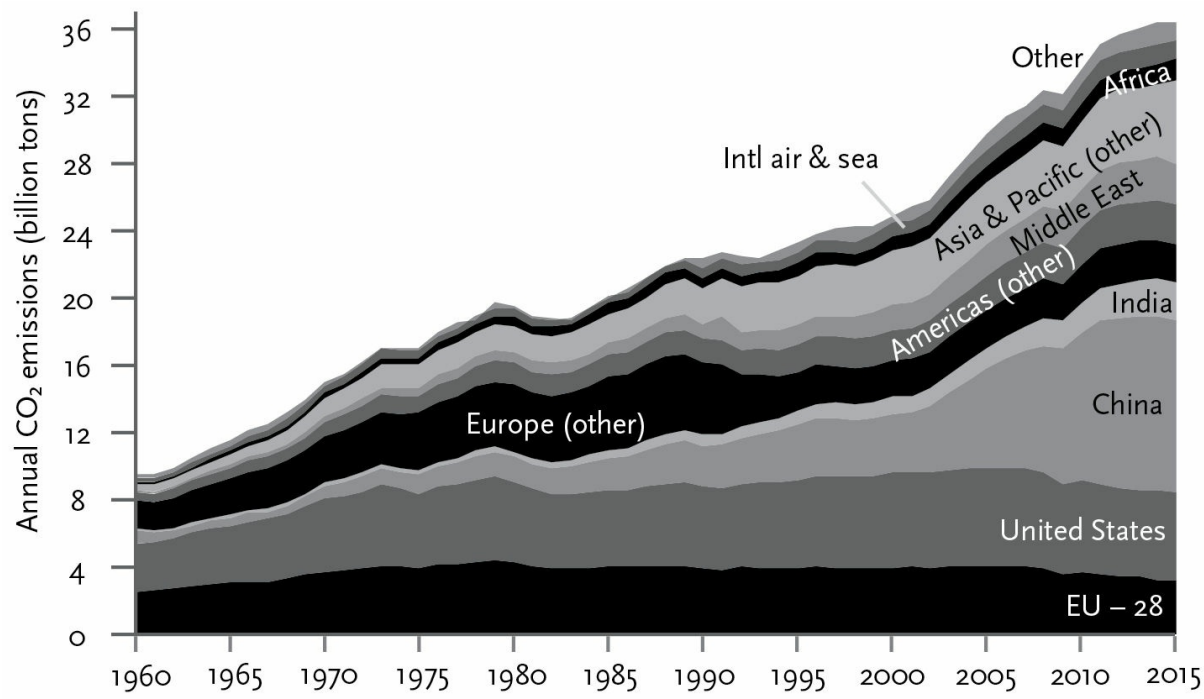


Figure 10-8: CO_2 emissions, 1960–2015

Sources: *Our World in Data,* Ritchie & Roser 2017 and https://ourworldindata.org/grapher/annual-co2-emissions-by-region, based on data from the Carbon Dioxide Information Analysis Center, http://cdiac.ornl.gov/CO2_Emission/, and Le Quéré et al. 2016. "International air & sea" refers to aviation and sea transport; it corresponds to "Bunker fuels" in the original sources. "Other" refers to the difference between estimated global CO_2 emissions and the sum of the regional and national totals; it corresponds to the "Statistical difference" component.

The long sweep of decarbonization shows that economic growth is not synonymous with burning carbon. Some optimists believe that if the trend is allowed to evolve into its next phase—from low-carbon natural gas to zero-carbon nuclear energy, a process abbreviated as "N2N"—the climate will have a soft landing. But only the sunniest believe this will happen by itself. Annual CO_2 emissions may have leveled off for the time being at around 36 billion tons, but that's still a *lot* of CO_2 added to the atmosphere every year, and

there is no sign of the precipitous plunge we would need to stave off the harmful outcomes. Instead, decarbonization needs to be helped along with pushes from policy and technology, an idea called deep decarbonization.[73]

It begins with carbon pricing: charging people and companies for the damage they do when they dump their carbon into the atmosphere, either as a tax on carbon or as a national cap with tradeable credits. Economists across the political spectrum endorse carbon pricing because it combines the unique advantages of governments and markets.[74] No one owns the atmosphere, so people (and companies) have no reason to stint on emissions that allow each of them to enjoy their energy while harming everyone else, a perverse outcome that economists call a negative externality (another name for the collective costs in a public goods game, or the damage to the commons in the Tragedy of the Commons). A carbon tax, which only governments can impose, "internalizes" the public costs, forcing people to factor the harm into every carbon-emitting decision they make. Having billions of people decide how best to conserve, given their values and the information conveyed by prices, is bound to be more efficient and humane than having government analysts try to divine the optimal mixture from their desks. The potters don't have to hide their kilns from the Carbon Police; they can do their part in saving the planet by taking shorter showers, forgoing Sunday drives, and switching from beef to eggplant. Parents don't have to calculate whether diaper services, with their trucks and laundries, emit more carbon than the makers of disposable diapers; the difference will be folded into the prices, and each company has an incentive to lower its emissions to compete with the other. Inventors and entrepreneurs can take risks on carbon-free energy sources that would compete against fossil fuels on a level playing field rather than the tilted one we have now, in which the fossils get to spew their waste into the atmosphere for free. Without carbon pricing, fossil fuels—which are uniquely abundant, portable, and energy-dense—have too great an advantage over the alternatives.

Carbon taxes, to be sure, hit the poor in a way that concerns the left, and they transfer money from the private to the public sector in a way that annoys the right. But these effects can be neutralized by

adjusting sales, payroll, income, and other taxes and transfers. (As Al Gore put it: Tax what you burn, not what you earn.) And if the tax starts low and increases steeply and predictably over time, people can factor the increase into their long-term purchases and investments, and by favoring low-carbon technologies as they evolve, escape most of the tax altogether.[75]

A second key to deep decarbonization brings up an inconvenient truth for the traditional Green movement: nuclear power is the world's most abundant and scalable carbon-free energy source.[76] Although renewable energy sources, particularly solar and wind, have become drastically cheaper, and their share of the world's energy has more than tripled in the past five years, that share is still a paltry 1.5 percent, and there are limits on how high it can go.[77] The wind is often becalmed, and the sun sets every night and may be clouded over. But people need energy around the clock, rain or shine. Batteries that could store and release large amounts of energy from renewables will help, but ones that could work on the scale of cities are years away. Also, wind and solar sprawl over vast acreage, defying the densification process that is friendliest to the environment. The energy analyst Robert Bryce estimates that simply keeping up with the world's increase in energy use would require turning an area the size of Germany into wind farms every year.[78] To satisfy the world's needs with renewables by 2050 would require tiling windmills and solar panels over an area the size of the United States (including Alaska), plus Mexico, Central America, and the inhabited portion of Canada.[79]

Nuclear energy, in contrast, represents the ultimate in density, because, in a nuclear reaction, $E = mc^2$: you get an immense amount of energy (proportional to the speed of light squared) from a small bit of mass. Mining the uranium for nuclear energy leaves a far smaller environmental scar than mining coal, oil, or gas, and the power plants themselves take up about one five-hundredth of the land needed by wind or solar.[80] Nuclear energy is available around the clock, and it can be plugged into power grids that provide concentrated energy where it is needed. It has a lower carbon footprint than solar, hydro, and biomass, and it's safer than them, too. The sixty years with nuclear power have seen thirty-one deaths in the 1986 Chernobyl disaster, the result of extraordinary Soviet-

era bungling, together with a few thousand early deaths from cancer above the 100,000 natural cancer deaths in the exposed population.[81] The other two famous accidents, at Three Mile Island in 1979 and Fukushima in 2011, killed no one. Yet vast numbers of people are killed day in, day out by the pollution from burning combustibles and by accidents in mining and transporting them, none of which make headlines. Compared with nuclear power, natural gas kills 38 times as many people per kilowatt-hour of electricity generated, biomass 63 times as many, petroleum 243 times as many, and coal *387* times as many—perhaps a million deaths a year.[82]

Nordhaus and Shellenberger summarize the calculations of an increasing number of climate scientists: "There is no credible path to reducing global carbon emissions without an enormous expansion of nuclear power. It is the only low carbon technology we have today with the demonstrated capability to generate large quantities of centrally generated electric power."[83] The Deep Decarbonization Pathways Project, a consortium of research teams that have worked out roadmaps for countries to reduce their emissions enough to meet the 2°C target, estimates that the United States will have to get between 30 and 60 percent of its electricity from nuclear power by 2050 (1.5 to 3 times the current fraction), at the same time that it generates far more of that electricity to take over from fossil fuels in heating homes, powering vehicles, and producing steel, cement, and fertilizer.[84] In one scenario, this would require quadrupling its nuclear capacity. Similar expansions would be necessary in China, Russia, and other countries.[85]

Unfortunately, the use of nuclear power has been shrinking just when it should be growing. In the United States, eleven nuclear reactors have recently been closed or are threatened with closure, which would cancel the entire carbon savings from the expanded use of solar and wind. Germany, which has relied on nuclear energy for much of its electricity, is shutting down its plants as well, increasing its carbon emissions from the coal-fired plants that replace them, and France and Japan may follow its lead.

Why are Western countries going the wrong way? Nuclear power presses a number of psychological buttons—fear of poisoning, ease of imagining catastrophes, distrust of the unfamiliar and the man-

made—and the dread has been amplified by the traditional Green movement and its dubiously "progressive" supporters.[86] One commentator blames global warming on the Doobie Brothers, Bonnie Raitt, and the other rock stars whose 1979 *No Nukes* concert and film galvanized baby-boomer sentiment against nuclear power. (Sample lyrics of the closing anthem: "Just give me the warm power of the sun . . . But won't you take all your atomic poison power away.")[87] Some of the blame might go to Jane Fonda, Michael Douglas, and the producers of the 1979 disaster film *The China Syndrome,* so named because the melted-down nuclear reactor core would supposedly sink through the Earth's crust all the way to China, after making "an area the size of Pennsylvania" uninhabitable. In a devilish coincidence, the Three Mile Island plant in central Pennsylvania suffered its partial meltdown two weeks after the movie's release, creating widespread panic and making the very idea of nuclear power as radioactive as its uranium fuel.

It's often said that with climate change, those who know the most are the most frightened, but with nuclear power, those who know the most are the least frightened.[88] As with oil tankers, cars, planes, buildings, and factories (chapter 12), engineers have learned from the accidents and near-misses and have progressively squeezed more safety out of nuclear reactors, reducing the risks of accidents and contamination far below those of fossil fuels. The advantage even extends to radioactivity, which is a natural property of the fly ash and flue gases emitted by burning coal.

Still, nuclear power is expensive, mainly because it must clear crippling regulatory hurdles while its competitors have been given easy passage. Also, in the United States, nuclear power plants are now being built, after a lengthy hiatus, by private companies using idiosyncratic designs, so they have not climbed the engineer's learning curve and settled on the best practices in design, fabrication, and construction. Sweden, France, and South Korea, in contrast, have built standardized reactors by the dozen and now enjoy cheap electricity with substantially lower carbon emissions. As Ivan Selin, former commissioner of the Nuclear Regulatory Commission, put it, "The French have two kinds of reactors and hundreds of kinds of cheese, whereas in the United States the figures are reversed."[89]

For nuclear power to play a transformative role in decarbonization it will eventually have to leap past the second-generation technology of light-water reactors. (The "first generation" consisted of prototypes from the 1950s and early 1960s.) Soon to come on line are a few Generation III reactors, which evolved from the current designs with improvements in safety and efficiency but so far have been plagued by financial and construction snafus. Generation IV reactors comprise a half-dozen new designs which promise to make nuclear plants a mass-produced commodity rather than finicky limited editions.[90] One type might be cranked out on an assembly line like jet engines, fitted into shipping containers, transported by rail, and installed on barges anchored offshore cities. This would allow them to clear the NIMBY hurdle, ride out storms or tsunamis, and be towed away at the end of their useful lives for decommissioning. Depending on the design, they could be buried and operated underground, cooled by inert gas or molten salt that needn't be pressurized, refueled continuously with a stream of pebbles rather than shut down for the replacement of fuel rods, equipped to co-generate hydrogen (the cleanest of fuels), and designed to shut themselves off without power or human intervention if they overheat. Some would be fueled by relatively abundant thorium, and others by uranium extracted from seawater, from dismantled nuclear weapons (the ultimate beating of swords into plowshares), from the waste of existing reactors, or even from their own waste—the closest we will ever get to a perpetual-motion machine, capable of powering the world for thousands of years. Even nuclear fusion, long derided as the energy source that is "thirty years away and always will be," really may be thirty years away (or less) this time.[91]

The benefits of advanced nuclear energy are incalculable. Most climate change efforts call for policy reforms (such as carbon pricing) which remain contentious and will be hard to implement worldwide even in the rosiest scenarios. An energy source that is cheaper, denser, and cleaner than fossil fuels would sell itself, requiring no herculean political will or international cooperation.[92] It would not just mitigate climate change but furnish manifold other gifts. People in the developing world could skip the middle rungs in the energy ladder, bringing their standard of living up to that of the

West without choking on coal smoke. Affordable desalination of seawater, an energy-ravenous process, could irrigate farms, supply drinking water, and, by reducing the need for both surface water and hydro power, allow dams to be dismantled, restoring the flow of rivers to lakes and seas and revivifying entire ecosystems. The team that brings clean and abundant energy to the world will benefit humanity more than all of history's saints, heroes, prophets, martyrs, and laureates combined.

Breakthroughs in energy may come from startups founded by idealistic inventors, from the skunk works of energy companies, or from the vanity projects of tech billionaires, especially if they have a diversified portfolio of safe bets and crazy moonshots.[93] But research and development will also need a boost from governments, because these global public goods are too great a risk with too little reward for private companies. Governments must play a role because, as Brand points out, "infrastructure is one of the things we hire governments to handle, especially energy infrastructure, which requires no end of legislation, bonds, rights of way, regulations, subsidies, research, and public-private contracts with detailed oversight."[94] This includes a regulatory environment that is suited to 21st-century challenges rather than to 1970s-era technophobia and nuclear dread. Some fourth-generation nuclear technologies are shovel-ready, but are trussed in regulatory green tape and may never see the light of day, at least not in the United States.[95] China, Russia, India, and Indonesia, which are hungry for energy, sick of smog, and free from American squeamishness and political gridlock, may take the lead.

Whoever does it, and whichever fuel they use, the success of deep decarbonization will hinge on technological progress. Why assume that the know-how of 2018 is the best the world can do? Decarbonization will need breakthroughs not just in nuclear power but on other technological frontiers: batteries to store the intermittent energy from renewables; Internet-like smart grids that distribute electricity from scattered sources to scattered users at scattered times; technologies that electrify and decarbonize industrial processes such as the production of cement, fertilizer, and steel; liquid biofuels for heavy trucks and planes that need dense, portable energy; and methods of capturing and storing CO_2.

The last of these is critical for a simple reason. Even if greenhouse gas emissions are halved by 2050 and zeroed by 2075, the world would still be on course for risky warming, because the CO_2 already emitted will remain in the atmosphere for a very long time. It's not enough to stop thickening the greenhouse; at some point we have to dismantle it.

The basic technology is more than a billion years old. Plants suck carbon out of the air as they use the energy in sunlight to combine CO_2 with H_2O and make sugars (like $C_6H_{12}O_6$), cellulose (a chain of $C_6H_{10}O_5$ units), and lignin (a chain of units like $C_{10}H_{14}O_4$); the latter two make up most of the biomass in wood and stems. The obvious way to remove CO_2 from the air, then, is to recruit as many carbon-hungry plants as we can to help us. We can do this by encouraging the transition from deforestation to reforestation and afforestation (planting new forests), by reversing tillage and wetland destruction, and by restoring coastal and marine habitats. And to reduce the amount of carbon that returns to the atmosphere when dead plants rot, we could encourage building with wood and other plant products, or cook the biomass into non-rotting charcoal and bury it as a soil amendment called biochar.[96]

Other ideas for carbon capture span a broad range of flakiness, at least by the standards of current technology. The more speculative end shades into geoengineering, and includes plans to disperse pulverized rock that takes up CO_2 as it weathers, to add alkali to clouds or the oceans to dissolve more CO_2 in water, and to fertilize the ocean with iron to accelerate photosynthesis by plankton.[97] The more proven end consists of technologies that can scrub CO_2 from the smokestacks of fossil fuel plants and pump it into nooks and crannies in the earth's crust. (Skimming the sparse 400 parts per million directly from the atmosphere is theoretically possible but prohibitively inefficient, though that could change if nuclear power became cheap enough.) The technologies can be retrofitted into existing factories and power plants, and though they are themselves energy-hungry, they could slash carbon emissions from the vast energy infrastructure that is already in place (resulting in so-called clean coal). The technologies can also be fitted onto gasification

plants that convert coal into liquid fuels, which may still be needed for planes and heavy trucks. The geophysicist Daniel Schrag points out that the gasification process already has to separate CO_2 from the gas stream, so sequestering that CO_2 to protect the atmosphere is a modest incremental expense, and it would yield liquid fuel with a smaller carbon footprint than that of petroleum.[98] Better still, if the coal feedstock is supplemented with biomass (including grasses, agricultural waste, forest cuttings, municipal garbage, and perhaps someday genetically engineered plants or algae), it could be carbon-neutral. Best of all, if the feedstock consisted *exclusively* of biomass, it would be carbon-*negative*. The plants pull CO_2 out of the atmosphere, and when their biomass is used for energy (via combustion, fermentation, or gasification), the carbon capture process keeps it out. The combination, sometimes called BECCS—bioenergy with carbon capture and storage—has been called climate change's savior technology.[99]

Will any of this happen? The obstacles are unnerving; they include the world's growing thirst for energy, the convenience of fossil fuels with their vast infrastructure, the denial of the problem by energy corporations and the political right, the hostility to technological solutions from traditional Greens and the climate justice left, and the tragedy of the carbon commons. For all that, preventing climate change is an idea whose time has come. One indication is a trio of headlines that appeared in *Time* magazine within a three-week span in 2015: "China Shows It's Serious About Climate Change," "Walmart, McDonald's, and 79 Others Commit to Fight Global Warming," and "Americans' Denial of Climate Change Hits Record Low." In the same season the *New York Times* reported, "Poll Finds Global Consensus on a Need to Tackle Climate Change." In all but one of the forty countries surveyed (Pakistan), a majority of respondents were in favor of limiting greenhouse gas emissions, including 69 percent of the Americans.[100]

The global consensus is not just hot air. In December 2015, 195 countries signed a historic agreement that committed them to keeping the global temperature rise to "well below" 2°C (with a target of 1.5°C) and to setting aside $100 billion annually in climate mitigation financing for developing countries (which had been a sticking point in prior, unsuccessful attempts at a global

consensus).[101] In October 2016, 115 of the signatories ratified the agreement, putting it into force. Most of the signatories submitted detailed plans on how they would pursue these goals through 2025, and all promised to update their plans every five years with stepped-up efforts. Without this ratcheting, the current plans are inadequate: they would allow the world's temperature to rise by 2.7°C, and would reduce the chance of a dangerous 4°C rise in 2100 by only 75 percent, which is still too close for comfort. But the public commitments, combined with contagious technological advances, could push the ratchet upward, in which case the Paris agreement would substantially reduce the likelihood of a 2°C rise and essentially eliminate the possibility of a 4°C rise.[102]

This game plan faced a setback in 2017 when Donald Trump, who had notoriously called climate change a Chinese hoax, announced that the United States would withdraw from the agreement. Even if the withdrawal takes place in November 2020 (the earliest possible date), the decarbonization driven by technology and economics will continue, and climate change policies will be advanced by cities, states, business and tech leaders, and the world's other countries, which have declared the deal "irreversible" and may pressure the United States to keep its word by imposing carbon tariffs on American exports and other sanctions.[103]



Even with fair winds and following seas, the effort needed to prevent climate change is immense, and we have no guarantee that the necessary transformations in technology and politics will be in place soon enough to slow down global warming before it causes extensive harm. This brings us to a last-ditch protective measure: lowering the world's temperature by reducing the amount of solar radiation that reaches the lower atmosphere and Earth's surface.[104] A fleet of airplanes could spray a fine mist of sulfates, calcite, or nanoparticles into the stratosphere, spreading a thin veil that would reflect back just enough sunlight to prevent dangerous warming.[105] This would mimic the effects of a volcanic eruption such as that of Mount Pinatubo in the Philippines in 1991, which spewed so much sulfur dioxide into the atmosphere that the planet cooled down by half a degree Celsius (about one degree Fahrenheit) for two years.

Or a fleet of cloudships could spray a fine mist of seawater into the air. As the water evaporated, salt crystals would waft into the clouds and water vapor would condense around them, forming droplets that would whiten the clouds and reflect more sunlight back into space. These measures are relatively inexpensive, require no exotic new technologies, and could bring global temperatures down quickly. Other ideas for manipulating the atmosphere and oceans have been bruited about as well, though research on all of them is in its infancy.

The very idea of climate engineering sounds like the crazed scheme of a mad scientist, and it once was close to taboo. Critics see it as a Promethean folly that could have unintended consequences such as disrupting rainfall patterns and damaging the ozone layer. Since the effects of any measure applied to the entire planet are uneven from place to place, climate engineering raises the question of whose hand should be on the world's thermostat: as with a bickering couple, if one country lowered the temperature at the expense of another, it could set off a war. Once the world depended on climate engineering, then if for any reason it slacked off, temperatures in the carbon-soaked atmosphere would soar far more quickly than people could adapt. The mere mention of an escape hatch for the climate crisis creates a moral hazard, tempting countries to shirk their duty to reduce greenhouse gas emissions. And the accumulated CO_2 in the atmosphere would continue to dissolve in seawater, slowly turning the oceans into carbonic acid.

For all these reasons, no responsible person could maintain that we can just keep pumping carbon into the air and slather sunscreen onto the stratosphere to compensate. But in a 2013 book the physicist David Keith makes a case for a form of climate engineering that is *moderate, responsive,* and *temporary*. "Moderate" means that the amounts of sulfate or calcite would be just enough to reduce the rate of warming, not cancel it altogether; moderation is a virtue because small manipulations are less likely to bring unwelcome surprises. "Responsive" means that any manipulation would be careful, gradual, closely monitored, constantly adjusted, and, if indicated, halted altogether. And "temporary" means that the program would be designed only to give humanity breathing space until it eliminates greenhouse gas emissions and brings the CO_2 in

the atmosphere back to preindustrial levels. In response to the fear that the world would become addicted to climate engineering forever, Keith remarks, "Is it plausible that we will not figure out how to pull, say, five gigatons of carbon per year out of the air by 2075? I don't buy it."[106]

Though Keith is among the world's foremost climate engineers, he cannot be accused of being carried away by innovation thrill. A similarly thoughtful case may be found in the journalist Oliver Morton's 2015 book *The Planet Remade,* which presents the historical, political, and moral dimensions of climate engineering alongside the technical state of the art. Morton shows that humanity has been disrupting global cycles of water, nitrogen, and carbon for more than a century, so it's too late to preserve a primeval Earth system. And given the enormity of the climate change problem, it's unwise to assume we will solve it quickly or easily. Research into how we might minimize the harm to millions of people before the solutions are completely in place only seems prudent, and Morton lays out scenarios of how a program of moderate and temporary climate engineering might be implemented even in a world that falls short of ideal global governance. The legal scholar Dan Kahan has shown that far from creating a moral hazard, providing information about climate engineering makes people *more* concerned about climate change and less biased by their political ideology.[107]



Despite a half-century of panic, humanity is not on an irrevocable path to ecological suicide. The fear of resource shortages is misconceived. So is the misanthropic environmentalism that sees modern humans as vile despoilers of a pristine planet. An enlightened environmentalism recognizes that humans need to use energy to lift themselves out of the poverty to which entropy and evolution consign them. It seeks the means to do so with the least harm to the planet and the living world. History suggests that this modern, pragmatic, and humanistic environmentalism can work. As the world gets richer and more tech-savvy, it dematerializes, decarbonizes, and densifies, sparing land and species. As people get richer and better educated, they care more about the environment, figure out ways to protect it, and are better able to pay the costs.

Many parts of the environment are rebounding, emboldening us to deal with the admittedly severe problems that remain.

First among them is the emission of greenhouse gases and the threat they pose of dangerous climate change. People sometimes ask me whether I think that humanity will rise to the challenge or whether we will sit back and let disaster unfold. For what it's worth, I think we'll rise to the challenge, but it's vital to understand the nature of this optimism. The economist Paul Romer distinguishes between *complacent* optimism, the feeling of a child waiting for presents on Christmas morning, and *conditional* optimism, the feeling of a child who wants a treehouse and realizes that if he gets some wood and nails and persuades other kids to help him, he can build one.[108] We cannot be complacently optimistic about climate change, but we can be conditionally optimistic. We have some practicable ways to prevent the harms and we have the means to learn more. Problems are solvable. That does not mean that they will solve themselves, but it does mean that we can solve them *if* we sustain the benevolent forces of modernity that have allowed us to solve problems so far, including societal prosperity, wisely regulated markets, international governance, and investments in science and technology.

CHAPTER 11

PEACE

How deep do the currents of progress flow? Can they suddenly come to a halt or go into reverse? The history of violence provides an opportunity to confront these questions. In *The Better Angels of Our Nature* I showed that, as of the first decade of the 21st century, every objective measure of violence had been in decline. As I was writing it, reviewers warned me that it could all explode before the first copy hit the stores. (A war, possibly nuclear, between Iran and either Israel or the United States was the worry of the day.) Since the book was published in 2011, a cascade of bad news would seem to make it obsolete: civil war in Syria, atrocities in the Islamic State, terrorism in Western Europe, autocracy in Eastern Europe, shootings by police in the United States, and hate crimes and other outbursts of racism and misogyny from angry populists throughout the West.

But the same Availability and Negativity biases that made people incredulous about the possibility that violence had declined can make them quick to conclude that any decline has been reversed. In the next five chapters I will put the recent bad news in perspective by going back to the data. I'll plot the historical trajectories of several kinds of violence up to the present, including a reminder of the last data point available when *The Better Angels of Our Nature* went to press.[1] Seven years or so is an eyeblink in history, but it offers a crude indication of whether the book capitalized on a lucky instant or identified an ongoing trend. More important, I'll try to explain the trends in terms of deeper historical forces, placing them within the narrative of progress that is the subject of this book. (In doing so I'll introduce some new ideas on what those forces are.) I'll begin with the most extravagant form of violence, war.

For most of human history, war was the natural pastime of governments, peace a mere respite between wars.[2] This can be seen in figure 11-1, which plots the proportion of time over the last half-millennium that the great powers of the day were at war. (Great powers are the handful of states and empires that can project force beyond their borders, that treat each other as peers, and that collectively control a majority of the world's military resources.)[3] Wars between great powers, which include world wars, are the most intense forms of destruction our sorry species has managed to dream up, and they are responsible for a majority of the victims of all wars combined. The graph shows that at the dawn of the modern era the great powers were pretty much always at war. But nowadays they are never at war: the last one pitted the United States against China in Korea more than sixty years ago.



Figure 11-1: Great power war, 1500–2015

Source: Levy & Thompson 2011, updated for the 21st century. Percentage of years the great powers fought each other in wars, aggregated over 25-year periods, except for 2000–2015. The arrow points to 1975–1999, the last quarter-century plotted in fig. 5–12 of Pinker 2011.

The jagged decline of great power war conceals two trends that until recently went in opposite directions.[4] For 450 years, wars involving a great power became shorter and less frequent. But as their armies became better manned, trained, and armed, the wars that did take place became more lethal, culminating in the brief but stunningly destructive world wars. It was only after the second of these that all three measures of war—frequency, duration, and lethality—declined in tandem, and the world entered the period that has been called the Long Peace.

It's not just the great powers that have stopped fighting each other. War in the classic sense of an armed conflict between the uniformed armies of two nation-states appears to be obsolescent.[5] There have been no more than three in any year since 1945, none in most years since 1989, and none since the American-led invasion of Iraq in 2003, the longest stretch without an interstate war since the end of World War II.[6] Today, skirmishes between national armies kill dozens of people rather than the hundreds of thousands or millions who died in the all-out wars that nation-states have fought throughout history. The Long Peace has certainly been tested since 2011, such as in conflicts between Armenia and Azerbaijan, Russia and Ukraine, and the two Koreas, but in each case the belligerents backed down rather than escalating into all-out war. This doesn't, of course, mean that escalation to major war is impossible, just that it is considered extraordinary, something that nations try to avoid at (almost) all costs.

The geography of war also continues to shrink. In 2016 a peace agreement between the government of Colombia and Marxist FARC guerrillas ended the last active political armed conflict in the Western Hemisphere, and the last remnant of the Cold War. This is a momentous change from just decades before.[7] In Guatemala, El Salvador, and Peru, as in Colombia, leftist guerrillas battled American-backed governments, and in Nicaragua it was the other way around (American-backed contras battling a left-wing government), in conflicts that collectively killed more than 650,000 people.[8] The transition of an entire hemisphere to peace follows the path of other large regions of the world. Western Europe's bloody centuries of warfare, culminating in the two world wars, have given way to more than seven decades of peace. In East Asia, the wars of

the mid-20th century took millions of lives—in Japan's conquests, the Chinese Civil War, and the wars in Korea and Vietnam. Yet despite serious political disputes, East and Southeast Asia today are almost entirely free from active interstate combat.

The world's wars are now concentrated almost exclusively in a zone stretching from Nigeria to Pakistan, an area containing less than a sixth of the world's population. Those wars are civil wars, which the Uppsala Conflict Data Program (UCDP) defines as an armed conflict between a government and an organized force which verifiably kills at least a thousand soldiers and civilians a year. Here we find some recent cause for discouragement. A precipitous decline in the number of civil wars after the end of the Cold War—from fourteen in 1990 to four in 2007—went back up to eleven in 2014 and 2015 and to twelve in 2016.[9] The flip is driven mainly by conflicts that have a radical Islamist group on one side (eight of the eleven in 2015, ten of the twelve in 2016); without them, there would have been no increase in the number of wars at all. Perhaps not coincidentally, two of the wars in 2014 and 2015 were fueled by another counter-Enlightenment ideology, Russian nationalism, which drove separatist forces, backed by Vladimir Putin, to battle the government of Ukraine in two of its provinces.

The worst of the ongoing wars is in Syria, where the government of Bashar al-Assad has pulverized his country in an attempt to defeat a diverse set of rebel forces, Islamist and non-Islamist, with the assistance of Russia and Iran. The Syrian civil war, with 250,000 battle deaths as of 2016 (conservatively estimated), is responsible for most of the uptick in the global rate of war deaths shown in figure 11-2.[10]

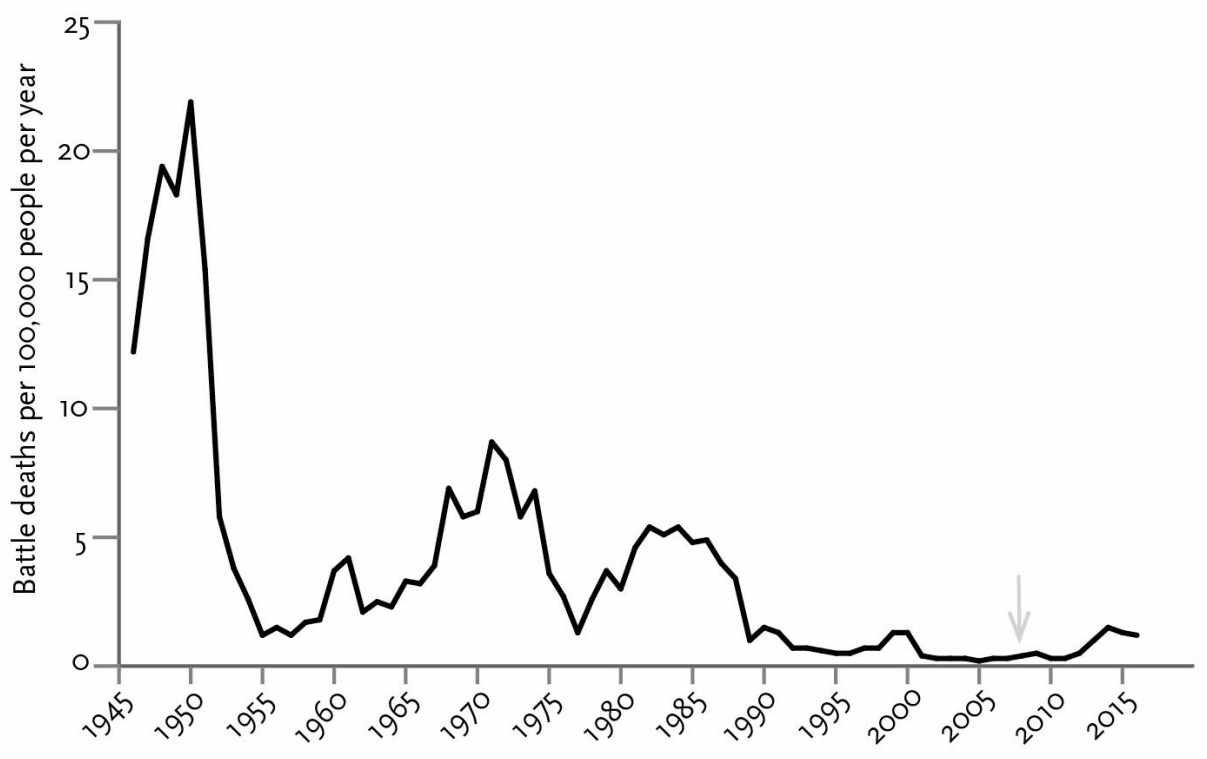


Figure 11-2: Battle deaths, 1946–2016

Sources: Adapted from Human Security Report Project 2007. **For 1946–1988:** *Peace Research Institute of Oslo Battle Deaths Dataset* 1946–2008, Lacina & Gleditsch 2005. **For 1989–2015:** *UCDP Battle-Related Deaths Dataset version 5.0*, Uppsala Conflict Data Program 2017, Melander, Pettersson, & Themnér 2016, updated with information from Therese Pettersson and Sam Taub of UCDP. **World population figures:** 1950–2016, US Census Bureau; 1946–1949, McEvedy & Jones 1978, with adjustments. The arrow points to 2008, the last year plotted in fig. 6–2 of Pinker 2011.

That uptick, however, comes at the end of a vertiginous six-decade plunge. World War II at its worst saw almost 300 battle deaths per 100,000 people per year; it is not shown in the graph because it would have scrunched the line for all subsequent years into a wrinkled carpet. In the postwar years, as the graph shows, the rate of deaths roller-coastered downward, cresting at 22 during the Korean War, 9 during the Vietnam War in the late 1960s and early 1970s, and 5 during the Iran-Iraq War in the mid-1980s, before bobbing along the floor at less than 0.5 between 2001 and 2011. It crept up to 1.5 in 2014 and subsided to 1.2 in 2016, the most recent year for which data are available.

Followers of the news in the mid-2010s might have expected the Syrian carnage to have erased all of the historic progress of the preceding decades. That's because they forget the many civil wars

that ended without fanfare after 2009 (in Angola, Chad, India, Iran, Peru, and Sri Lanka) and also forget earlier ones with massive death tolls, such as the wars in Indochina (1946–54, 500,000 deaths), India (1946–48, a million deaths), China (1946–50, a million deaths), Sudan (1956–72, 500,000 deaths, and 1983–2002, a million deaths), Uganda (1971–78, 500,000 deaths), Ethiopia (1974–91, 750,000 deaths), Angola (1975–2002, a million deaths), and Mozambique (1981–92, 500,000 deaths).[11]

Searing images of desperate refugees from the Syrian civil war, many of them struggling to resettle in Europe, have led to the claim that the world now has more refugees than at any time in history. But this is another symptom of historical amnesia and the Availability bias. The political scientist Joshua Goldstein notes that today's four million Syrian refugees are outnumbered by the ten million displaced by the Bangladesh War of Independence in 1971, the fourteen million displaced by the partition of India in 1947, and the sixty million displaced by World War II in Europe alone, eras when the world's population was a fraction of what it is now. Quantifying this misery is by no means callous to the terrible suffering of today's victims. It honors the suffering of yesterday's victims, and it ensures that policymakers will act in their interests by working from an accurate understanding of the world. In particular, it should prevent them from drawing dangerous conclusions about "a world at war," which could tempt them to scrap global governance or return to a mythical "stability" of Cold War confrontation. "The world is not the problem," Goldstein notes; "Syria is the problem. . . . The policies and practices that ended wars [elsewhere] can with effort and intelligence end wars today in South Sudan, Yemen, and perhaps even Syria."[12]

Mass killings of unarmed civilians, also known as genocides, democides, or one-sided violence, can be as lethal as wars and often overlap with them. According to the historians Frank Chalk and Kurt Jonassohn, "Genocide has been practiced in all regions of the world and during all periods in history."[13] During World War II, tens of millions of civilians were slaughtered by Hitler, Stalin, and imperial Japan, and in deliberate bombings of civilian areas by all sides (twice with nuclear weapons); at its peak the death rate was about 350 per 100,000 per year.[14] But contrary to the assertion that

"the world has learned nothing from the Holocaust," the postwar period has seen nothing like the blood flood of the 1940s. Even within the postwar period, the rate of deaths in genocides has juddered down a steep sawtooth, as we see in two datasets shown in figure 11-3.

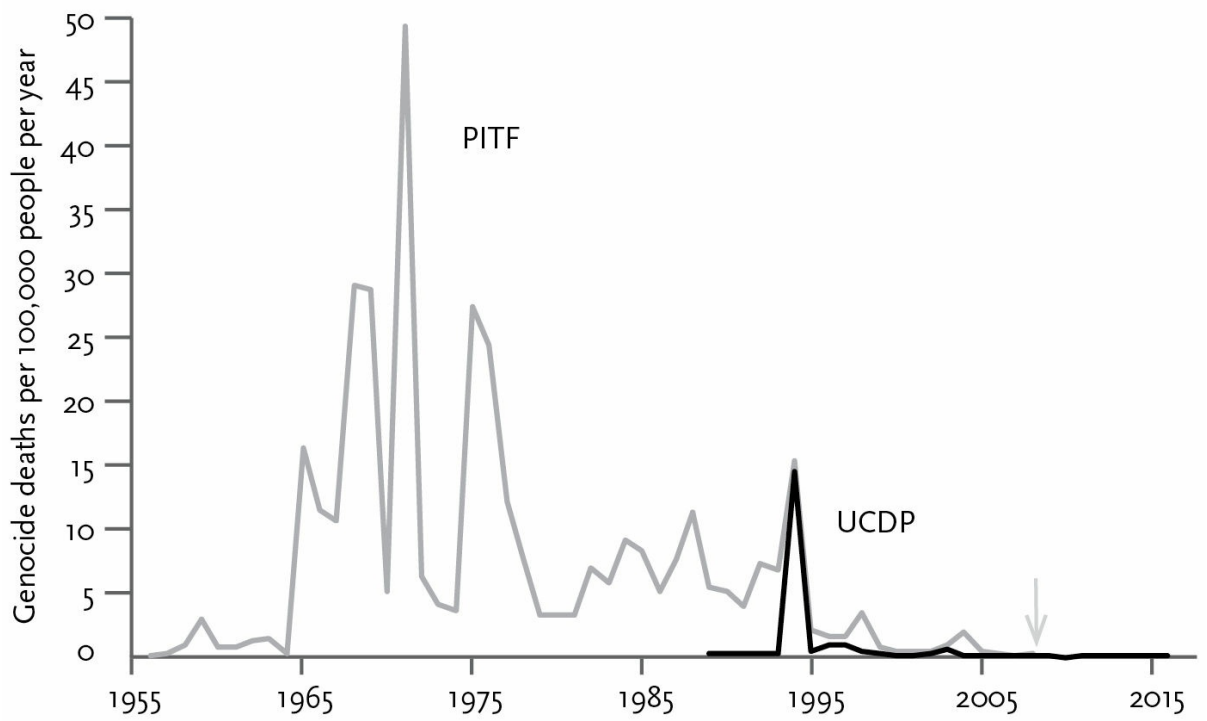


Figure 11-3: Genocide deaths, 1956–2016

Sources: PITF, 1955–2008: *Political Instability Task Force State Failure Problem Set*, 1955–2008, Marshall, Gurr, & Harff 2009; Center for Systemic Peace 2015. Calculations described in Pinker 2011, p. 338. **UCDP, 1989–2016:** *UCDP One-Sided Violence Dataset v. 2.5-2016,* Melander, Pettersson, & Themnér 2016; Uppsala Conflict Data Program 2017, "High fatality" estimates, updated with data provided by Sam Taub of UCDP, scaled by world population figures from US Census Bureau. The arrow points to 2008, the last year plotted in fig. 6–8 of Pinker 2011.

The peaks in the graph correspond to mass killings in the Indonesian anti-Communist "year of living dangerously" (1965–66, 700,000 deaths), the Chinese Cultural Revolution (1966–75, 600,000), Tutsis against Hutus in Burundi (1965–73, 140,000), the Bangladesh War of Independence (1971, 1.7 million), north-against-south violence in Sudan (1956–72, 500,000), Idi Amin's regime in Uganda (1972–79, 150,000), Pol Pot's regime in Cambodia (1975–79, 2.5 million), killings of political enemies in Vietnam (1965–75, 500,000), and more recent massacres in Bosnia (1992–95,

225,000), Rwanda (1994, 700,000), and Darfur (2003–8, 373,000).[15] The barely perceptible swelling from 2014 to 2016 includes the atrocities that contribute to the impression that we are living in newly violent times: at least 4,500 Yazidis, Christians, and Shiite civilians killed by ISIS; 5,000 killed by Boko Haram in Nigeria, Cameroon, and Chad; and 1,750 killed by Muslim and Christian militias in the Central African Republic.[16] One can never use the word "fortunately" in connection with the killing of innocents, but the numbers in the 21st century are a fraction of those in earlier decades.

Of course, the numbers in a dataset cannot be interpreted as a direct readout of the underlying risk of war. The historical record is especially scanty when it comes to estimating any change in the likelihood of very rare but very destructive wars.[17] To make sense of sparse data in a world whose history plays out only once, we need to supplement the numbers with knowledge about the generators of war, since, as the UNESCO motto notes, "Wars begin in the minds of men." And indeed we find that the turn away from war consists in more than just a reduction in wars and war deaths; it also may be seen in nations' preparations for war. The prevalence of conscription, the size of armed forces, and the level of global military spending as a percentage of GDP have all decreased in recent decades.[18] Most important, there have been changes in the minds of men (and women).



How did it happen? The Age of Reason and the Enlightenment brought denunciations of war from Pascal, Swift, Voltaire, Samuel Johnson, and the Quakers, among others. It also saw practical suggestions for how to reduce or even eliminate war, particularly Kant's famous essay "Perpetual Peace."[19] The spread of these ideas has been credited with the decline in great power wars in the 18th and 19th centuries and with several hiatuses in war during that interval.[20] But it was only after World War II that the pacifying forces identified by Kant and others were systematically put into place.

As we saw in chapter 1, many Enlightenment thinkers advanced the theory of gentle commerce, according to which international trade should make war less appealing. Sure enough, trade as a

proportion of GDP shot up in the postwar era, and quantitative analyses have confirmed that trading countries are less likely to go to war, holding all else constant.[21]

Another brainchild of the Enlightenment is the theory that democratic government serves as a brake on glory-drunk leaders who would drag their countries into pointless wars. Starting in the 1970s, and accelerating after the fall of the Berlin Wall in 1989, more countries gave democracy a chance (chapter 14). While the categorical statement that no two democracies have ever gone to war is dubious, the data support a graded version of the Democratic Peace theory, in which pairs of countries that are more democratic are less likely to confront each other in militarized disputes.[22]

The Long Peace was also helped along by some realpolitik. The massive destructive powers of the American and Soviet armies (even without their nuclear weapons) made the Cold War superpowers think twice about confronting each other on the battlefield—which, to the world's surprise and relief, they never did.[23]

Yet the biggest single change in the international order is an idea we seldom appreciate today: *war is illegal*. For most of history, that was not the case. Might made right, war was the continuation of policy by other means, and to the victor went the spoils. If one country felt it had been wronged by another, it could declare war, conquer some territory as compensation, and expect the annexation to be recognized by the rest of the world. The reason that Arizona, California, Colorado, Nevada, New Mexico, and Utah are American states is that in 1846 the United States conquered them from Mexico in a war over unpaid debts. That cannot happen today: the world's nations have committed themselves to not waging war except in self-defense or with the approval of the United Nations Security Council. States are immortal, borders are grandfathered in, and any country that indulges in a war of conquest can expect opprobrium, not acquiescence, from the rest.

The legal scholars Oona Hathaway and Scott Shapiro argue that it's the outlawry of war that deserves much of the credit for the Long Peace. The idea that nations should agree to make war illegal was proposed by Kant in 1795. It was first agreed upon in the much-ridiculed 1928 Pact of Paris, also known as the Kellogg-Briand pact,

but really became effective only with the founding of the United Nations in 1945. Since then, the conquest taboo has occasionally been enforced with a military response, such as when an international coalition reversed Iraq's conquest of Kuwait in 1990–91. More often the prohibition has functioned as a norm—"War is something that civilized nations just don't do"—backed by economic sanctions and symbolic punishments. Those penalties are effective to the extent that nations value their standing in the international community—a reminder of why we should cherish and strengthen that community in the face of threats from populist nationalism today.[24]

To be sure, the norm is sometimes honored in the breach, most recently in 2014, when Russia annexed Crimea. This would seem to confirm the cynical view that until we have a world government, international norms are toothless and will be flouted with impunity. Hathaway and Shapiro reply that laws within a country are broken, too, from parking violations to homicides, yet an imperfectly enforced law is better than no rule of law at all. The century before the Paris Peace Pact, they calculate, saw the equivalent of *eleven Crimea-sized annexations a year,* most of which stuck. But virtually every acre of land that was conquered after 1928 has been returned to the state that lost it. Frank Kellogg and Aristide Briand (the US secretary of state and the French foreign minister) may deserve the last laugh.

Hathaway and Shapiro point out that the outlawry of interstate war had a downside. As European empires vacated the colonial territories they had conquered, they often left behind weak states with fuzzy borders and no single recognized successor to govern them. The states often fell into civil war and intercommunal violence. Under the new international order, they were no longer legitimate targets of conquest by more effective powers, and hung on in semi-anarchy for years or decades.

The decline of interstate war was still a magnificent example of progress. Civil wars kill fewer people than interstate wars, and since the late 1980s civil wars have declined as well.[25] When the Cold War ended, the great powers became less interested in who won a civil war than in how to end it, and they supported UN peacekeeping forces and other international posses which inserted themselves

between belligerents and, more often than not, really did keep the peace.[26] Also, as countries get richer, they become less vulnerable to civil war. Their governments can afford to provide services like health care, education, and policing and thus outcompete rebels for the allegiance of their citizens, and they can regain control of the frontier regions that warlords, mafias, and guerrillas (often the same people) stake out.[27] And since many wars are ignited by the mutual fear that unless a country attacks preemptively it will be annihilated by a preemptive attack (the game-theoretic scenario called a security dilemma or Hobbesian trap), the alighting of peace in a neighborhood, whatever its first cause, can be self-reinforcing. (Conversely, war can be contagious.)[28] That helps explain the shrinking geography of war, with most regions of the globe at peace.



Together with ideas and policies that reduce the incidence of war, there has been a change in values. The pacifying forces we have seen so far are, in a sense, technological: they are means by which the odds can be tilted in favor of peace if it's peace that people want. At least since the folk-song-and-Woodstock '60s, the idea that peace is inherently worthy has become second nature to Westerners. When military interventions have been launched they have been rationalized as regrettable but necessary measures to prevent greater violence. But not so long ago it was *war* that was considered worthy. War was glorious, thrilling, spiritual, manly, noble, heroic, altruistic—a cleansing purgative for the effeminacy, selfishness, consumerism, and hedonism of decadent bourgeois society.[29]

Today, the idea that it is inherently noble to kill and maim people and destroy their roads, bridges, farms, dwellings, schools, and hospitals strikes us as the raving of a madman. But during the 19th-century counter-Enlightenment, it all made sense. Romantic militarism became increasingly fashionable, not just among *Pickelhaube*-topped military officers but among many artists and intellectuals. War "enlarges the mind of a people and raises their character," wrote Alexis de Tocqueville. It is "life itself," said Émile Zola; "the foundation of all the arts . . . [and] the high virtues and faculties of man," wrote John Ruskin.[30]

Romantic militarism sometimes merged with romantic nationalism, which exalted the language, culture, homeland, and

racial makeup of an ethnic group—the ethos of blood and soil—and held that a nation could fulfill its destiny only as an ethnically cleansed sovereign state.[31] It drew strength from the muzzy notion that violent struggle is the life force of nature ("red in tooth and claw") and the engine of human progress. (This can be distinguished from the Enlightenment idea that the engine of human progress is problem-solving.) The valorization of struggle harmonized with Friedrich Hegel's theory of a dialectic in which historical forces bring forth a superior nation-state: wars are necessary, Hegel wrote, "for they save the state from social petrifaction and stagnation."[32] Marx adapted the idea to economic systems and prophesied that a progression of violent class conflicts would climax in a communist utopia.[33]

But perhaps the biggest impetus to romantic militarism was declinism, the revulsion among intellectuals at the thought that ordinary people seemed to be enjoying their lives in peace and prosperity.[34] Cultural pessimism became particularly entrenched in Germany through the influence of Schopenhauer, Nietzsche, Jacob Burckhardt, Georg Simmel, and Oswald Spengler, author in 1918–23 of *The Decline of the West*. (We will return to these ideas in chapter 23.) To this day, historians of World War I puzzle over why England and Germany, countries with a lot in common—Western, Christian, industrialized, affluent—would choose to hold a pointless bloodbath. The reasons are many and tangled, but insofar as they involve ideology, Germans before World War I "saw themselves as *outside* European or Western civilization," as Arthur Herman points out.[35] In particular, they thought they were bravely resisting the creep of a liberal, democratic, commercial culture that had been sapping the vitality of the West since the Enlightenment, with the complicity of Britain and the United States. Only from the ashes of a redemptive cataclysm, many thought, could a new heroic order arise. They got their wish for a cataclysm. After a second and even more horrific one, the romance had finally been drained from war, and peace became the stated goal of every Western and international institution. Human life has become more precious, while glory, honor, preeminence, manliness, heroism, and other symptoms of excess testosterone have been downgraded.

Many people refuse to believe that progress toward peace, however fitful, could even be possible. Human nature, they insist, includes an insatiable drive for conquest. (And not just human nature; some commentators project the megalomania of *Homo sapiens* males onto every form of intelligence, warning that we must not search for extraterrestrial life lest an advanced race of space aliens discovers our existence and comes over to subjugate us.) While a vision of world peace may have given John and Yoko some good songs, it is hopelessly naïve in the real world.

In fact, war may be just another obstacle an enlightened species learns to overcome, like pestilence, hunger, and poverty. Though conquest may be tempting over the short term, it's ultimately better to figure out how to get what you want without the costs of destructive conflict and the inherent hazards of living by the sword, namely that if you are a menace to others you have given them an incentive to destroy you first. Over the long run, a world in which all parties refrain from war is better for everyone. Inventions such as trade, democracy, economic development, peacekeeping forces, and international law and norms are tools that help build that world.

CHAPTER 12

SAFETY

The human body is a fragile thing. Even when people keep themselves fueled, functioning, and free of pathogens, they are vulnerable to "the thousand natural shocks that flesh is heir to." Our ancestors were easy pickings for predators like crocodiles and large cats. They were done in by the venom of snakes, spiders, insects, snails, and frogs. Trapped in the omnivore's dilemma, they could be poisoned by toxic ingredients in their expansive diets, including fish, beans, roots, seeds, and mushrooms. As they ventured up trees in pursuit of fruit and honey, their bodies obeyed Newton's law of universal gravitation and were liable to accelerate toward the ground at a rate of 9.8 meters per second. If they waded too far into lakes and rivers, the water could cut off their air supply. They played with fire and sometimes got burned. And they could be victims of malice aforethought: any technology that can fell an animal can fell a human rival.

Few people get eaten today, but every year tens of thousands die from snakebites, and other hazards continue to kill us in large numbers.[1] Accidents are the fourth-leading cause of death in the United States, after heart disease, cancer, and respiratory diseases. Worldwide, injuries account for about a tenth of all deaths, outnumbering the victims of AIDS, malaria, and tuberculosis combined, and are responsible for 11 percent of the years lost to death and disability.[2] Personal violence also takes a toll: it is among the top five hazards for young people in the United States and for all people in Latin America and sub-Saharan Africa.[3]

People have long given thought to the causes of danger and how they might be forfended. Perhaps the most stirring moment in

Jewish religious observance is a prayer recited before the open Torah ark during the Days of Awe:

> On Rosh Hashanah will be inscribed and on Yom Kippur will be sealed: . . . who will live and who will die; who will die at his allotted time and who before his time, who by water and who by fire, who by sword and who by beast, who by famine and who by thirst, who by earthquake and who by plague, who by strangling and who by stoning. . . . But repentance, prayer, and charity annul the severity of the decree.

Fortunately, our knowledge of how fatalities are caused has gone beyond divine inscription, and our means of preventing them have become more reliable than repentance, prayer, and charity. Human ingenuity has been vanquishing the major hazards of life, including every one enumerated in the prayer, and we are now living in the safest time in history.

In previous chapters we have seen how cognitive and moralistic biases work to damn the present and absolve the past. In this one we will see another way in which they conceal our progress. Though lethal injuries are a major scourge of human life, bringing the numbers down is not a sexy cause. The inventor of the highway guard rail did not get a Nobel Prize, nor are humanitarian awards given to designers of clearer prescription drug labels. Yet humanity has benefited tremendously from unsung efforts that have decimated the death toll from every kind of injury.



Who by sword. Let's begin with the category of injury that is the hardest to eliminate precisely because it is no accident, homicide. With the exception of the world wars, more people are killed in homicides than wars.[4] During the battle-scarred year of 2015 the ratio was around 4.5 to 1; more commonly it is 10 to 1 or higher. Homicides were an even greater threat to life in the past. In medieval Europe, lords massacred the serfs of their rivals, aristocrats and their retinues fought each other in duels, brigands and highwaymen murdered the victims of their robberies, and ordinary people stabbed each other over insults at the dinner table.[5]

But in a sweeping historical development that the German sociologist Norbert Elias called the Civilizing Process, Western Europeans, starting in the 14th century, began to resolve their disputes in less violent ways.[6] Elias credited the change to the emergence of centralized kingdoms out of the medieval patchwork of baronies and duchies, so that the endemic feuding, brigandage, and warlording were tamed by a "king's peace." Then, in the 19th century, criminal justice systems were further professionalized by municipal police forces and a more deliberative court system. Over those centuries Europe also developed an infrastructure of commerce, both physical, in the form of better roads and vehicles, and financial, in the form of currency and contracts. Gentle commerce proliferated, and the zero-sum plundering of land gave way to a positive-sum trade of goods and services. People became enmeshed in networks of commercial and occupational obligations laid out in legal and bureaucratic rules. Their norms for everyday conduct shifted from a macho culture of honor, in which affronts had to be answered with violence, to a gentlemanly culture of dignity, in which status was won by displays of propriety and self-control.

The historical criminologist Manuel Eisner has assembled datasets on homicide in Europe which put numbers to the narrative that Elias had published in 1939.[7] (Homicide rates are the most reliable indicator of violent crime across different times and places because a corpse is always hard to overlook, and rates of homicide correlate with rates of other violent crimes like robbery, assault, and rape.) Eisner argues that Elias's theory was on the right track, and not just in Europe. Whenever a government brings a frontier region under the rule of law and its people become integrated into a commercial society, rates of violence fall. In figure 12-1, I show Eisner's data for England, the Netherlands, and Italy, with updates through 2012; the curves for other Western European countries are similar. I have added lines for parts of the Americas in which law and order came later: colonial New England, followed by a region in the "Wild West," followed by Mexico, notorious for its violence today but far more violent in the past.

When I introduced the concept of progress I noted that no progressive trend is inexorable, and violent crime is a case in point.

Starting in the 1960s, most Western democracies saw a boom in personal violence that erased a century of progress.[8] It was most dramatic in the United States, where the rate of homicide shot up by a factor of two and a half, and where urban and political life were upended by a widespread (and partly justified) fear of crime. Yet this reversal of progress has its own lessons for the nature of progress.

During the high-crime decades, most experts counseled that nothing could be done about violent crime. It was woven into the fabric of a violent American society, they said, and could not be controlled without solving the root causes of racism, poverty, and inequality. This version of historical pessimism may be called root-causism: the pseudo-profound idea that every social ill is a symptom of some deep moral sickness and can never be mitigated by simplistic treatments which fail to cure the gangrene at the core.[9] The problem with root-causism is not that real-world problems are simple but the opposite: they are more complex than a typical root-cause theory allows, especially when the theory is based on moralizing rather than data. So complex, in fact, that treating the symptoms may be the best way of dealing with the problem, because it does not require omniscience about the intricate tissue of actual causes. Indeed, by seeing what really does reduce the symptoms, one can test hypotheses about the causes, rather than just assuming them to be true.

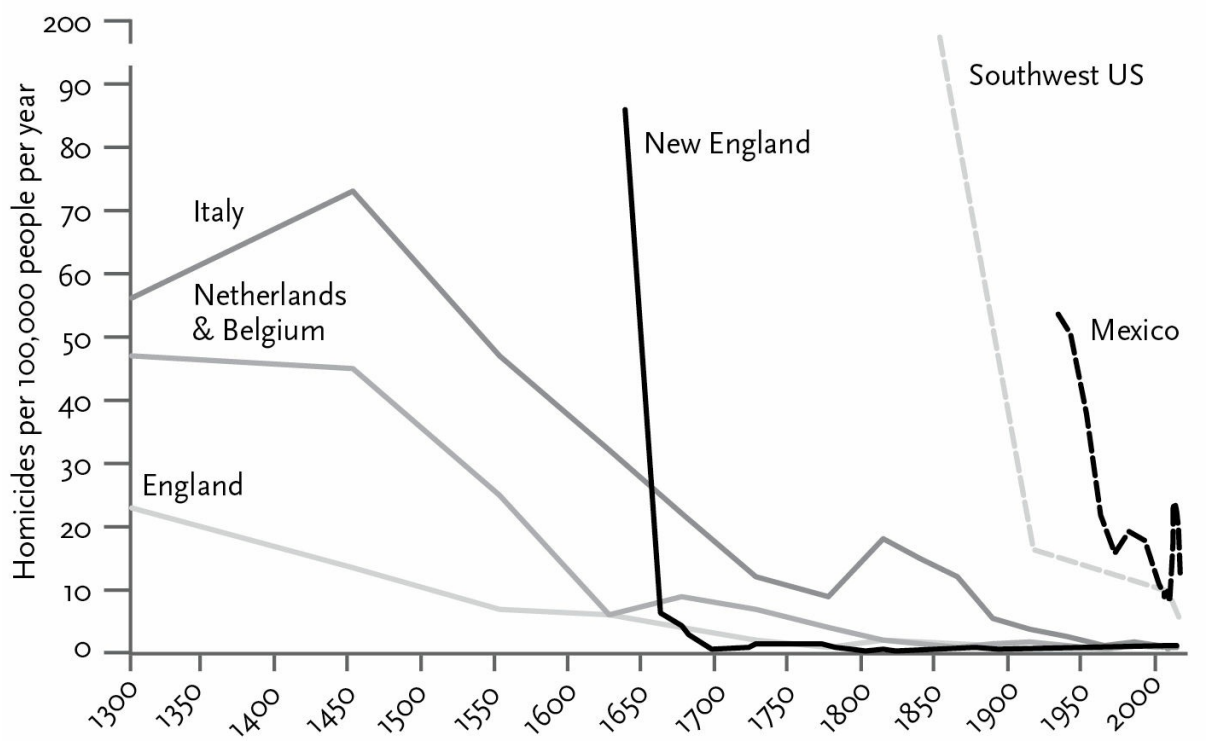


Figure 12-1: Homicide deaths, Western Europe, US, and Mexico, 1300–2015

Sources: England, Netherlands & Belgium, Italy, 1300–1994: Eisner 2003, plotted in fig. 3–3 of Pinker 2011. **England, 2000–2014:** UK Office for National Statistics. **Italy and Netherlands, 2010–2012:** United Nations Office on Drugs and Crime 2014. **New England (New England, whites only, 1636–1790, and Vermont and New Hampshire, 1780–1890):** Roth 2009, plotted in fig. 3–13 of Pinker 2011; 2006 and 2014 from FBI Uniform Crime Reports. **Southwest US (Arizona, Nevada, and New Mexico), 1850 and 1914:** Roth 2009, plotted in fig. 3–16 of Pinker 2011; 2006 and 2014 from FBI Uniform Crime Reports. **Mexico:** Carlos Vilalta, personal communication, originally from Instituto Nacional de Estadística y Geografía 2016 and Botello 2016, averaged over decades until 2010.

In the case of the 1960s crime explosion, even the facts at hand refuted the root-cause theory. That was the decade of civil rights, with racism in steep decline (chapter 15), and of an economic boom, with levels of inequality and unemployment for which we are nostalgic.[10] The 1930s, in contrast, was the decade of the Great Depression, Jim Crow laws, and monthly lynchings, yet the overall rate of violent crime plummeted. The root-cause theory was truly deracinated by a development that took everyone by surprise. Starting in 1992, the American homicide rate went into free fall during an era of steeply rising inequality, and then took another dive during the Great Recession beginning in 2007 (figure 12-2).[11] England, Canada, and most other industrialized countries also saw their homicide rates fall in the past two decades. (Conversely, in

Venezuela during the Chávez-Maduro regime, inequality fell while homicide soared.)[12] Though numbers for the entire world exist only for this millennium and include heroic guesstimates for countries that are data deserts, the trend appears to be downward as well, from 8.8 homicides per 100,000 people in 2000 to 6.2 in 2012. That means there are 180,000 people walking around today who would have been murdered just in the last year if the global homicide rate had remained at its level of a dozen years before.[13]

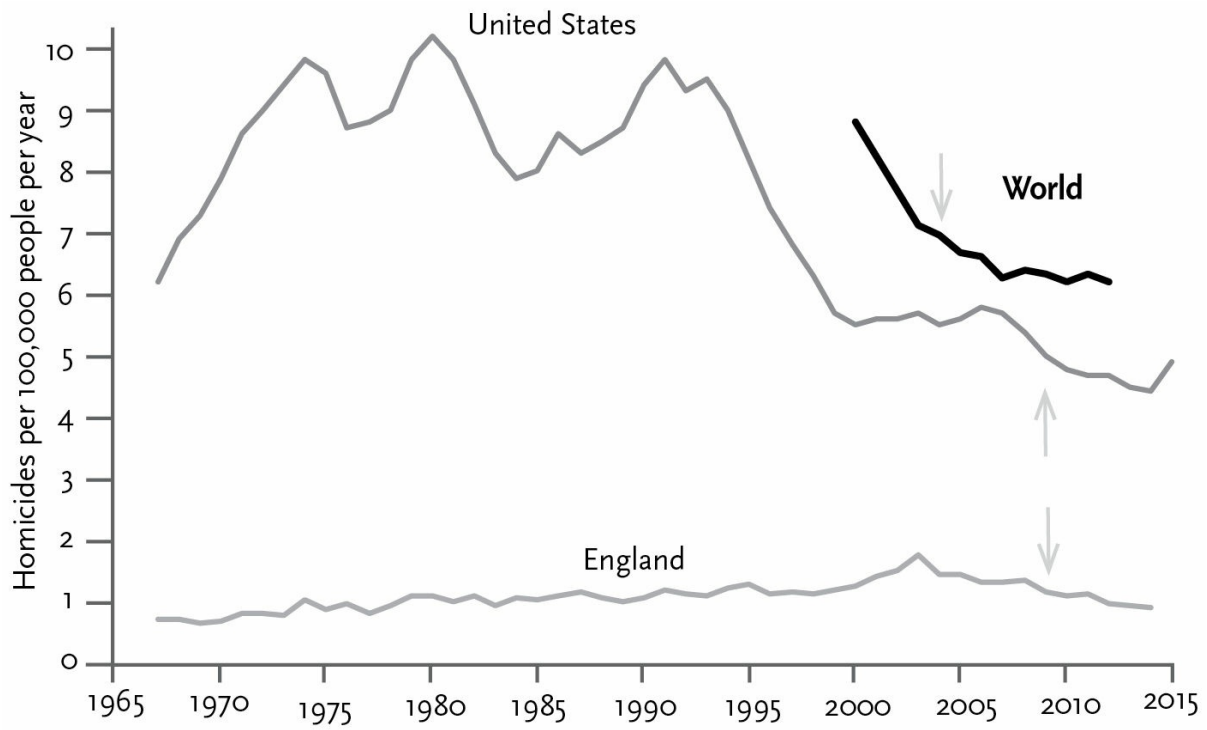


Figure 12-2: Homicide deaths, 1967–2015

Sources: United States: *FBI Uniform Crime Reports*, https://ucr.fbi.gov/, and Federal Bureau of Investigation 2016a. **England** (data include Wales): Office for National Statistics 2017. **World, 2000:** Krug et al. 2002. **World, 2003–2011:** United Nations Economic and Social Council 2014, fig. 1; the percentages were converted to homicide rates by setting the 2012 rate at 6.2, the estimate reported in United Nations Office on Drugs and Crime 2014, p. 12. The arrows point to the most recent years plotted in Pinker 2011 for the world (2004, fig. 3–9), US (2009, fig. 3–18), and England (2009, fig. 3–19).

Violent crime is a solvable problem. We may never get the homicide rate for the world down to the levels of Kuwait (0.4 per 100,000 per year), Iceland (0.3), or Singapore (0.2), let alone all the way to 0.[14] But in 2014, Eisner, in consultation with the World Health Organization, proposed a goal of reducing the rate of global homicide by 50 percent within thirty years.[15] The aspiration is not

utopian but practical, based on two facts about the statistics of homicide.

The first is that the distribution of homicide is highly skewed at every level of granularity. The homicide rates of the most dangerous countries are several hundred times those of the safest, including Honduras (90.4 homicides per 100,000 per year), Venezuela (53.7), El Salvador (41.2), Jamaica (39.3), Lesotho (38), and South Africa (31).[16] Half of the world's homicides are committed in just twenty-three countries containing about a tenth of humanity, and a quarter are committed in just four: Brazil (25.2), Colombia (25.9), Mexico (12.9), and Venezuela. (The world's two murder zones—northern Latin America and southern sub-Saharan Africa—are distinct from its war zones, which stretch from Nigeria through the Middle East into Pakistan.) The lopsidedness continues down the fractal scale. Within a country, most of the homicides cluster in a few cities, such as Caracas (120 per 100,000) and San Pedro Sula (in Honduras, 187). Within cities, the homicides cluster in a few neighborhoods; within neighborhoods, they cluster in a few blocks; and within blocks, many are carried out by a few individuals.[17] In my hometown of Boston, 70 percent of the shootings take place in 5 percent of the city, and half the shootings were perpetrated by one percent of the youths.[18]

The other inspiration for the 50-30 goal is evident from figure 12-2: high rates of homicide can be brought down quickly. The most murderous affluent democracy, the United States, saw its homicide rate plunge by almost half in nine years; New York City's decline during that time was even steeper, around 75 percent.[19] Countries that are still more famous for their violence have also enjoyed steep declines, including Russia (from 19 per 100,000 in 2004 to 9.2 in 2012), South Africa (from 60.0 in 1995 to 31.2 in 2012), and Colombia (from 79.3 in 1991 to 25.9 in 2015).[20] Among the eighty-eight countries with reliable data, sixty-seven have seen a decline in the last fifteen years.[21] The unlucky ones (mostly in Latin America) have been ravaged by terrible increases, but even there, when leaders of cities and regions set their mind to reducing the bloodshed, they often succeed.[22] Figure 12-1 shows that Mexico, after suffering a reversal from 2007 to 2011 (entirely attributable to organized crime), enjoyed a reversal of the reversal by 2014,

including an almost 90 percent drop from 2010 to 2012 in notorious Juárez.[23] Bogotá and Medellín saw declines by four-fifths in two decades, and São Paulo and the favelas of Rio de Janeiro saw declines by two-thirds.[24] Even the world's murder capital, San Pedro Sula, has seen homicide rates plunge by 62 percent in just *two years*.[25]

Now, combine the cockeyed distribution of violent crime with the proven possibility that high rates of violent crime can be brought down quickly, and the math is straightforward: a 50 percent reduction in thirty years is not just practicable but almost conservative.[26] And it's no statistical trick. The moral value of quantification is that it treats all lives as equally valuable, so actions that bring down the highest numbers of homicides prevent the greatest amount of human tragedy.

The lopsided skew of violent crime also points a flashing red arrow at the best way to reduce it.[27] Forget root causes. Stay close to the symptoms—the neighborhoods and individuals responsible for the biggest wedges of violence—and chip away at the incentives and opportunities that drive them.

It begins with law enforcement. As Thomas Hobbes argued during the Age of Reason, zones of anarchy are always violent.[28] It's not because everyone wants to prey on everyone else, but because in the absence of a government the threat of violence can be self-inflating. If even a few potential predators lurk in the region or could show up on short notice, people must adopt an aggressive posture to deter them. This deterrent is credible only if they advertise their resolve by retaliating against any affront and avenging any depredation, regardless of the cost. This "Hobbesian trap," as it is sometimes called, can easily set off cycles of feuding and vendetta: you have to be at least as violent as your adversaries lest you become their doormat. The largest category of homicide, and the one that varies the most across times and places, consists of confrontations between loosely acquainted young men over turf, reputation, or revenge. A disinterested third party with a monopoly on the legitimate use of force—that is, a state with a police force and judiciary—can nip this cycle in the bud. Not only does it disincentivize aggressors by the threat of punishment, but it

reassures everyone else that the aggressors are disincentivized and thereby relieves them of the need for belligerent self-defense.

The most blatant evidence for the impact of law enforcement may be found in the sky-high rates of violence in the times and places where law enforcement is rudimentary, such as the upper left tips of the curves in figure 12-1. Equally persuasive is what happens when police go on strike: an eruption of looting and vigilantism.[29] But crime rates can also soar when law enforcement is merely ineffective—when it is so inept, corrupt, or overwhelmed that people know they can break the law with impunity. That was a contributor to the 1960s crime boom, when the judicial system was no match for a wave of baby boomers entering their crime-prone years, and it is a contributor to the high-crime regions of Latin America today.[30] Conversely, an expansion of policing and criminal punishment (though with a big overshoot in incarceration) explains a good part of the Great American Crime Decline of the 1990s.[31]

Here is Eisner's one-sentence summary of how to halve the homicide rate within three decades: "An effective rule of law, based on legitimate law enforcement, victim protection, swift and fair adjudication, moderate punishment, and humane prisons is critical to sustainable reductions in lethal violence."[32] The adjectives *effective, legitimate, swift, fair, moderate,* and *humane* differentiate his advice from the get-tough-on-crime rhetoric favored by right-wing politicians. The reasons were explained by Cesare Beccaria two hundred and fifty years ago. While the threat of ever-harsher punishments is both cheap and emotionally satisfying, it's not particularly effective, because scofflaws just treat them like rare accidents—horrible, yes, but a risk that comes with the job. Punishments that are predictable, even if less draconian, are likelier to be factored into day-to-day choices.

Together with the presence of law enforcement, the *legitimacy* of the regime appears to matter, because people not only respect legitimate authority themselves but factor in the degree to which they expect their potential adversaries to respect it. Eisner, together with the historian Randolph Roth, notes that crime often shoots up in decades in which people question their society and government, including the American Civil War, the 1960s, and post-Soviet Russia.[33]

Recent reviews of what does and doesn't work in crime prevention back up Eisner's advisory, particularly a massive meta-analysis by the sociologists Thomas Abt and Christopher Winship of 2,300 studies evaluating just about every policy, plan, program, project, initiative, intervention, nostrum, and gimmick that has been tried in recent decades.[34] They concluded that the single most effective tactic for reducing violent crime is *focused deterrence*. A "laser-like focus" must first be directed on the neighborhoods where crime is rampant or even just starting to creep up, with the "hot spots" identified by data gathered in real time. It must be further beamed at the individuals and gangs who are picking on victims or roaring for a fight. And it must deliver a simple and concrete message about the behavior that is expected of them, like "Stop shooting and we will help you, keep shooting and we will put you in prison." Getting the message through, and then enforcing it, depends on the cooperation of other members of the community—the store owners, preachers, coaches, probation officers, and relatives.

Also provably effective is cognitive behavioral therapy. This has nothing to do with psychoanalyzing an offender's childhood conflicts or propping his eyelids open while he retches to violent film clips like in *A Clockwork Orange*. It is a set of protocols designed to override the habits of thought and behavior that lead to criminal acts. Troublemakers are impulsive: they seize on sudden opportunities to steal or vandalize, and lash out at people who cross them, heedless of the long-term consequences.[35] These temptations can be counteracted with therapies that teach strategies of self-control. Troublemakers also have narcissistic and sociopathic thought patterns, such as that they are always in the right, that they are entitled to universal deference, that disagreements are personal insults, and that other people have no feelings or interests. Though they cannot be "cured" of these delusions, they can be trained to recognize and counteract them.[36] This swaggering mindset is amplified in a culture of honor, and it can be deconstructed in therapies of anger management and social-skills training as part of counseling for at-risk youth or programs to prevent recidivism.

Whether or not their impetuousness has been brought under control, potential miscreants can stay out of trouble simply because

opportunities for instant gratification have been removed from their environments.[37] When cars are harder to steal, houses are harder to burgle, goods are harder to pilfer and fence, pedestrians carry more credit cards than cash, and dark alleys are lit and video-monitored, would-be criminals don't seek another outlet for their larcenous urges. The temptation passes, and a crime is not committed. Cheap consumer goods are another development that has turned weak-willed delinquents into law-abiding citizens despite themselves. Who nowadays would take the risk of breaking into an apartment just to steal a clock radio?

Together with anarchy, impulsiveness, and opportunity, a major trigger of criminal violence is contraband. Entrepreneurs in illegal goods and pastimes cannot file a lawsuit when they feel they have been swindled, or call the police when someone threatens them, so they have to protect their interests with a credible threat of violence. Violent crime exploded in the United States when alcohol was prohibited in the 1920s and when crack cocaine became popular in the late 1980s, and it is rampant in Latin American and Caribbean countries in which cocaine, heroin, and marijuana are trafficked today. Drug-fueled violence remains an unsolved international problem. Perhaps the ongoing decriminalization of marijuana, and in the future other drugs, will lift these industries out of their lawless underworld. In the meantime, Abt and Winship observe that "aggressive drug enforcement yields little anti-drug benefits and generally increases violence," while "drug courts and treatment have a long history of effectiveness."[38]

Any evidence-based reckoning is bound to pour cold water on programs that seemed promising in the theater of the imagination. Conspicuous by their absence from the list of what works are bold initiatives like slum clearance, gun buybacks, zero-tolerance policing, wilderness ordeals, three-strikes-and-you're-out mandatory sentencing, police-led drug awareness classes, and "scared straight" programs in which at-risk youths are exposed to squalid prisons and badass convicts. And perhaps most disappointing to those who hold strong opinions without needing evidence are the equivocal effects of gun legislation. Neither right-to-carry laws favored by the right, nor bans and restrictions favored by the left, have been shown to make much difference—though

there is much we don't know, and political and practical impediments to finding out more.[39]



As I sought to explain various declines of violence in *The Better Angels of Our Nature* I put little stock in the idea that in the past "human life was cheap" and that over time it became more precious. It seemed woolly and untestable, almost circular, so I stuck to explanations that were closer to the phenomena, such as governance and trade. After sending in the manuscript, I had an experience that gave me second thoughts. To reward myself for completing that massive undertaking I decided to replace my rusty old car, and in the course of car shopping I bought the latest issue of *Car and Driver* magazine. The issue opened with an article called "Safety in Numbers: Traffic Deaths Fall to an All-Time Low," and it was illustrated with a graph that was instantly familiar: time on the *x*-axis, rate of death on the *y*-axis, and a line that snaked from the top left to the bottom right.[40] Between 1950 and 2009, the rate of death in traffic accidents fell *sixfold*. Staring up at me was yet another decline in violent death, but this time dominance and hatred had nothing to do with it. Some combination of forces had been working over the decades to reduce the risk of death from driving—as if, yes, life had become more precious. As society became richer, it spent more of its income, ingenuity, and moral passion on saving lives on the roads.

Later I learned that *Car and Driver* had been conservative. Had they plotted the dataset from its first year, 1921, it would have shown an almost *twenty-four-fold* reduction in the death rate. Figure 12-3 shows the full time line—though not even the full story, since for every person who died there were others who were crippled, disfigured, and racked with pain.

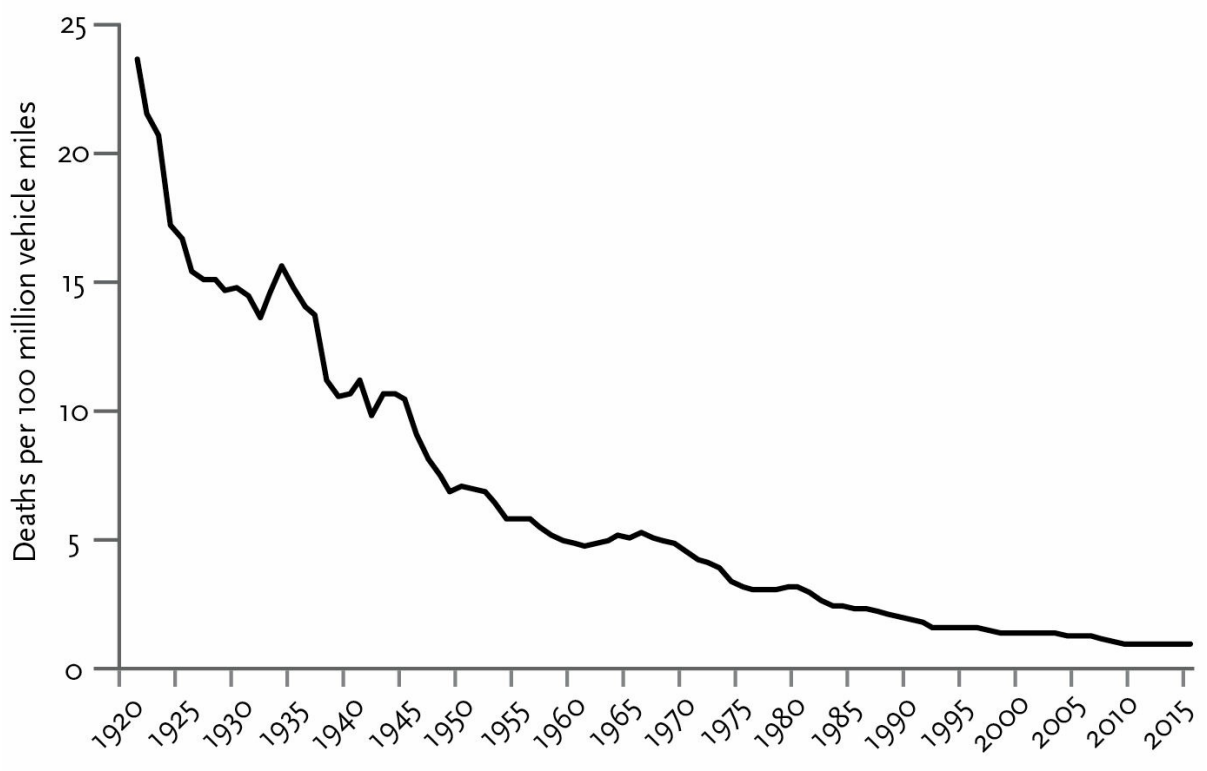


Figure 12-3: Motor vehicle accident deaths, US, 1921–2015

Sources: National Highway Traffic Safety Administration, accessed from http://www.informedforlife.org/demos/FCKeditor/UserFiles/File/TRAFFICFATALITIES(2005).pdf, http://www-fars.nhtsa.dot.gov/Main/index.aspx, and https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812384.

The magazine graph was annotated with landmarks in auto safety which identified the technological, commercial, political, and moralistic forces at work. Over the short run they sometimes pushed against each other, but over the long run they collectively pulled the death rate down, down, down. At times there were moral crusades to reduce the carnage, with automobile manufacturers as the villains. In 1965 a young lawyer named Ralph Nader published *Unsafe at Any Speed,* a *j'accuse* of the industry for neglecting safety in automotive design. Soon after, the National Highway Traffic Safety Administration was established and legislation was passed requiring new cars to be equipped with a number of safety features. Yet the graph shows that steeper reductions came *before* the activism and the legislation, and the auto industry was sometimes ahead of its customers and regulators. A signpost in the graph pointing to 1956 notes, "Ford Motor Company offers the 'Lifeguard' package. . . . It includes seatbelts, a padded dash, padded visors, and

a recessed steering-wheel hub designed to not turn drivers into a kebab during a collision. It is a sales failure." It took a decade for those features to become mandatory.

Sprinkled along the slope were other episodes of push and pull among engineers, consumers, corporate suits, and government bureaucrats. At various times, crumple zones, four-wheel dual braking systems, collapsible steering columns, high-mounted center brake lights, buzzing and garroting seat belts, and air bags and stability control systems wended their way from the lab to the showroom. Another lifesaver was the paving of long ribbons of countryside into divided, reflectored, guard-railed, smooth-curved, and broad-shouldered interstate highways. In 1980 Mothers Against Drunk Driving was formed, and they lobbied for higher drinking ages, lowered legal blood alcohol levels, and the stigmatization of drunk driving, which popular culture had treated as a source of comedy (such as in the movies *North by Northwest* and *Arthur*). Crash testing, traffic law enforcement, and driver education (together with unintentional boons like congested roads and economic recessions) saved still more lives. A *lot* of lives: since 1980, about 650,000 Americans have lived who would have died if traffic death rates had remained the same.[41] The numbers are all the more remarkable when we consider that with each passing decade, Americans drove more miles (55 billion in 1920, 458 billion in 1950, 1.5 trillion in 1980, and 3 trillion in 2013), so they were enjoying all the pleasures of leafy suburbs, soccer-playing children, seeing the USA in their Chevrolet, or just cruising down the streets, feeling out of sight, spending all their money on a Saturday night.[42] The additional miles driven did not eat up the safety gains: automobile deaths per capita (as opposed to per vehicle mile) peaked in 1937 at close to 30 per 100,000 per year, and have been in steady decline since the late 1970s, hitting 10.2 in 2014, the lowest rate since 1917.[43]

The progress in the number of motorists who arrive alive is not uniquely American. Fatality rates have sunk in other wealthy countries such as France, Australia, and of course safety-conscious Sweden. (I ended up buying a Volvo.) But it *can* be attributed to living in a wealthy country. Emerging nations like India, China, Brazil, and Nigeria have per capita traffic death rates that are

double that of the United States and seven times that of Sweden.[44] Wealth buys life.

A decline in road deaths would be a dubious achievement if it left us more endangered than we were before the automobile was invented. But life before the car was not so safe either. The pictorial curator Otto Bettmann recounts contemporary accounts of city streets in the horse-drawn era:

> "It takes more skill to cross Broadway . . . than to cross the Atlantic in a clamboat." . . . The engine of city mayhem was the horse. Underfed and nervous, this vital brute was often flogged to exhaustion by pitiless drivers, who exulted in pushing ahead "with utmost fury, defying law and delighting in destruction." Runaways were common. The havoc killed thousands of people. According to the National Safety Council, the horse-associated fatality rate was ten times the car-associated rate of modern times [in 1974, which is more than double the per capita rate today—SP].[45]

The Brooklyn Dodgers, before they moved to Los Angeles, had been named after the city's pedestrians, famous for their skill at darting out of the way of hurtling streetcars. (Not everyone in that era succeeded: my grandfather's sister was killed by a streetcar in Warsaw in the 1910s.) Like the lives of drivers and passengers, the lives of pedestrians have become more precious, thanks to lights, crosswalks, overpasses, traffic law enforcement, and the demise of hood ornaments, bumper bullets, and other chrome-plated weaponry. Figure 12-4 shows that walking the streets of America today is six times as safe as it was in 1927.

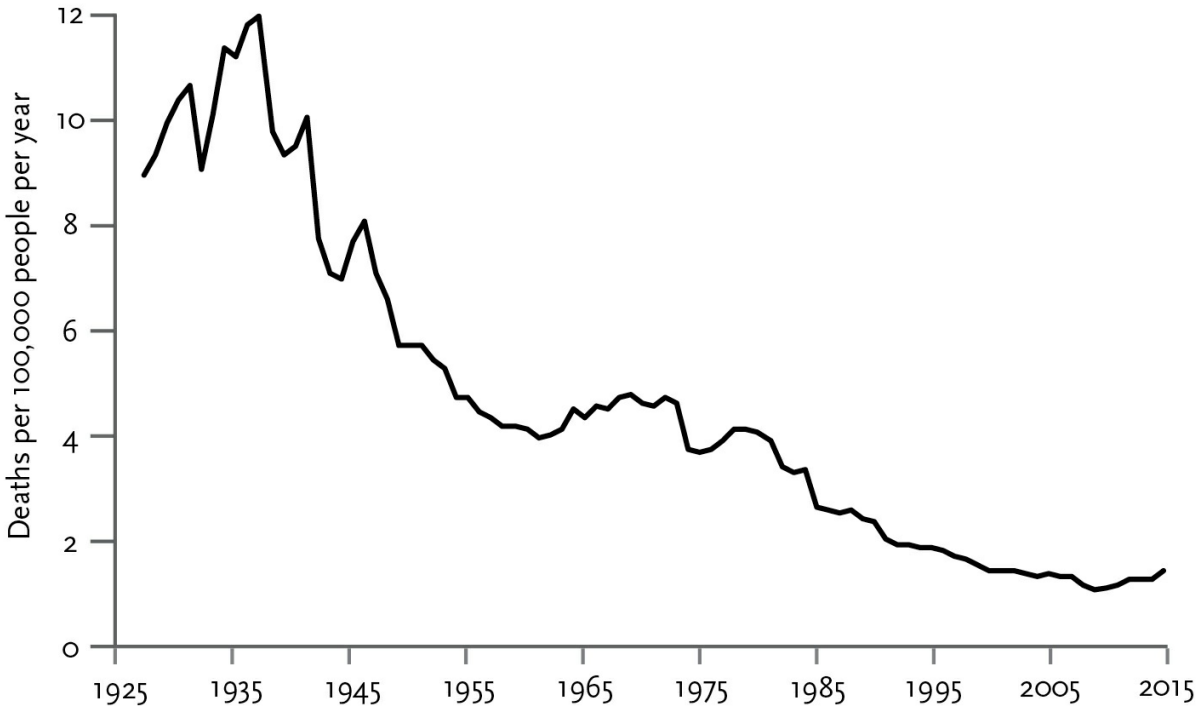


Figure 12-4: Pedestrian deaths, US, 1927–2015

Sources: National Highway Traffic Safety Administration. **For 1927–1984:** Federal Highway Administration 2003. **For 1985–1995:** National Center for Statistics and Analysis 1995. **For 1995–2005:** National Center for Statistics and Analysis 2006. **For 2005–2014:** National Center for Statistics and Analysis 2016. **For 2015:** National Center for Statistics and Analysis 2017.

The almost 5,000 pedestrians killed in 2014 is still a shocking toll (just compare it with the 44 killed by terrorists to much greater publicity), but it's better than the 15,500 who were mowed down in 1937, when the country had two-fifths as many people and far fewer cars. And the biggest salvation is to come. Within a decade of this writing, most new cars will be driven by computers rather than by slow-witted and scatterbrained humans. When robotic cars are ubiquitous, they could save more than a million lives a year, becoming one of the greatest gifts to human life since the invention of antibiotics.

A cliché in discussions of risk perception is that many people have a fear of flying but almost no one a fear of driving, despite the vastly greater safety of plane travel. But the overseers of air traffic safety are never satisfied. They scrutinize the black box and wreckage after every crash, and have steadily made an already safe mode of transportation even safer. Figure 12-5 shows that in 1970 the chance that an airline passenger would die in a plane crash was

less than five in a million; by 2015 that small risk had fallen a hundredfold.

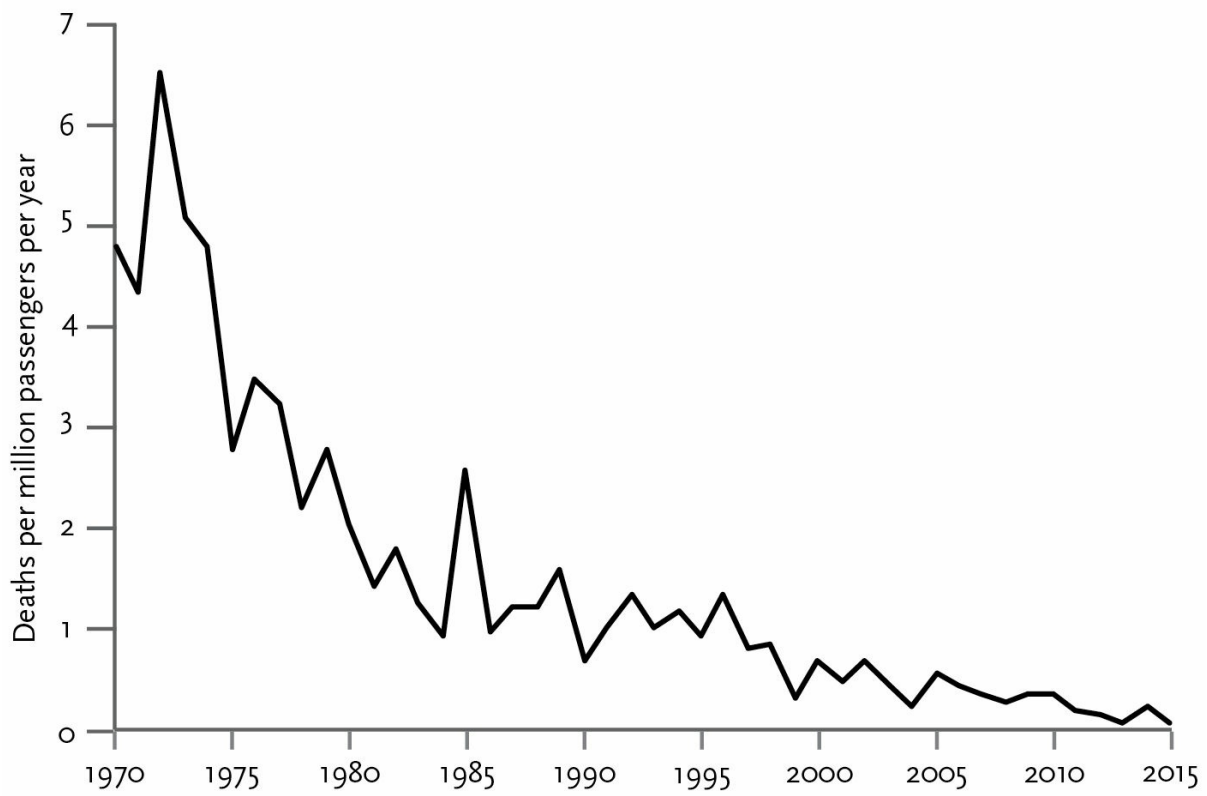


Figure 12-5: Plane crash deaths, 1970–2015

Source: Aviation Safety Network 2017. Data on the number of passengers are from World Bank 2016b.

Who by water and who by fire. Well before the invention of cars and planes, people were vulnerable to lethal dangers in their environments. The sociologist Robert Scott began his history of life in medieval Europe as follows: "On December 14, 1421, in the English city of Salisbury, a fourteen-year-old girl named Agnes suffered a grievous injury when a hot spit pierced her torso." (She was reportedly cured by a prayer to Saint Osmund.)[46] It was just one example of how the communities of medieval Europe were "very dangerous places." Infants and toddlers, who were left unattended while their parents worked, were especially vulnerable, as the historian Carole Rawcliffe explains:

> The juxtaposition in dark, cramped surroundings of open hearths, straw bedding, rush-covered floors and naked flames posed a constant threat to curious infants. [Even at play] children were in danger because of ponds, agricultural or industrial implements, stacks of timber, unattended boats and loaded wagons, all of which appear with depressing frequency in coroners' reports as causes of death among the young.[47]

The *Encyclopedia of Children and Childhood in History and Society* notes that "to modern audiences, the image of a sow devouring a baby, which appears in Chaucer's 'The Knight's Tale,' borders on the bizarre, but it almost certainly reflected the common threat that animals posed to children."[48]

Adults were no safer. A Web site called *Everyday Life and Fatal Hazard in Sixteenth-Century England* (sometimes known as the Tudor Darwin Awards) posts monthly updates on the historians' analyses of coroners' reports. The causes of death include eating tainted mackerel, getting stuck while climbing through a window, being crushed by a stack of peat slabs, being strangled by a strap that hung baskets from one's shoulders, plunging off a cliff while hunting cormorants, and falling onto one's knife while slaughtering a pig.[49] In the absence of artificial lighting, anyone who ventured out after dark faced the risk of drowning in wells, rivers, ditches, moats, canals, and cesspools.

Today we don't worry about babies getting eaten by sows, but other hazards are still with us. After car crashes, the likeliest cause of accidental death consists of falls, followed by drownings and fires, followed by poisonings. We know this because epidemiologists and safety engineers tabulate accidental deaths with almost plane-wreckage attention to detail, classifying and sub-classifying them to determine which kill the most people and how the risks may be reduced. (The *International Classification of Diseases,* tenth revision, has codes for 153 kinds of falls alone, together with 39 exclusions.) As their advisories are translated into laws, building codes, inspection regimes, and best practices, the world becomes safer. Since the 1930s, the chance that Americans will fall to their deaths has declined by 72 percent, because they have been protected by railings, signage, window guards, grab bars, worker harnesses,

safer flooring and ladders, and inspections. (Most of the remaining deaths are of frail, elderly people.) Figure 12-6 shows the fall of falling,[50] together with the trajectories of the other major risks of accidental death since 1903.

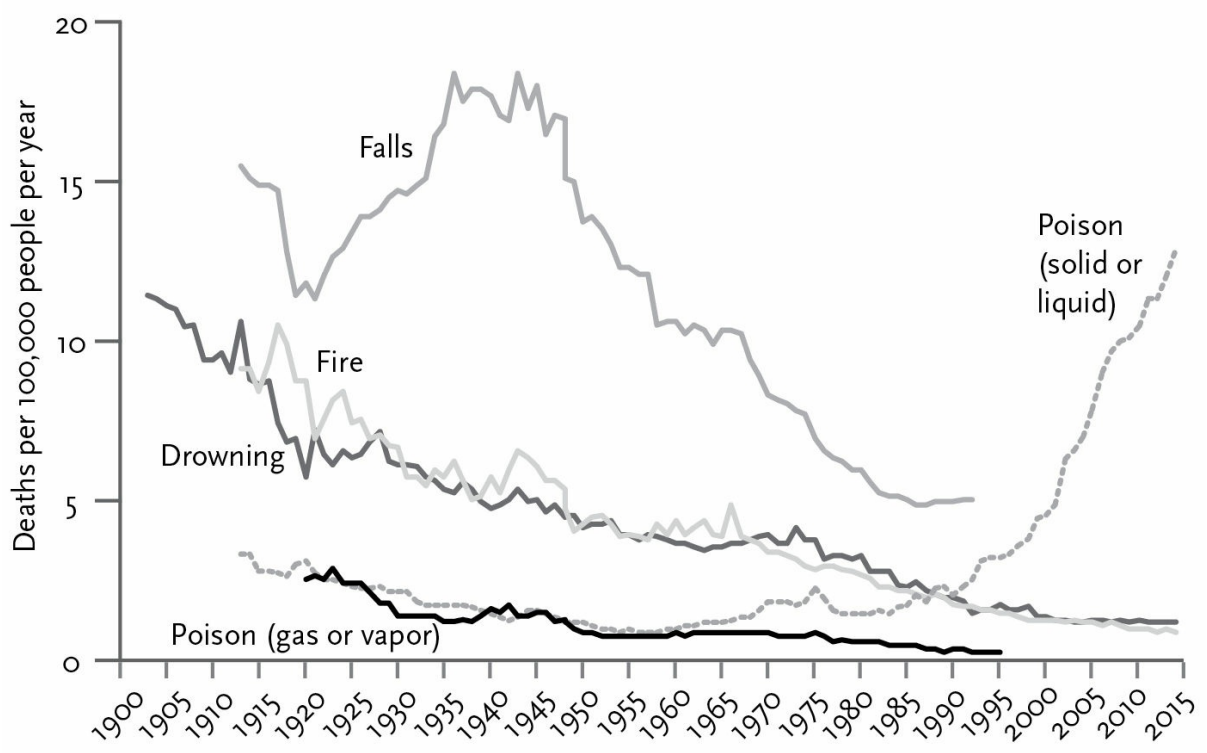


Figure 12-6: Deaths from falls, fire, drowning, and poison, US, 1903–2014

Source: National Safety Council 2016. Data for Fire, Drowning, and Poison (solid or liquid) are aggregated over 1903–1998 and 1999–2014 datasets. For 1999–2014, data for Poison (solid or liquid) include poisonings by gas or vapor. Data for Falls extend only to 1992 because of reporting artifacts in subsequent years (see note 50 for details).

The slopes for the liturgical categories of dying by fire and dying by water are almost identical, and the number of victims of each has declined by more than 90 percent. Fewer Americans drown today, thanks to lifejackets, lifeguards, fences around pools, instruction in swimming and lifesaving, and increased awareness of the vulnerability of small children, who can drown in bathtubs, toilets, even buckets.

Fewer are overcome by flames and smoke. In the 19th century, professional brigades were established to extinguish fires before they turned into conflagrations that could raze entire cities. In the middle of the 20th century, fire departments turned from just

fighting fires to preventing them. The campaign was prompted by horrific blazes such as the 1942 Cocoanut Grove nightclub fire in Boston, which left 492 dead, and it was publicized with the help of heart-wrenching photos of firefighters carrying the lifeless bodies of small children out of smoldering houses. Fire was designated a nationwide moral emergency in reports from presidential commissions with titles like *America Burning*.[51] The campaign led to the now-ubiquitous sprinklers, smoke detectors, fire doors, fire escapes, fire drills, fire extinguishers, fire-retardant materials, and fire safety education mascots like Smokey the Bear and Sparky the Fire Dog. As a result, fire departments are putting themselves out of business. About 96 percent of their calls are for cardiac arrests and other medical emergencies, and most of the remainder are for small fires. (Contrary to a charming image, they don't rescue kittens from trees.) A typical firefighter will see just one burning building every other year.[52]

Fewer Americans are accidentally gassing themselves to death. One advance was a transition starting in the 1940s from toxic coal gas to nontoxic natural gas in household cooking and heating. Another was better design and maintenance of gas stoves and heaters so they wouldn't burn their fuel incompletely and spew carbon monoxide into the house. Starting in the 1970s, cars were equipped with catalytic converters, which had been designed to reduce air pollution but which also prevented them from becoming mobile gas chambers. And throughout the century people were increasingly reminded that it's a bad idea to run cars, generators, charcoal grills, and combustion heaters indoors or beneath windows.

Figure 12-6 shows an apparent exception to the conquest of accidents: the category called "Poison (solid or liquid)." The steep rise starting in the 1990s is anomalous in a society that is increasingly latched, alarmed, padded, guard-railed, and warning-stickered, and at first I could not understand why more Americans were apparently eating roach powder or drinking bleach. Then I realized that the category of accidental poisonings includes drug overdoses. (I should have recalled that Leonard Cohen's song based on the Yom Kippur prayer contains the lines "Who in her lonely slip / Who by barbiturate.") In 2013, 98 percent of the "Poison" deaths

were from drugs (92 percent) or alcohol (6 percent), and almost all the others were from gases and vapors (mostly carbon monoxide). Household and occupational hazards like solvents, detergents, insecticides, and lighter fluid were responsible for less than a half of one percent of the poisoning deaths, and would scrape the bottom of figure 12-6.[53] Though small children still rummage under sinks, taste the offerings, and get rushed to poison control centers, few of them die.

So the single rising curve in figure 12-6 is not a counterexample to humanity's progress in reducing environmental hazards, though it certainly is a step backward with respect to a different kind of hazard, drug abuse. The curve begins to rise in the psychedelic 1960s, jerks up again during the crack cocaine epidemic of the 1980s, and blasts off during the far graver epidemic of opioid addiction in the 21st century. Starting in the 1990s, doctors overprescribed synthetic opioid painkillers like oxycodone, hydrocodone, and fentanyl, which are not just addictive but gateway drugs to heroin. Overdoses of both the legal and illegal opioids have become a major menace, killing more than 40,000 a year and lifting "poison" into the largest category of accidental death, exceeding even traffic accidents.[54]

Drug overdoses clearly are a different kind of phenomenon from car crashes, falls, fires, drownings, and gassings. People don't get addicted to carbon monoxide, or crave taller and taller ladders, so the kinds of mechanical safeguards that worked so well for environmental hazards will not be enough to end the opioid epidemic. Politicians and public health officials are coming to grips with the enormity of the problem, and countermeasures are being implemented: monitoring prescriptions, encouraging the use of safer analgesics, shaming or punishing pharma companies that recklessly promote the drugs, making the antidote naloxone more available, and treating addicts with opiate antagonists and cognitive behavior therapy.[55] A sign that the measures might be effective is that the number of overdoses of prescription opioids (though not of illicit heroin and fentanyl) peaked in 2010 and may be starting to come down.[56]

Also noteworthy is that opioid overdoses are largely an epidemic of the druggy Baby Boomer cohort reaching middle age. The peak

age of poisoning deaths in 2011 was around fifty, up from the low forties in 2003, the late thirties in 1993, the early thirties in 1983, and the early twenties in 1973.[57] Do the subtractions and you find that in every decade it's the members of the generation born between 1953 and 1963 who are drugging themselves to death. Despite perennial panic about teenagers, today's kids are, relatively speaking, all right, or at least better. According to a major longitudinal study of teenagers called Monitoring the Future, high schoolers' use of alcohol, cigarettes, and drugs (other than marijuana and vaping) have dropped to the lowest levels since the survey began in 1976.[58]



With the shift from a manufacturing to a service economy, many social critics have expressed nostalgia for the era of factories, mines, and mills, probably because they never worked in one. On top of all the lethal hazards we've examined, industrial workplaces add countless others, because whatever a machine can do to its raw materials—sawing, crushing, baking, rendering, stamping, threshing, or butchering them—it can also do to the workers tending it. In 1892 President Benjamin Harrison noted that "American workmen are subjected to peril of life and limb as great as a soldier in time of war." Bettmann comments on some of the gruesome pictures and captions he collected from the era:

> The miner, it was said, "went down to work as to an open grave, not knowing when it might close on him." . . . Unprotected powershafts maimed and killed hoopskirted workers. . . . The circus stuntman and test pilot today enjoy greater life assurance than did the [railroad] brakeman of yesterday, whose work called for precarious leaps between bucking freight cars at the command of the locomotive's whistle. . . . Also subject to sudden death . . . were the train couplers, whose omnipresent hazard was loss of hands and fingers in the primitive link-and-pin devices. . . . Whether a worker was mutilated by a buzz saw, crushed by a beam, interred in a mine, or fell down a shaft, it was always "his own bad luck."[59]

"Bad luck" was a convenient explanation for employers, and until recently it was a part of a widespread fatalism about lethal accidents, which were commonly attributed to destiny or acts of God. (Today, safety engineers and public health researchers don't even use the word *accident,* since it implies a fickle finger of fate; the term of art is *unintentional injury*.) The first safety measures and insurance policies in the 18th and 19th centuries protected property, not people. As injuries and deaths started to increase unignorably during the Industrial Revolution, they were written off as "the price of progress," according to a nonhumanistic definition of "progress" that was not reckoned in human welfare. A railroad superintendent, justifying his refusal to put a roof over a loading platform, explained that "men are cheaper than shingles. . . . There's a dozen waiting when one drops out."[60] The inhuman pace of industrial production has been immortalized in cultural icons such as Charlie Chaplin on the assembly line in *Modern Times* and Lucille Ball in the chocolate factory in *I Love Lucy*.

Workplaces began to change in the late 19th century as the first labor unions organized, journalists took up the cause, and government agencies started to collect data quantifying the human toll.[61] Bettmann's comment on the lethality of work on trains was based on more than just pictures: in the 1890s, the annual death rate for trainmen was an astonishing 852 per 100,000, almost one percent a year. The carnage was reduced when an 1893 law mandated the use of air brakes and automatic couplers in all freight trains, the first federal law intended to improve workplace safety.

The safeguards spread to other occupations in the early decades of the 20th century, the Progressive Era. They were the result of agitation by reformers, labor unions, and muckraking journalists and novelists like Upton Sinclair.[62] The most effective reform was a simple change in the law brought over from Europe: employers' liability and workmen's compensation. Previously, injured workers or their survivors had to sue for compensation, usually unsuccessfully. Now, employers were required to compensate them at a fixed rate. The change appealed to management as much as to workers, since it made their costs more predictable and the workers more cooperative. Most important, it yoked the interests of management and labor: both had a stake in making workplaces

safer, as did the insurers and government agencies that underwrote the compensation. Companies set up safety committees and safety departments, hired safety engineers, and implemented many protections, sometimes out of economic or humanitarian motives, sometimes as a response to public shaming after a well-publicized disaster, often under the duress of lawsuits and government regulations. The results are plain to see in figure 12-7.[63]

At almost 5,000 deaths in 2015, the number of workers killed on the job is still too high, but it's much better than the 20,000 deaths in 1929, when the population was less than two-fifths the size. Much of the savings is the result of the movement of the labor force from farms and factories to stores and offices. But much of it is a gift of the discovery that saving lives while producing the same number of widgets is a solvable engineering problem.

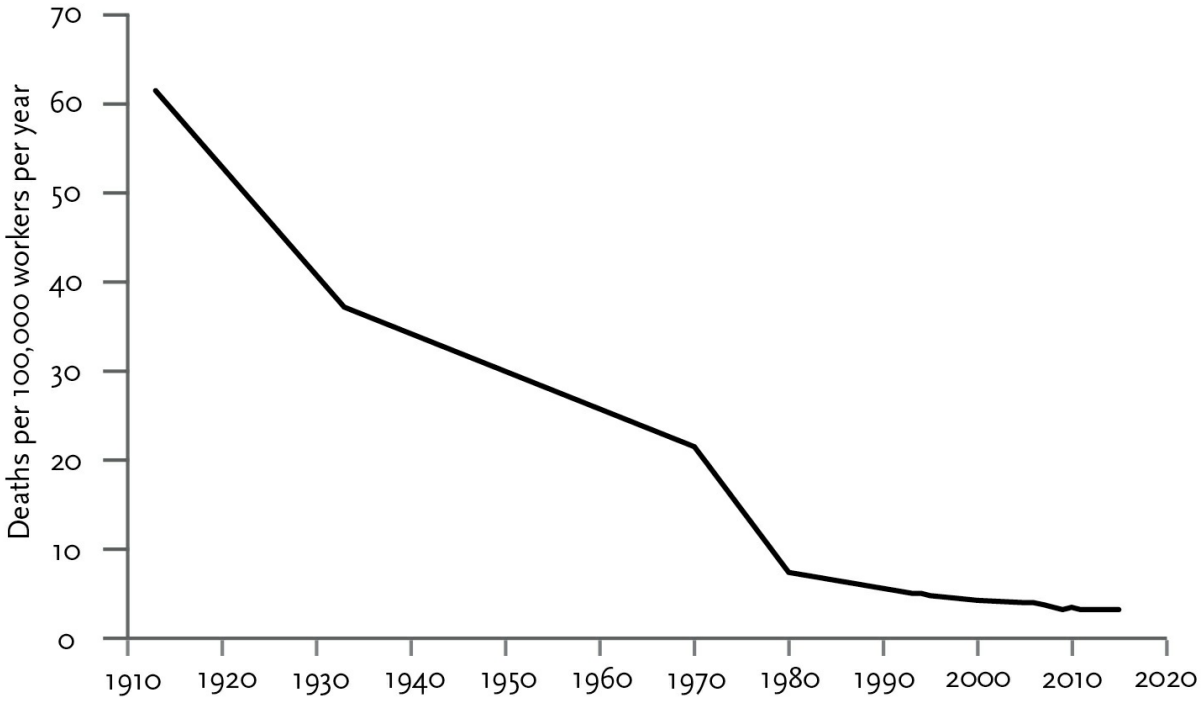


Figure 12-7: Occupational accident deaths, US, 1913–2015

Sources: Data are from different sources and may not be completely commensurable (see note 63 for details). **For 1913, 1933, and 1980:** Bureau of Labor Statistics, National Safety Council, and CDC National Institute for Occupational Safety and Health, respectively, cited in Centers for Disease Control 1999. **For 1970:** Occupational Safety and Health Administration, "Timeline of OSHA's 40 Year History," https://www.osha.gov/osha40/timeline.html. **For 1993–1994:** Bureau of Labor Statistics, cited in Pegula & Janocha 2013. **For 1995–2005:** National Center for Health Statistics 2014, table 38. **For 2006–2014:** Bureau of Labor Statistics 2016a. The latter data were reported as deaths per full-time-equivalent workers and are multiplied by .95 for

rough commensurability with the preceding years, based on the year 2007, when the Census of Fatal Occupation Injuries reported rates both per worker (3.8) and per FTE (4.0).

Who by earthquake. Could the efforts of mortals even mitigate what lawyers call "acts of God"—the droughts, floods, wildfires, storms, volcanoes, avalanches, landslides, sinkholes, heat waves, cold snaps, meteor strikes, and yes, earthquakes that are the quintessentially uncontrollable catastrophes? The answer, shown in figure 12-8, is yes.

After the ironic 1910s, when the world was ravaged by a world war and an influenza pandemic but relatively spared from natural disasters, the rate of death from disasters has rapidly declined from its peak. It's not that with each passing decade the world has miraculously been blessed with fewer earthquakes, volcanoes, and meteors. It's that a richer and more technologically advanced society can prevent natural hazards from becoming human catastrophes. When an earthquake strikes, fewer people are crushed by collapsing masonry or burned in conflagrations. When the rains stop, they can use water impounded in reservoirs. When the temperature soars or plummets, they stay in climate-controlled interiors. When a river floods its banks, their drinking water is safeguarded from human and industrial waste. The dams and levees that impound water for drinking and irrigation, when properly designed and built, make floods less likely in the first place. Early warning systems allow people to evacuate or take shelter before a cyclone makes landfall. Though geologists can't yet predict earthquakes, they can often predict volcanic eruptions, and can prepare the people who live along the Rim of Fire and other fault systems to take lifesaving precautions. And of course a richer world can rescue and treat its injured and quickly rebuild.

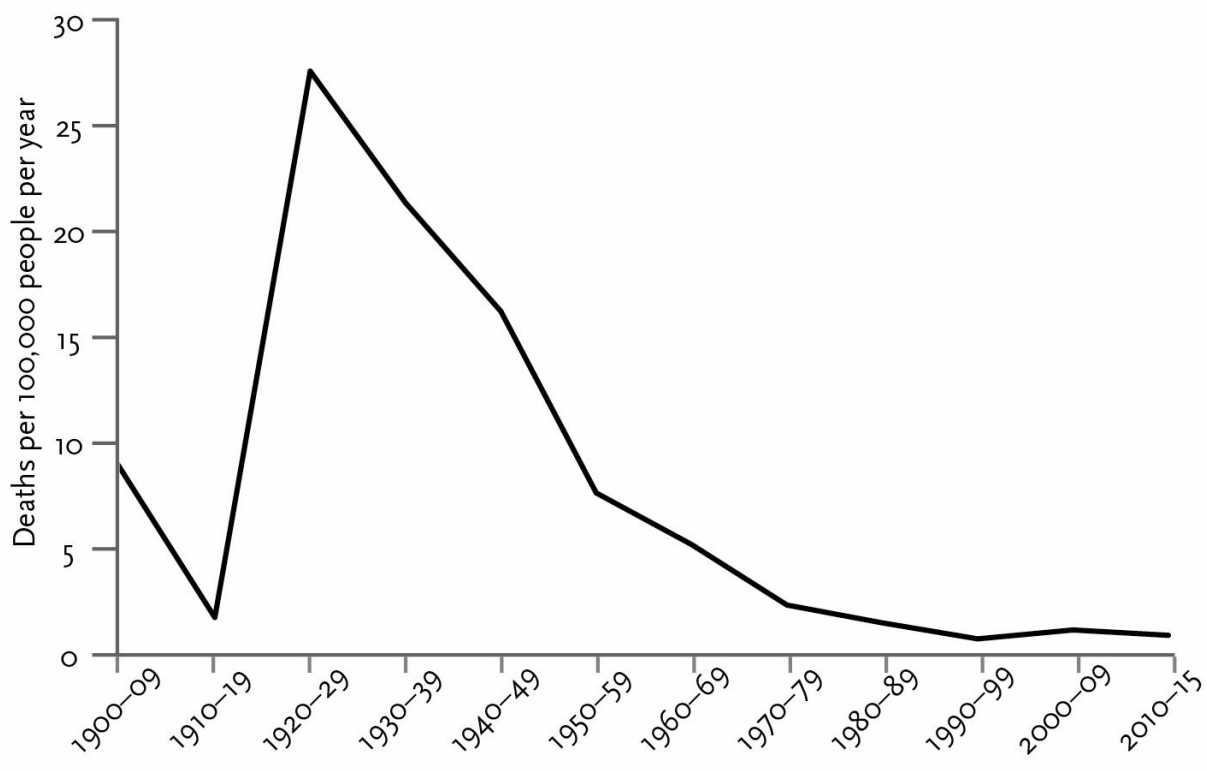


Figure 12-8: Natural disaster deaths, 1900–2015

Source: *Our World in Data,* Roser 2016q, based on data from EM-DAT, *The International Disaster Database*, www.emdat.be. The graph plots the sum of the death rates for Drought, Earthquake, Extreme temperature, Flood, Impact, Landslide, Mass movement (dry), Storm, Volcanic activity, and Wildfire (excluding Epidemics). In many decades a single disaster type dominates the numbers: droughts in the 1910s, 1920s, 1930s, and 1960s; floods in the 1930s and 1950s; earthquakes in the 1970s, 2000s, and 2010s.

It's the poorer countries today that are most vulnerable to natural hazards. A 2010 earthquake in Haiti killed more than 200,000 people, while a stronger one in Chile a few weeks later killed just 500. Haiti also loses ten times as many of its citizens to hurricanes as the richer Dominican Republic, the country with which it shares the island of Hispaniola. The good news is that as poorer countries get richer, they get safer (at least as long as economic development outpaces climate change). The annual death rate from natural disasters in low-income countries has come down from 0.7 per 100,000 in the 1970s to 0.2 today, which is lower than the rate for upper-middle-income countries in the 1970s. That's still higher than the rate for high-income countries today (0.05, down from 0.09), but it shows that rich and poor countries alike can make progress in defending themselves against a vengeful deity.[64]

And what about the very archetype of an act of God? The projectile that Zeus hurled down from Olympus? The standard idiom for an unpredictable date with death? The literal bolt from the blue? Figure 12-9 shows the history.

Yes, thanks to urbanization and to advances in weather prediction, safety education, medical treatment, and electrical systems, there has been a thirty-seven-fold decline since the turn of the 20th century in the chance that an American will be killed by a bolt of lightning.

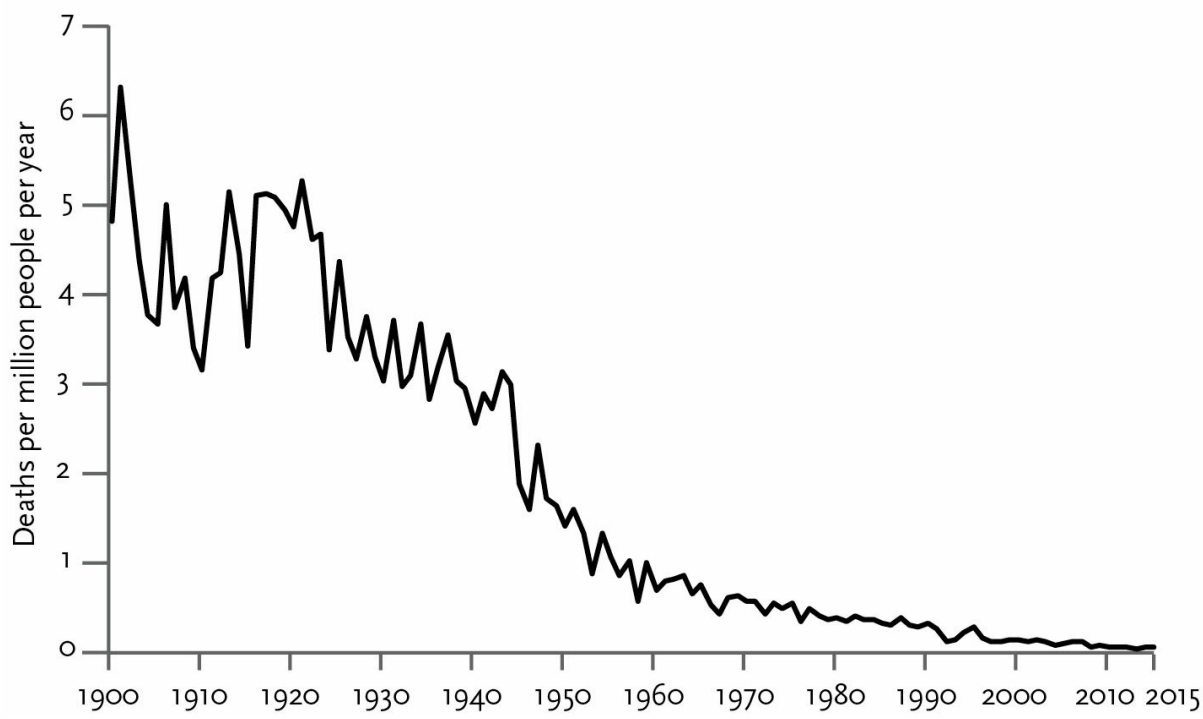


Figure 12-9: Lightning strike deaths, US, 1900–2015

Source: *Our World in Data,* Roser 2016q, based on data from National Oceanic and Atmospheric Administration, http://www.lightningsafety.noaa.gov/victims.shtml, and López & Holle 1998.

Humanity's conquest of everyday danger is a peculiarly unappreciated form of progress. (Some readers of a draft of this chapter wondered what it was even doing in a book on progress.) Though accidents kill more people than all but the worst wars, we seldom see them through a moral lens. As we say: Accidents will happen. Had we ever been confronted with the dilemma of whether

a million deaths and tens of millions of injuries a year was a price worth paying for the convenience of driving our own cars at enjoyable speeds, few would have argued that it was. Yet that is the monstrous choice we tacitly made, because the dilemma was never put to us in those terms.[65] Now and again a hazard is moralized and a crusade against it is mounted, particularly if a disaster makes the news and a villain can be fingered (a greedy factory owner, a negligent public official). But soon it recedes back into the lottery of life.

Just as people tend not to see accidents as atrocities (at least when they are not the victims), they don't see gains in safety as moral triumphs, if they are aware of them at all. Yet the sparing of millions of lives, and the reduction of infirmity, disfigurement, and suffering on a massive scale, deserve our gratitude and demand an explanation. That is true even of murder, the most moralized of acts, whose rate has plummeted for reasons that defy standard narratives.

Like other forms of progress, the ascent of safety was led by some heroes, but it was also advanced by a motley of actors who pushed in the same direction inch by inch: grassroots activists, paternalistic legislators, and an unsung cadre of inventors, engineers, policy wonks, and number-crunchers. Though we sometimes chafe at the false alarms and the nanny-state intrusions, we get to enjoy the blessings of technology without the threats to life and limb.

And though the story of seat belts, smoke alarms, and hot-spot policing is not a customary part of the Enlightenment saga, it plays out the Enlightenment's deepest themes. Who will live and who will die are not inscribed in a Book of Life. They are affected by human knowledge and agency, as the world becomes more intelligible and life becomes more precious.

CHAPTER 13

TERRORISM

When I wrote in the preceding chapter that we are living in the safest time in history, I was aware of the incredulity those words would evoke. In recent years, highly publicized terrorist attacks and rampage killings have set the world on edge and fostered an illusion that we live in newly dangerous times. In 2016, a majority of Americans named terrorism as the most important issue facing the country, said they were worried that they or a family member would be a victim, and identified ISIS as a threat to the existence or survival of the United States.[1] The fear has addled not just ordinary citizens trying to get a pollster off the phone but public intellectuals, especially cultural pessimists perennially hungry for signs that Western civilization is (as always) on the verge of collapse. The political philosopher John Gray, an avowed progressophobe, has described the contemporary societies of Western Europe as "terrains of violent conflict" in which "peace and war [are] fatally blurred."[2]

But yes, all this is an illusion. Terrorism is a unique hazard because it combines major dread with minor harm. I will not count trends in terrorism as an example of progress, since they don't show the long-term decline we've seen for disease, hunger, poverty, war, violent crime, and accidents. But I will show that terrorism is a distraction in our assessment of progress, and, in a way, a backhanded tribute to that progress.

Gray dismissed actual data on violence as "amulets" and "sorcery." The following table shows why he needed this ideological innumeracy to prosecute his jeremiad. It shows the number of victims of four categories of killing—terrorism, war, homicide, and accidents—together with the total of all deaths, in the most recent

year for which data are available (2015 or earlier). A graph is impossible, because swatches for the terrorism numbers would be smaller than a pixel.

Table 13-1: Deaths from Terrorism, War, Homicide, and Accidents

	US	Western Europe	World
Terrorism	44	175	38,422
War	28	5	97,496
Homicide	15,696	3,962	437,000
Motor vehicle accidents	35,398	19,219	1,250,000
All accidents	136,053	126,482	5,000,000
All deaths	2,626,418	3,887,598	56,400,000

"Western Europe" is defined as in the Global Terrorism Database, comprising 24 countries and a 2014 population of 418,245,997 (Statistics Times 2015). I omit Andorra, Corsica, Gibraltar, Luxembourg, and the Isle of Man.
Sources: Terrorism (2015): National Consortium for the Study of Terrorism and Responses to Terrorism 2016. **War, US and Western Europe (UK + NATO) (2015):** icasualties.org, http://icasualties.org. **War, World (2015):** *UCDP Battle-Related Deaths Dataset,* Uppsala Conflict Data Program 2017. **Homicide, US (2015):** Federal Bureau of Investigation 2016a. **Homicide, Western Europe and World (2012 or most recent):** United Nations Office on Drugs and Crime 2013. Data for Norway exclude the Utøya terrorist attack. **Motor vehicle accidents, All accidents, and All deaths, US (2014):** Kochanek et al. 2016, table 10. **Motor vehicle accidents, Western Europe (2013):** World Health Organization 2016c. **All accidents, Western Europe (2014 or most recent):** World Health Organization 2015a. **Motor vehicle accidents and All accidents, World (2012):** World Health Organization 2014. **All deaths, Western Europe (2012 or most recent):** World Health Organization 2017a. **All deaths, World (2015):** World Health Organization 2017c.

Start with the United States. What jumps out of the table is the tiny number of deaths in 2015 caused by terrorism compared with those from hazards that inspire far less anguish or none at all. (In 2014 the terrorist death toll was even lower, at 19.) Even the estimate of 44 is generous: it comes from the Global Terrorism Database, which counts hate crimes and most rampage shootings as examples of "terrorism." The toll is comparable to the number of military fatalities in Afghanistan and Iraq (28 in 2015, 58 in 2014),

which, consistent with the age-old devaluing of the lives of soldiers, received a fraction of the news coverage. The next rows down reveal that in 2015 an American was more than 350 times as likely to be killed in a police-blotter homicide as in a terrorist attack, 800 times as likely to be killed in a car crash, and 3,000 times as likely to die in an accident of any kind. (Among the categories of accident that typically kill more than 44 people in a given year are "Lightning," "Contact with hot tap water," "Contact with hornets, wasps, and bees," "Bitten or struck by mammals other than dogs," "Drowning and submersion while in or falling into bathtub," and "Ignition or melting of clothing and apparel other than nightwear.")[3]

In Western Europe, the relative danger of terrorism was higher than in the United States. In part this is because 2015 was an *annus horribilis* for terrorism in that region, including the deadly attacks on the *Charlie Hebdo* offices, the Bataclan theater, and other targets in Paris and its surroundings. (In 2014, just 5 people were killed.) But the relatively higher terrorism risk is also a sign of how much safer Europe is in every other way. Western Europeans are less murderous than Americans (with about a quarter their homicide rate) and also less car-crazy, so fewer die on the road.[4] Even with these factors tipping the scale toward terrorism, a Western European in 2015 was more than 20 times as likely to die in one of their (relatively rare) homicides as in a terrorist attack, more than 100 times as likely to die in a car crash, and more than 700 times as likely to be crushed, poisoned, burned, asphyxiated, or otherwise killed in an accident.

The third column shows that for all the recent anguish about terrorism in the West, we have it easy compared with other parts of the world. Though the United States and Western Europe contain about a tenth of the world's population, in 2015 they suffered one-half of one percent of the terrorist deaths. That's not because terrorism is a major cause of death elsewhere. It's because terrorism, as it is now defined, is largely a phenomenon of war, and wars no longer take place in the United States or Western Europe. In the years since the attacks of September 11, 2001, violence that used to be called "insurgency" or "guerrilla warfare" is now often classified as "terrorism."[5] (The Global Terrorism Database, incredibly, does not classify any deaths in Vietnam in the last five

years of the war there as "terrorism.")[6] A majority of the world's terrorist deaths take place in zones of civil war (including 8,831 in Iraq, 6,208 in Afghanistan, 5,288 in Nigeria, 3,916 in Syria, 1,606 in Pakistan, and 689 in Libya), and many of these are double-counted as war deaths, because "terrorism" during a civil war is simply a war crime—a deliberate attack on civilians—committed by a group other than the government. (Excluding these six civil war zones, the terrorism death count for 2015 was 11,884.) Yet even with the double counting of terrorism and war during the 21st century's worst year for war deaths, a global citizen was 11 times as likely to have died in a homicide as in a terrorist attack, more than 30 times as likely to have died in a car crash, and more than 125 times as likely to have died in an accident of any kind.

Has terrorism, whatever its toll, increased over time? The historical trends are elusive. Because "terrorism" is an elastic category, the trend lines look different depending on whether a dataset includes civil war crimes, multiple murders (which include robberies or mafia hits in which several victims are shot), or suicidal rampages in which the killer ranted about some political grievance beforehand. (The Global Terrorism Database, for example, includes the 1999 Columbine school massacre but not the 2012 Sandy Hook school massacre.) Also, mass killings are media-driven spectacles, in which coverage inspires copycats, so they can yo-yo up and down as one event inspires another until the novelty wears off for a while.[7] In the United States, the number of "active shooter incidents" (public rampage killings with guns) has wobbled with an upward trend since 2000, though the number of "mass murders" (four or more deaths in an incident) shows no systematic change (if anything, it shows a slight decline) from 1976 to 2011.[8] The per capita death rate from "terrorism incidents" is shown in figure 13-1, together with the messy trends for Western Europe and the world.

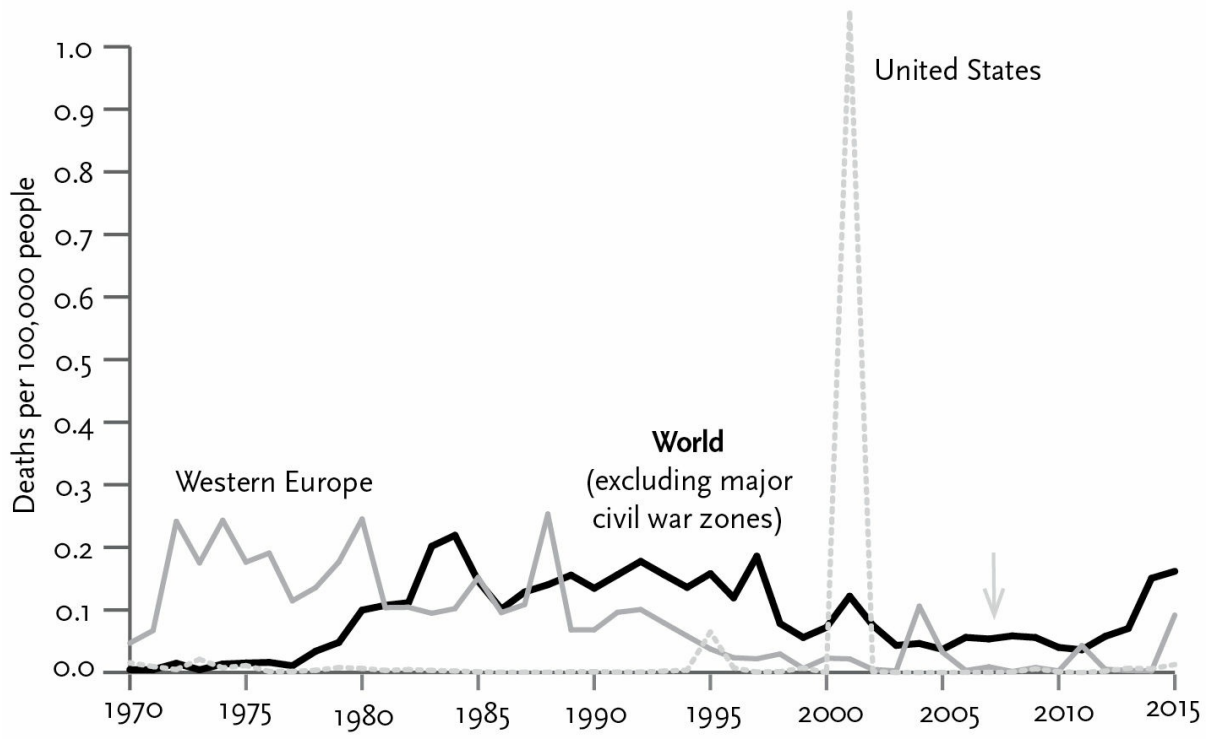


Figure 13-1: Terrorism deaths, 1970–2015

Sources: "Global Terrorism Database," National Consortium for the Study of Terrorism and Responses to Terrorism 2016, https://www.start.umd.edu/gtd/. The rate for the world excludes deaths in Afghanistan after 2001, Iraq after 2003, Pakistan after 2004, Nigeria after 2009, Syria after 2011, and Libya after 2014. Population estimates for the world and Western Europe are from the United Nation's 2015 Revision of World Population Prospects (https://esa.un.org/unpd/wpp/); estimates for the United States are from US Census Bureau 2017. The vertical arrow points to 2007, the last year plotted in figs. 6–9, 6–10, and 6–11 in Pinker 2011.

The death rate for American terrorism for the year 2001, which includes the 3,000 deaths from the 9/11 attacks, dominates the graph. Elsewhere we see a bump for the Oklahoma City bombing in 1995 (165 deaths) and barely perceptible wrinkles in other years.[9] Excluding 9/11 and Oklahoma, about twice as many Americans have been killed since 1990 by right-wing extremists as by Islamist terror groups.[10] The line for Western Europe shows that the rise in 2015 came after a decade of relative quiescence, and is not even the worst that Western Europe has seen: the rate of killing was higher in the 1970s and 1980s, when Marxist and secessionist groups (including the Irish Republican Army and the Basque ETA movement) carried out regular bombings and shootings. The line for the world as a whole (excluding recent deaths in major war zones, which we examined in the chapter on war) contains a spiky plateau for the

1980s and 1990s, a fall after the end of the Cold War, and a recent rise to a level that still falls below that of the earlier decades. So the historical trends, like the current numbers, belie the fear that we are living in newly dangerous times, particularly in the West.



Though terrorism poses a minuscule danger compared with other risks, it creates outsize panic and hysteria because that is what it is designed to do. Modern terrorism is a by-product of the vast reach of the media.[11] A group or an individual seeks a slice of the world's attention by the one guaranteed means of attracting it: killing innocent people, especially in circumstances in which readers of the news can imagine themselves. News media gobble the bait and give the atrocities saturation coverage. The Availability heuristic kicks in and people become stricken with a fear that is unrelated to the level of danger.

It's not just the salience of a horrific event that stokes the terror. Our emotions are far more engaged when the cause of a tragedy is malevolent intent rather than accidental misfortune.[12] (I confess that as a frequent visitor to London, I was far more upset when I read the headline RUSSELL SQUARE "TERROR" KNIFE ATTACK LEAVES WOMAN DEAD than when I read RENOWNED ART COLLECTOR DIES AFTER BEING HIT BY BUS IN OXFORD STREET TRAGEDY.) Something is uniquely unsettling about the thought of a human being who wants to kill you, and for a good evolutionary reason. Accidental causes of death don't *try* to do you in, and they don't care how you react, whereas human malefactors deploy their intelligence to outsmart you, and vice versa.[13]

Given that terrorists are not mindless hazards but human agents with goals, could it be *rational* to worry about them despite the small amount of damage they do? After all, we are justly outraged by despots who execute dissidents, even though the number of their victims may be as small as those of terrorism. The difference is that despotic violence has strategic effects that are disproportionate to the body count: it eliminates the most potent threats to the regime, and it deters the rest of the population from replacing them. Terrorist violence, almost by definition, strikes victims at random. The objective significance of the threat, then, beyond the immediate

damage, depends on what the scattershot killing is designed to accomplish.

With many terrorists, the goal is little more than publicity itself. The legal scholar Adam Lankford has analyzed the motives of the overlapping categories of suicide terrorists, rampage shooters, and hate crime killers, including both the self-radicalized lone wolves and the bomb fodder recruited by terrorist masterminds.[14] The killers tend to be loners and losers, many with untreated mental illness, who are consumed with resentment and fantasize about revenge and recognition. Some fused their bitterness with Islamist ideology, others with a nebulous cause such as "starting a race war" or "a revolution against the federal government, taxes, and anti-gun laws." Killing a lot of people offered them the chance to be a somebody, even if only in the anticipation, and going out in a blaze of glory meant that they didn't have to deal with the irksome aftermath of being a mass murderer. The promise of paradise, and an ideology that rationalizes how the massacre serves a greater good, makes the posthumous fame all the more inviting.

Other terrorists belong to militant groups that seek to call attention to their cause, to extort a government to change its policies, to provoke it into an extreme response that might recruit new sympathizers or create a zone of chaos for them to exploit, or to undermine the government by spreading the impression that it cannot protect its own citizens. Before we conclude that they "pose a threat to the existence or survival of the United States," we should bear in mind how weak the tactic actually is.[15] The historian Yuval Harari notes that terrorism is the opposite of military action, which tries to damage the enemy's ability to retaliate and prevail.[16] When Japan attacked Pearl Harbor in 1941, it left the United States without a fleet to send to Southeast Asia in response. It would have been mad for Japan to have opted for terrorism, say, by torpedoing a passenger ship to provoke the United States into responding with an intact navy. From their position of weakness, Harari notes, what terrorists seek to accomplish is not damage but theater. The image that most people retain from 9/11 is not Al Qaeda's attack on the Pentagon—which actually destroyed part of the enemy's military headquarters and killed commanders and analysts—but its attack

on the totemic World Trade Center, which killed brokers, accountants, and other civilians.

Though terrorists hope for the best, their small-scale violence almost never gets them what they want. Separate surveys by the political scientists Max Abrahms, Audrey Cronin, and Virginia Page Fortna of hundreds of terrorist movements active since the 1960s show that they all were extinguished or faded away without attaining their strategic goals.[17]

Indeed, the rise of terrorism in public awareness is not a sign of how dangerous the world has become but the opposite. The political scientist Robert Jervis observes that the placement of terrorism at the top of the list of threats "in part stems from a security environment that is remarkably benign."[18] It is not only interstate war that has become rare; so has the use of political violence in the domestic arena. Harari points out that in the Middle Ages, every sector of society retained a private militia—aristocrats, guilds, towns, even churches and monasteries—and they secured their interests by force: "If in 1150 a few Muslim extremists had murdered a handful of civilians in Jerusalem, demanding that the Crusaders leave the Holy Land, the reaction would have been ridicule rather than terror. If you wanted to be taken seriously, you should have at least gained control of a fortified castle or two." As modern states have successfully claimed a monopoly on force, driving down the rate of killing within their borders, they opened a niche for terrorism:

> The state has stressed so many times that it will not tolerate political violence within its borders that it has no alternative but to see any act of terrorism as intolerable. The citizens, for their part, have become used to zero political violence, so the theatre of terror incites in them visceral fears of anarchy, making them feel as if the social order is about to collapse. After centuries of bloody struggles, we have crawled out of the black hole of violence, but we feel that the black hole is still there, patiently waiting to swallow us again. A few gruesome atrocities and we imagine that we are falling back in.[19]

As states try to carry out the impossible mandate of protecting their citizens from all political violence everywhere and all the time, they are tempted to respond with theater of their own. The most damaging effect of terrorism is countries' overreaction to it, the case in point being the American-led invasions of Afghanistan and Iraq following 9/11.

Instead, countries could deal with terrorism by deploying their greatest advantage: knowledge and analysis, not least knowledge of the numbers. The uppermost goal should be to make sure the numbers stay small by securing weapons of mass destruction (chapter 19). Ideologies that justify violence against innocents, such as militant religions, nationalism, and Marxism, can be countered with better systems of value and belief (chapter 23). The media can examine their essential role in the show business of terrorism by calibrating their coverage to the objective dangers and giving more thought to the perverse incentives they have set up. (Lankford, together with the sociologist Eric Madfis, has recommended a policy for rampage shootings of "Don't Name Them, Don't Show Them, but Report Everything Else," based on a policy for juvenile shooters already in effect in Canada and on other strategies of calculated media self-restraint.)[20] Governments can step up their intelligence and clandestine actions against networks of terrorism and their financial tributaries. And people could be encouraged to keep calm and carry on, as the British wartime poster famously urged during a time of much greater peril.

Over the long run, terrorist movements sputter out as their small-scale violence fails to achieve their strategic goals, even as it causes local misery and fear.[21] It happened to the anarchist movements at the turn of the 20th century (after many bombings and assassinations), it happened to the Marxist and secessionist groups in the second half of the 20th century, and it will almost certainly happen to ISIS in the 21st. We may never drive the already low numbers of terrorist casualties to zero, but we can remember that terror about terrorism is a sign not of how dangerous our society has become, but of how safe.

CHAPTER 14

DEMOCRACY

Since the first governments appeared around five thousand years ago, humanity has tried to steer a course between the violence of anarchy and the violence of tyranny. In the absence of a government or powerful neighbors, tribal peoples tend to fall into cycles of raiding and feuding, with death rates exceeding those of modern societies, even including their most violent eras.[1] Early governments pacified the people they ruled, reducing internecine violence, but imposed a reign of terror that included slavery, harems, human sacrifice, summary executions, and the torture and mutilation of dissidents and deviants.[2] (The Bible has no shortage of examples.) Despotism has persisted through history not just because being a despot is nice work if you can get it, but because from the people's standpoint the alternative was often worse. Matthew White, who calls himself a necrometrician, has estimated the death tolls of the hundred bloodiest episodes in 2,500 years of human history. After looking for patterns in the list, he reported this one as his first:

> Chaos is deadlier than tyranny. More of these multicides result from the breakdown of authority rather than the exercise of authority. In comparison to a handful of dictators such as Idi Amin and Saddam Hussein who exercised their absolute power to kill hundreds of thousands, I found more and deadlier upheavals like the Time of Troubles [in 17th-century Russia], the Chinese Civil War [1926–37, 1945–49], and the Mexican Revolution [1910–20] where no one exercised enough control to stop the death of millions.[3]

One can think of *democracy* as a form of government that threads the needle, exerting just enough force to prevent people from preying on each other without preying on the people itself. A good democratic government allows people to pursue their lives in safety, protected from the violence of anarchy, and in freedom, protected from the violence of tyranny. For that reason alone, democracy is a major contributor to human flourishing. But it's not the only reason: democracies also have higher rates of economic growth, fewer wars and genocides, healthier and better-educated citizens, and virtually no famines.[4] If the world has become more democratic over time, that is progress.

In fact the world *has* become more democratic, though not in a steadily rising tide. The political scientist Samuel Huntington organized the history of democratization into three waves.[5] The first swelled in the 19th century, when that great Enlightenment experiment, American constitutional democracy with its checks on government power, seemed to be working. The experiment, with local variations, was emulated by a number of countries, mainly in Western Europe, cresting at twenty-nine in 1922. The first wave was pushed back by the rise of fascism, and by 1942 had ebbed to just twelve countries. With the defeat of fascism in World War II, a second wave gathered force as colonies gained independence from their European overlords, pushing the number of recognized democracies up to thirty-six by 1962. Still, European democracies were sandwiched between Soviet-dominated dictatorships to the east and fascist dictatorships in Portugal and Spain to the southwest. And the second wave was soon pushed back by military juntas in Greece and Latin America, authoritarian regimes in Asia, and Communist takeovers in Africa, the Middle East, and Southeast Asia.[6] By the mid-1970s the prospects for democracy looked bleak. The West German chancellor Willy Brandt lamented that "Western Europe has only 20 or 30 more years of democracy left in it; after that it will slide, engineless and rudderless, under the surrounding sea of dictatorship." The American senator and social scientist Daniel Patrick Moynihan agreed, writing that "liberal democracy on the American model increasingly tends to the condition of monarchy in the 19th century: a holdover form of government, one which persists in isolated or peculiar places here and there, and may

even serve well enough for special circumstances, but which has simply no relevance to the future. It is where the world was, not where it is going."[7]

Before the ink was dry on these lamentations, democratization's third wave—more like a tsunami—erupted. Military and fascist governments fell in southern Europe (Greece and Portugal in 1974, Spain in 1975), Latin America (including Argentina in 1983, Brazil in 1985, and Chile in 1990), and Asia (including Taiwan and the Philippines around 1986, South Korea around 1987, and Indonesia in 1998). The Berlin Wall was torn down in 1989, freeing the nations of Eastern Europe to establish democratic governments, and communism imploded in the Soviet Union in 1991, clearing space for Russia and most of the other republics to make the transition. Some African countries threw off their strongmen, and the last European colonies to gain independence, mostly in the Caribbean and Oceania, opted for democracy as their first form of government. In 1989 the political scientist Francis Fukuyama published a famous essay in which he proposed that liberal democracy represented "the end of history," not because nothing would ever happen again but because the world was coming to a consensus over the humanly best form of governance and no longer had to fight over it.[8]

Fukuyama coined a runaway meme: in the decades since his essay appeared, books and articles have announced "the end of" nature, science, faith, poverty, reason, money, men, lawyers, illness, the free market, and sex. But Fukuyama also became a punching bag as editorialists, commenting on the latest bit of bad news, gleefully announced "the return of history" and the rise of alternatives to democracy such as theocracy in the Muslim world and authoritarian capitalism in China. Democracies themselves appeared to be backsliding into authoritarianism with populist victories in Poland and Hungary and power grabs by Recep Erdogan in Turkey and Vladimir Putin in Russia (the return of the sultan and the czar). Historical pessimists, with their customary schadenfreude, announced that the third wave of democratization had given way to an "undertow," "recession," "erosion," "rollback," or "meltdown."[9] Democratization, they said, was a conceit of

Westerners projecting their tastes onto the rest of the world, whereas authoritarianism seemed to suit most of humanity just fine.

Could recent history really imply that people are happy to be brutalized by their governments? The very idea is doubtful for two reasons. Most obviously, in a country that is not democratic, how could you tell? The pent-up demand for democracy might be enormous, but no one dares express it lest they be jailed or shot. The other is the headline fallacy: crackdowns make the news more often than liberalizations, and the Availability bias could make us forget about all the boring countries that become democratic bit by bit.

As always, the only way to know which way the world is going is to quantify. This raises the question of what counts as a "democracy," a word that has developed such an aura of goodness as to have become almost meaningless. A good rule of thumb is that any country that has the word "democratic" in its official name, like the Democratic People's Republic of Korea (a.k.a. North Korea) or the German Democratic Republic (a.k.a. East Germany), isn't one. Nor is it helpful to ask the citizens of undemocratic states what they think the word means: almost half think it means "The army takes over when the government is incompetent" or "Religious leaders ultimately interpret the laws."[10] Ratings by experts have a related problem when their checklists embrace a hodgepodge of good things such as "freedom from socioeconomic inequalities" and "freedom from war."[11] Yet another complication is that countries vary continuously in the different components of democracy such as freedom of speech, the openness of the political process, and the constraints on its leaders' power, so any tally that dichotomizes nations into "democracies" and "autocracies" will fluctuate from year to year depending on arbitrary choices about where to place the countries that hover near the boundary (a problem exacerbated when the raters' standards rise over time, a phenomenon we will return to).[12] The Polity Project deals with these obstacles by using a fixed set of criteria to assign a score between –10 and 10 to every country in every year indicating how autocratic or democratic it is, focusing on citizens' ability to express political preferences, constraints on the power of the executive, and a guarantee of civil

liberties.[13] The sum for the world since 1800, spanning the three waves of democratization, is shown in figure 14-1.

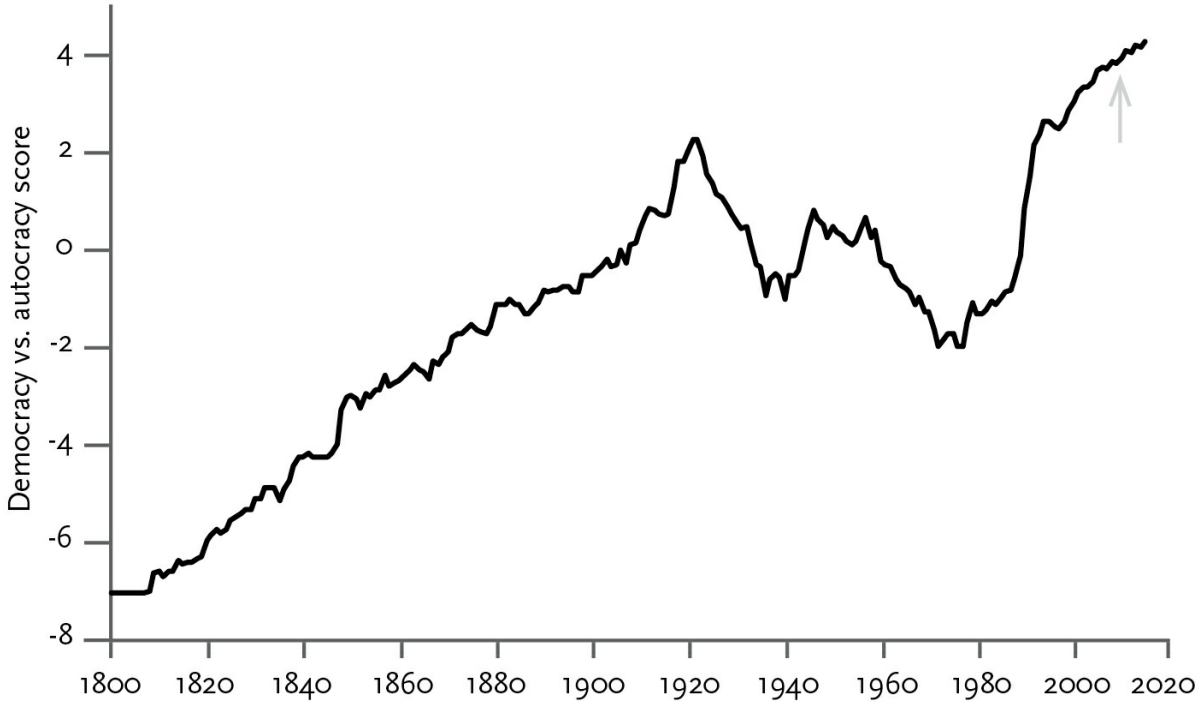


Figure 14-1: Democracy versus autocracy, 1800–2015

Source: *HumanProgress,* http://humanprogress.org/f1/2560, based on *Polity IV Annual Time-Series, 1800–2015*, Marshall, Gurr, & Jaggers 2016. Scores are summed over sovereign states with a population greater than 500,000, and range from –10 for a complete autocracy to 10 for a perfect democracy. The arrow points to 2008, the last year plotted in fig. 5–23 of Pinker 2011.

The graph shows that the third wave of democratization is far from over, let alone ebbing, even if it has not continued to surge at the rate of the years surrounding the fall of the Berlin Wall in 1989. At that time, the world had 52 democracies (defined by the Polity Project as countries with a score of 6 or higher on their scale), up from 31 in 1971. After swelling in the 1990s, this third wave spilled into the 21st century in a rainbow of "color revolutions" including Croatia (2000), Serbia (2000), Georgia (2003), Ukraine (2004), and Kyrgyzstan (2005), bringing the total at the start of the Obama presidency in 2009 to 87.[14] Belying the image of a rollback or meltdown under his watch, the number continued to grow. As of 2015, the most recent year in the dataset, the total stood at 103. The Nobel Peace Prize was awarded that year to a coalition of organizations in Tunisia that solidified a transition to democracy, a

success story from the Arab Spring of 2011. It also saw transitions to democracy in Myanmar and Burkina Faso, and positive movements in five other countries, including Nigeria and Sri Lanka. The world's 103 democracies in 2015 embraced 56 percent of the world's population, and if we add the 17 countries that were more democratic than autocratic, we get a total of *two-thirds* of the world's population living in free or relatively free societies, compared with less than two-fifths in 1950, a fifth in 1900, seven percent in 1850, and one percent in 1816. Of the people living in the 60 nondemocratic countries today (20 full autocracies, 40 more autocratic than democratic), four-fifths reside in a single country, China.[15]

Though history has not ended, Fukuyama had a point: democracy has proved to be more attractive than its eulogizers acknowledge.[16] After the first wave of democratization broke, there were theories "explaining" how democracy could never take root in Catholic, non-Western, Asian, Muslim, poor, or ethnically diverse countries, each refuted in turn. It is true that stable, top-shelf democracy is likelier to be found in countries that are richer and more highly educated.[17] But governments that are more democratic than not are a motley collection: they are entrenched in most of Latin America, in floridly multiethnic India, in Muslim Malaysia, Indonesia, Niger, and Kosovo, in fourteen countries in sub-Saharan Africa (including Namibia, Senegal, and Benin), and in poor countries elsewhere such as Nepal, Timor-Leste, and most of the Caribbean.[18]

Even the autocracies of Russia and China, which show few signs of liberalizing, are incomparably less repressive than the regimes of Stalin, Brezhnev, and Mao.[19] Johan Norberg summarizes life in China: "The Chinese people today can move almost however they like, buy a home, choose an education, pick a job, start a business, belong to a church (as long as they are Buddhists, Taoist, Muslims, Catholics or Protestants), dress as they like, marry whom they like, be openly gay without ending up in a labor camp, travel abroad freely, and even criticize aspects of the Party's policy (though not its right to rule unopposed). Even 'not free' is not what it used to be."[20]



Why has the tide of democratization repeatedly exceeded

expectations? The various backslidings, reversals, and black holes for democracy have led to theories which posit onerous prerequisites and an agonizing ordeal of democratization. (This serves as a convenient pretext for dictators to insist that their countries are not ready for it, like the revolutionary leader in Woody Allen's *Bananas* who upon taking power announces, "These people are peasants. They are too ignorant to vote.") The awe is reinforced by a civics-class idealization of democracy in which an informed populace deliberates about the common good and carefully selects leaders who carry out their preference.

By that standard, the number of democracies in the world is zero in the past, zero in the present, and almost certainly zero in the future. Political scientists are repeatedly astonished by the shallowness and incoherence of people's political beliefs, and by the tenuous connection of their preferences to their votes and to the behavior of their representatives.[21] Most voters are ignorant not just of current policy options but of basic facts, such as what the major branches of government are, who the United States fought in World War II, and which countries have used nuclear weapons. Their opinions flip depending on how a question is worded: they say that the government spends too much on "welfare" but too little on "assistance to the poor," and that it should "use military force" but not "go to war." When they do formulate a preference, they commonly vote for a candidate with the opposite one. But it hardly matters, because once in office politicians vote the positions of their party regardless of the opinions of their constituents.

Nor does voting even provide much of a feedback signal about a government's performance. Voters punish incumbents for recent events over which they have dubious control, such as macroeconomic swings and terrorist strikes, or no control at all, such as droughts, floods, even shark attacks. Many political scientists have concluded that most people correctly recognize that their votes are astronomically unlikely to affect the outcome of an election, and so they prioritize work, family, and leisure over educating themselves about politics and calibrating their votes. They use the franchise as a form of self-expression: they vote for candidates who they think are like them and stand for their kind of people.

So despite the widespread belief that elections are the quintessence of democracy, they are only one of the mechanisms by which a government is held responsible to those it governs, and not always a constructive one. When an election is a contest between aspiring despots, rival factions fear the worst if the other side wins and try to intimidate each other from the ballot box. Also, autocrats can learn to use elections to their advantage. The latest fashion in dictatorship has been called the competitive, electoral, kleptocratic, statist, or patronal authoritarian regime.[22] (Putin's Russia is the prototype.) The incumbents use the formidable resources of the state to harass the opposition, set up fake opposition parties, use state-controlled media to spread congenial narratives, manipulate electoral rules, tilt voter registration, and jigger the elections themselves. (Patronal authoritarians, for all that, are not invulnerable—the color revolutions sent several of them packing.)

If neither voters nor elected leaders can be counted on to uphold the ideals of democracy, why should this form of government work so not-badly—the worst form of government except all the others that have been tried, as Churchill famously put it? In his 1945 book *The Open Society and Its Enemies,* the philosopher Karl Popper argued that democracy should be understood not as the answer to the question "Who should rule?" (namely, "The People"), but as a solution to the problem of how to dismiss bad leadership without bloodshed.[23] The political scientist John Mueller broadens the idea from a binary Judgment Day to continuous day-to-day feedback. Democracy, he suggests, is essentially based on giving people the freedom to complain: "It comes about when the people effectively agree not to use violence to replace the leadership, and the leadership leaves them free to try to dislodge it by any other means."[24] He explains how this can work:

> If citizens have the right to complain, to petition, to organize, to protest, to demonstrate, to strike, to threaten to emigrate or secede, to shout, to publish, to export their funds, to express a lack of confidence, and to wheedle in back corridors, government will tend to respond to the sounds of the shouters and the importunings of the wheedlers: that is, it will

> necessarily become responsive—pay attention—whether there are elections or not.[25]

Women's suffrage is an example: by definition, they could not vote to grant themselves the vote, but they got it by other means.

The contrast between the messy reality of democracy and the civics-class ideal leads to perennial disillusionment. John Kenneth Galbraith once advised that if you ever want a lucrative book contract, just propose to write *The Crisis of American Democracy*. Reviewing the history, Mueller concludes that "inequality, disagreement, apathy, and ignorance seem to be normal, not abnormal, in a democracy, and to a considerable degree the beauty of the form is that it works despite these qualities—or, in some important respects, because of them."[26]

In this minimalist conception, democracy is not a particularly abstruse or demanding form of government. Its main prerequisite is that a government be competent enough to protect people from anarchic violence so they don't fall prey to, or even welcome, the first strongman who promises he can do the job. (Chaos is deadlier than tyranny.) That's one reason why democracy has trouble getting a toehold in extremely poor countries with weak governments, such as in sub-Saharan Africa, and in countries whose government has been decapitated, such as Afghanistan and Iraq following the American-led invasions. As the political scientists Steven Levitsky and Lucan Way point out, "State failure brings violence and instability; it almost never brings democratization."[27]

Ideas matter, too. For democracy to take root, influential people (particularly people with guns) have to think that it is better than alternatives such as theocracy, the divine right of kings, colonial paternalism, the dictatorship of the proletariat (in practice, its "revolutionary vanguard"), or authoritarian rule by a charismatic leader who directly embodies the will of the people. This helps explain other patterns in the annals of democratization, such as why democracy is less likely to take root in countries with less education, in countries that are remote from Western influence (such as in Central Asia), and in countries whose regimes were born of violent, ideologically driven revolutions (such as China, Cuba, Iran, North Korea, and Vietnam).[28] Conversely, as people recognize that

democracies are relatively nice places to live, the idea of democracy can become contagious and the number can increase over time.



The freedom to complain rests on an assurance that the government won't punish or silence the complainer. The front line in democratization, then, is constraining the government from abusing its monopoly on force to brutalize its uppity citizens.

A series of international agreements beginning with the Universal Declaration of Human Rights of 1948 drew red lines around thuggish governmental tactics, particularly torture, extrajudicial killings, the imprisonment of dissidents, and the ugly transitive verb coined during the Argentinian military regime of 1976–83, *to disappear someone*. These red lines are not the same as electoral democracy, since a majority of voters may be indifferent to government brutality as long as it isn't directed at them. In practice, democratic countries do show greater respect for human rights.[29] But the world also has some benevolent autocracies, like Singapore, and some repressive democracies, like Pakistan. This leads to a key question about whether the waves of democratization are really a form of progress. Has the rise in democracy brought a rise in human rights, or are dictators just using elections and other democratic trappings to cover their abuses with a smiley-face?

The US State Department, Amnesty International, and other organizations have monitored violations of human rights over the decades. If one were to look at their numbers since the 1970s, it would appear that governments are as repressive as ever—despite the spread of democracy, human rights norms, international criminal courts, and the watchdog organizations themselves. This has led to pronouncements (delivered with alarm by rights activists and with glee by cultural pessimists) that we have reached "the endtimes of human rights," "the twilight of human rights law," and, of course, "the post–human rights world."[30]

But progress has a way of covering its tracks. As our moral standards rise over the years, we become alert to harms that would have gone unnoticed in the past. Moreover, activist organizations feel they must always cry "crisis" to keep the heat up (though the strategy can backfire, implying that decades of activism have been a waste of time). The political scientist Kathryn Sikkink calls this the

information paradox: as human rights watchdogs admirably look harder for abuse, look in more places for abuse, and classify more acts as abuse, they find more of it—but if we don't compensate for their keener powers of detection, we can be misled into thinking that there is more abuse to detect.[31]

The political scientist Christopher Fariss has cut this knot with a mathematical model that compensates for more dogged reporting over time and estimates the actual amount of human rights abuse in the world. Figure 14-2 shows his scores for four countries from 1949 to 2014 and for the world as a whole. The graph displays numbers spat out by a mathematical model, so we should not take the exact values too seriously, but they do indicate differences and trends. The top line is for a country that represents a gold standard for human rights. As with most measures of human flourishing, it is Scandinavian, in this case Norway, and it started high and has grown higher. We see diverging lines for the two Koreas: North, which started low and sank even lower, and South, which rose from a right-wing autocracy during the Cold War into positive territory today. In China, human rights hit bottom during the Cultural Revolution, shot up after the death of Mao, and crested during the 1980s democracy movement before the government cracked down after the Tiananmen Square protests, though they are still well above the Maoist-era lowlands. But the most significant curve is the one for the world as a whole: for all its setbacks, the arc of human rights bends upward.

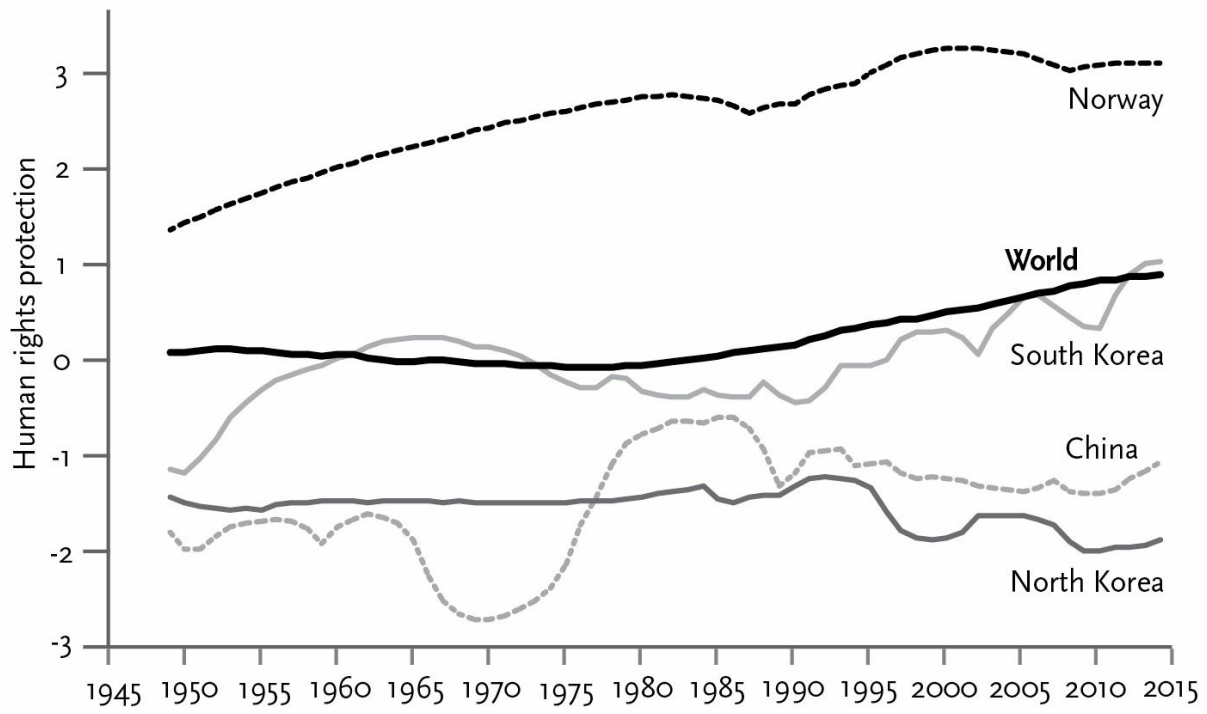


Figure 14-2: Human rights, 1949–2014

Source: *Our World in Data,* Roser 2016i, graphing an index devised by Fariss 2014, which estimates protection from torture, extrajudicial killing, political imprisonment, and disappearances. "0" is the mean over all countries and years; the units are standard deviations.

How does the curtailment of government power unfold in real time? An unusually clear window into the machinery of human progress is the fate of the ultimate exercise of violence by the state: deliberately killing its citizens.

Capital punishment was once ubiquitous among countries, and it was applied to hundreds of misdemeanors in gruesome public spectacles of torture and humiliation.[32] (The crucifixion of Jesus together with two common thieves is as good a reminder as any.) After the Enlightenment, European countries stopped executing people for any but the most heinous crimes: by the middle of the 19th century, Britain had reduced the number of capital offenses from 222 to 4. And the countries looked for methods of execution such as drop hanging that were as humane as such a gruesome practice could pretend to be. After World War II, when the Universal Declaration of Human Rights inaugurated a second humanitarian revolution, capital punishment was abolished

altogether in country after country, and in Europe today it lingers only in Belarus.

The abolition of capital punishment has gone global (figure 14-3), and today the death penalty is on death row.[33] In the last three decades, two or three countries have abolished it every year, and less than a fifth of the world's nations continue to execute people. (While ninety countries retain capital punishment in their law books, most have not put anyone to death in at least a decade.) The UN Special Rapporteur on executions, Christof Heyns, points out that if the current rate of abolition continues (not that he's prophesying it will), capital punishment will vanish from the face of the earth by 2026.[34]

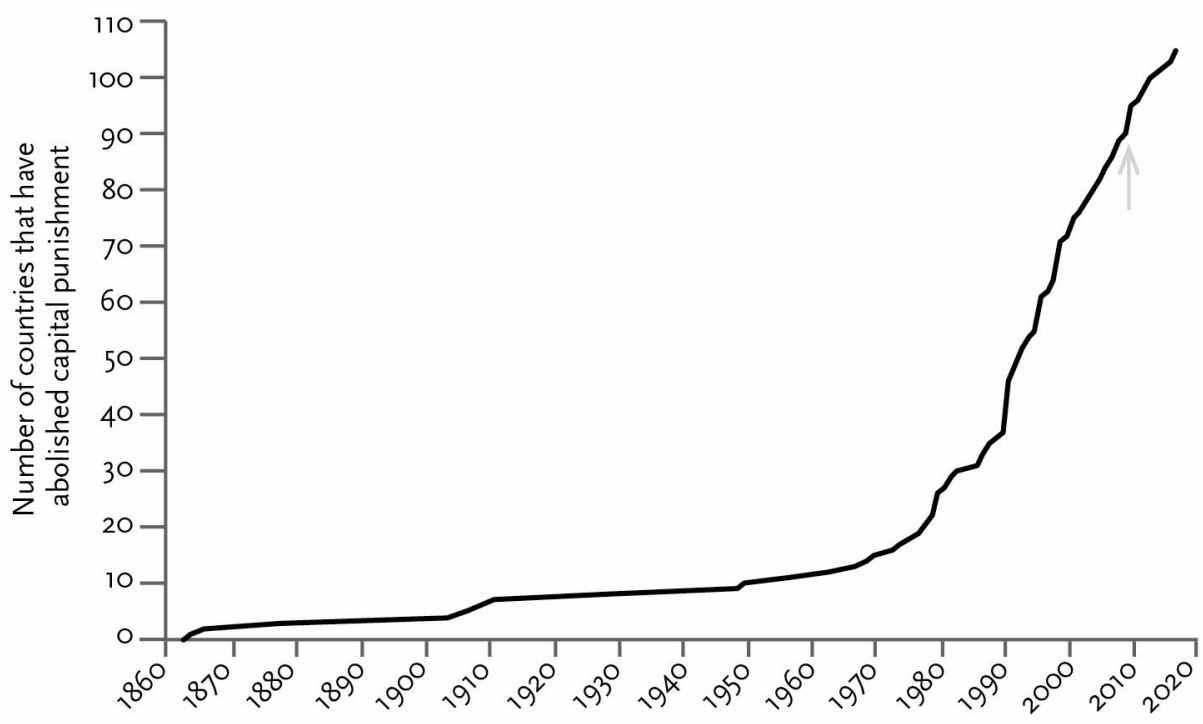


Figure 14-3: Death penalty abolitions, 1863–2016

Source: "Capital Punishment by Country: Abolition Chronology," *Wikipedia*, retrieved Aug. 15, 2016. Several European countries abolished the death penalty in their mainland earlier than indicated here, but the time line records the last abolition in any territory under their jurisdiction. The arrow points to 2008, the last year plotted in fig. 4–3 of Pinker 2011.

The top five countries that still execute people in significant numbers form an unlikely club: China and Iran (more than a thousand apiece annually), Pakistan, Saudi Arabia, and the United

States. As in other areas of human flourishing (such as crime, war, health, longevity, accidents, and education), the United States is a laggard among wealthy democracies. This American exceptionalism illuminates the tortuous path by which moral progress proceeds from philosophical arguments to facts on the ground. It also showcases the tension between the two conceptions of democracy we have been examining: a form of government whose power to inflict violence on its citizens is sharply circumscribed, and a form of government that carries out the will of the majority of its people. The reason the United States is a death-penalty outlier is that it is, in one sense, *too* democratic.

In his history of the abolition of capital punishment in Europe, the legal scholar Andrew Hammel points out that in most times and places the death penalty strikes people as perfectly just: if you take a life, you deserve to lose your own.[35] It was only with the Enlightenment that forceful arguments against the death penalty began to appear.[36] One argument was that the state's mandate to exercise violence may not breach the sacred zone of human life. Another was that the deterrent effect of capital punishment can be achieved with surer and less brutal penalties.

The ideas trickled down from a thin stratum of philosophers and intellectuals to the educated upper classes, particularly liberal professionals like doctors, lawyers, writers, and journalists. Abolition was soon folded into a portfolio of other progressive causes, including mandatory education, universal suffrage, and workers' rights. It was also sacralized under the halo of "human rights" and held out as a symbol of "the kind of society we choose to live in and the kind of people we choose to be." The abolitionist elites in Europe got their way over the misgivings of the common man because European democracies did not convert the opinions of the common man into policy. The penal codes of their countries were drafted by committees of renowned scholars, passed into law by legislators who thought of themselves as a natural aristocracy, and implemented by appointed judges who were lifelong civil servants. It was only after a couple of decades had elapsed and people saw that their country had not fallen into chaos—at which point it would have taken a concerted effort to *reintroduce* capital

punishment—that the populace came around to seeing it as unnecessary.

But the United States, for better or worse, is closer to having government by the people for the people. Other than for a few federal crimes like terrorism and treason, the death penalty is decided upon by individual states, voted on by legislators who are close to their constituents, and in many states sought and approved by prosecutors and judges who have to stand for reelection. Southern states have a longstanding culture of honor, with its ethos of justified retaliation, and not surprisingly, American executions are concentrated in a handful of Southern states, mainly Texas, Georgia, and Missouri—indeed, in a handful of *counties* in those states.[37]

Yet the United States, too, has been swept by the historical current, and capital punishment is on the way out despite its continuing popular appeal (with 61 percent in favor in 2015).[38] Seven states have repealed the death penalty in the past decade, an additional sixteen have moratoria, and thirty have not executed anyone in five years. Even Texas executed only seven prisoners in 2016, compared with forty in 2000. Figure 14-4 shows the steady decline of the use of the death penalty in the United States, with what may be a final slide to zero visible in the rightmost segment. And true to the pattern in Europe, as the practice becomes obsolescent, public opinion straggles behind: in 2016, popular support for the death penalty slipped just below 50 percent for the first time in almost fifty years.[39]

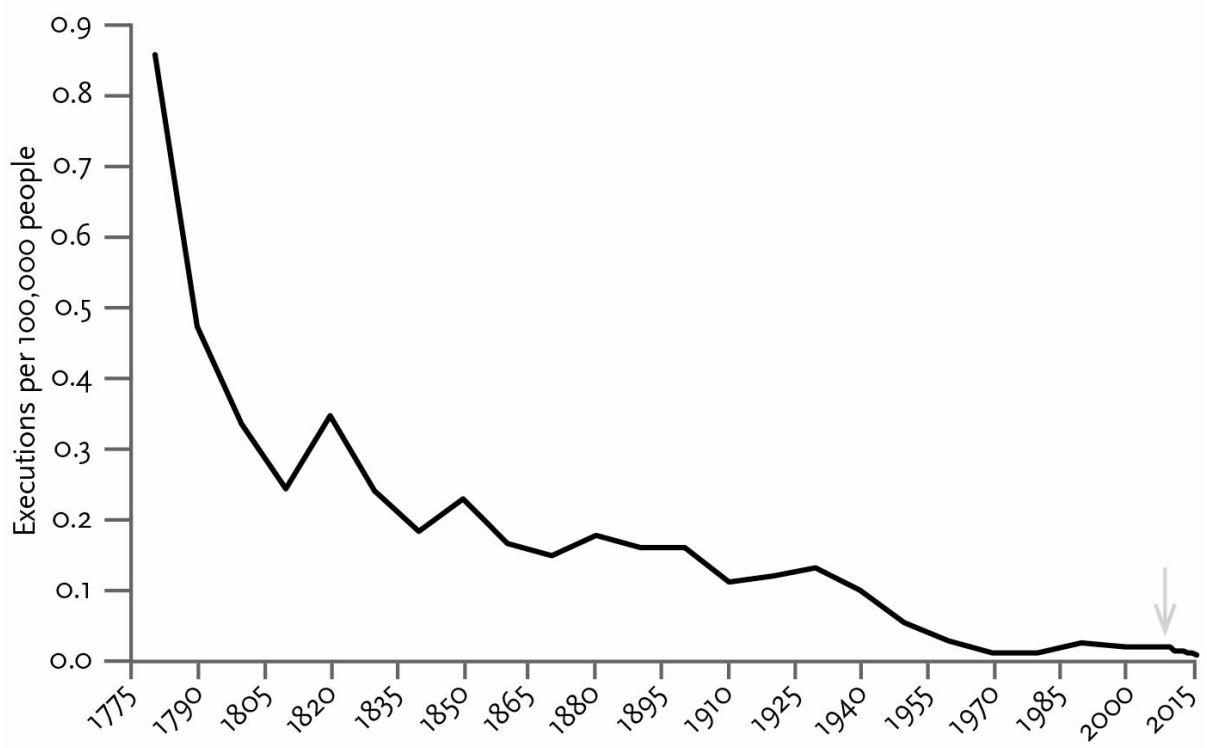


Figure 14-4: Executions, US, 1780–2016

Sources: Death Penalty Information Center 2017. Population estimates from US Census Bureau 2017. The arrow points to 2010, the last year plotted in fig. 4–4 of Pinker 2011.

How can the United States be doing away with capital punishment almost despite itself? Here we see another path along which moral progress can take place. Though the American political system is more populist than those of its Western peers, it still falls short of being a direct participatory democracy like ancient Athens (which, pointedly, put Socrates to death). With the historical expansion of sympathy and reason, even the staunchest fans of capital punishment have lost their stomach for lynch mobs, hanging judges, and rowdy public executions, and insist that the practice be carried out with a modicum of dignity and care. That requires an intricate apparatus of death and a team of mechanics to run and repair it. As the machine wears out and the mechanics refuse to maintain it, it becomes increasingly unwieldy and invites being scrapped.[40] The American death penalty is not so much being abolished as falling apart, piece by piece.

First, advances in forensic science, particularly DNA fingerprinting, have shown that innocent people have almost certainly been put to death, a scenario that unnerves even ardent

supporters of the death penalty. Second, the grisly business of snuffing out a life has evolved from the gory sadism of crucifixion and disembowelment, to the quick but still graphic ropes, bullets, and blades, to the invisible agents of gas and electricity, to the pseudo-medical procedure of lethal injection. But doctors refuse to administer it, pharmaceutical companies refuse to supply the drugs, and witnesses are disturbed by the death throes during botched attempts. Third, the chief alternative to the death penalty, life in prison, has become more reliable as escape-proof and riot-proof penitentiaries have been perfected. Fourth, as the rate of violent crime has plummeted (chapter 12), people feel less need for draconian remedies. Fifth, because the death penalty is seen as such a momentous undertaking, the summary executions of earlier eras have given way to a drawn-out legal ordeal. The sentencing phase after a guilty verdict is tantamount to a second trial, and a death sentence triggers a lengthy process of reviews and appeals—so lengthy that most death-row prisoners die of natural causes. Meanwhile, the billable hours from expensive lawyers cost the state eight times as much as life in prison. Sixth, social disparities in death sentences, with poor and black defendants disproportionately being put to death ("Those without the capital get the punishment"), have weighed increasingly on the nation's conscience. Finally, the Supreme Court, which is repeatedly tasked with formulating a consistent rationale for this crazy quilt, has struggled to rationalize the practice, and has chipped away at it piece by piece. In recent years it has ruled that states may not execute juveniles, people with intellectual disabilities, or perpetrators of crimes other than murder, and it came close to ruling against the hit-and-miss method of lethal injection. Court watchers believe it is only a matter of time before the Justices are forced to confront the caprice of the whole macabre practice head on, invoke "evolving standards of decency," and strike it down as a violation of the Eighth Amendment's prohibition of cruel and unusual punishment once and for all.

The uncanny assemblage of scientific, institutional, legal, and social forces all pushing to strip government of its power to kill makes it seem as if there really is a mysterious arc bending toward justice. More prosaically, we are seeing a moral principle—Life is sacred, so killing is onerous—become distributed across a wide

range of actors and institutions that have to cooperate to make the death penalty possible. As these actors and institutions implement the principle more consistently and thoroughly, they inexorably push the country away from the impulse to avenge a life with a life. The pathways are manifold and tortuous, the effects are slow and then sudden, but in the fullness of time an idea from the Enlightenment can transform the world.

CHAPTER 15

EQUAL RIGHTS

Humans are liable to treat entire categories of other humans as means to an end or nuisances to be cast aside. Coalitions bound by race or creed seek to dominate rival coalitions. Men try to control the labor, freedom, and sexuality of women.[1] People translate their discomfort with sexual nonconformity into moralistic condemnation.[2] We call these phenomena racism, sexism, and homophobia, and they have been rampant, to varying degrees, in most cultures throughout history. The disavowal of these evils is a large part of what we call civil rights or equal rights. The historical expansion of these rights—the stories of Selma, Seneca Falls, and Stonewall—is a stirring chapter in the story of human progress.[3]

The rights of racial minorities, women, and gay people continue to advance, each recently emblazoned on a milestone. The year 2017 saw the completion of two terms in office by the first African American president, an achievement movingly captured by First Lady Michelle Obama in a speech at the Democratic National Convention in 2016: "I wake up every morning in a house that was built by slaves, and I watch my daughters, two beautiful, intelligent black young women, playing with their dogs on the White House lawn." Barack Obama was succeeded by the first woman nominee of a major party in a presidential election, less than a century after American women were even allowed to vote; she won a solid plurality of the popular vote and would have been president were it not for peculiarities of the Electoral College system and other quirks of that election year. In a parallel universe very similar to this one until November 8, 2016, the world's three most influential nations (the United States, the United Kingdom, and Germany) are all led by women.[4] And in 2015, just a dozen years after it ruled that

homosexual activity may not be criminalized, the Supreme Court guaranteed the right of marriage to same-sex couples.

But it's in the nature of progress that it erases its tracks, and its champions fixate on the remaining injustices and forget how far we have come. An axiom of progressive opinion, especially in universities, is that we continue to live in a deeply racist, sexist, and homophobic society—which would imply that progressivism is a waste of time, having accomplished nothing after decades of struggle.

Like other forms of progressophobia, the denial of advances in rights has been abetted by sensational headlines. A string of highly publicized killings by American police officers of unarmed African American suspects, some of them caught on smartphone videos, has led to a sense that the country is suffering an epidemic of racist attacks by police on black men. Media coverage of athletes who have assaulted their wives or girlfriends, and of episodes of rape on college campuses, has suggested to many that we are undergoing a surge of violence against women. And one of the most heinous crimes in American history took place in 2016 when Omar Mateen opened fire at a gay nightclub in Orlando, killing forty-nine people and wounding another fifty-three.

The belief in an absence of progress has been fortified by the recent history of the universe we do live in, where Donald Trump rather than Hillary Clinton was the beneficiary of the American electoral system in 2016. During his campaign, Trump uttered misogynistic, anti-Hispanic, and anti-Muslim insults that were well outside the norms of American political discourse, and the rowdy followers he encouraged at his rallies were even more offensive. Some commentators worried that his victory represented a turning point in the nation's progress toward equality and rights, or that it uncovered the ugly truth that we had never made progress in the first place.

The goal of this chapter is to plumb the depths of the current that carries equal rights along. Is it an illusion, a turbulent whirlpool atop a stagnant pond? Does it easily change direction and flow backwards? Or does justice roll on like a river, righteousness like a mighty stream?[5] I'll end with a coda about progress in the rights of the most easily victimized sector of humanity, children.

By now you should be skeptical about reading history from the headlines, and that applies to the recent assaults on equal rights. The data suggest that the number of police shootings has *decreased,* not increased, in recent decades (even as the ones that do occur are captured on video), and three independent analyses have found that a black suspect is no more likely than a white suspect to be killed by the police.[6] (American police shoot too many people, but it's not primarily a racial issue.) A spate of news about rape cannot tell us whether there is now more violence against women, a bad thing, or whether we now care more about violence against women, a good thing. And to this day it is unclear whether the Orlando nightclub massacre was committed out of homophobia, sympathy for ISIS, or the drive for posthumous notoriety that motivates most rampage shooters.

Better first drafts of history can be gleaned from data on values and from vital statistics. The Pew Research Center has probed Americans' opinions on race, gender, and sexual orientation over the past quarter century, and has reported that these attitudes have undergone a "fundamental shift" toward tolerance and respect of rights, with formerly widespread prejudices sinking into oblivion.[7] The shift is visible in figure 15-1, which plots reactions to three survey statements that are representative of many others.

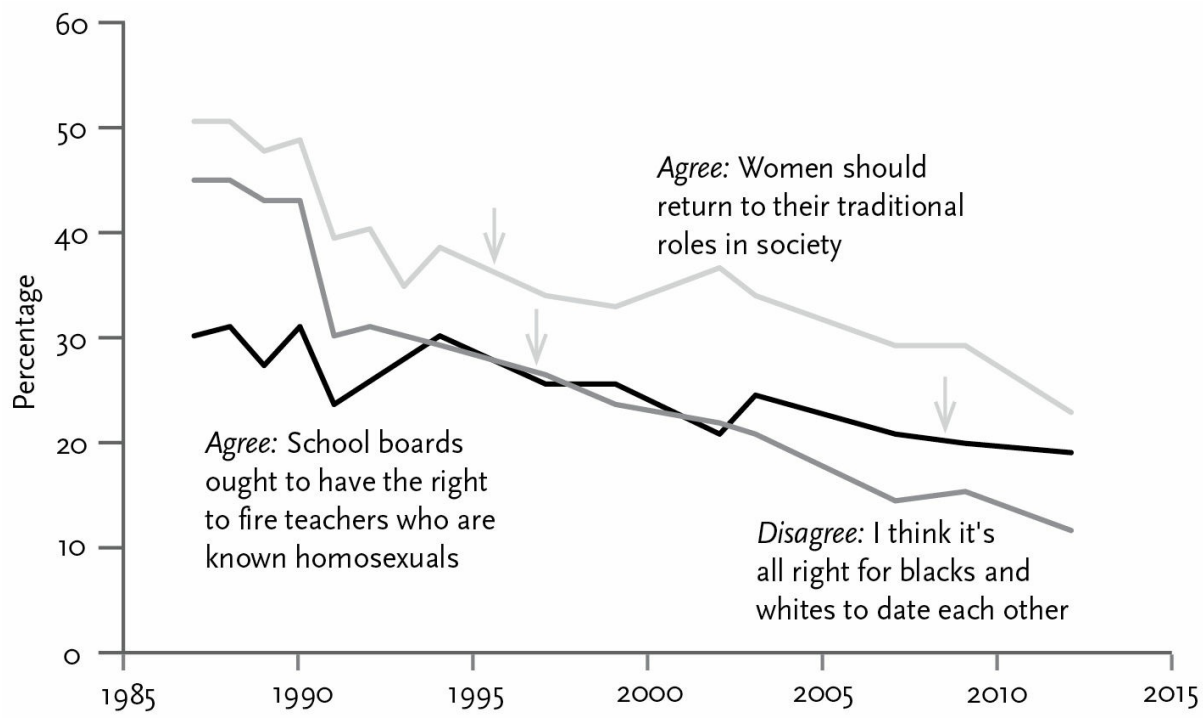


Figure 15-1: Racist, sexist, and homophobic opinions, US, 1987–2012

Source: Pew Research Center 2012b. The arrows point to the most recent years plotted in Pinker 2011 for similar questions: Blacks, 1997 (fig. 7–7); Women, 1995 (fig. 7–11); Homosexuals, 2009 (fig. 7–24).

Other surveys show the same shifts.[8] Not only has the American population become more liberal, but each generational cohort is more liberal than the one born before it.[9] As we will see, people tend to carry their values with them as they age, so the Millennials (those born after 1980), who are even less prejudiced than the national average, tell us which way the country is going.[10]

Of course one can wonder whether figure 15-1 displays a decline in prejudice or simply a decline in the social acceptability of prejudice, with fewer people willing to confess their disreputable attitudes to a pollster. The problem has long haunted social scientists, but recently the economist Seth Stephens-Davidowitz has discovered an indicator of attitudes that is the closest we've come to a digital truth serum.[11] In the privacy of their keyboards and screens, people query Google with every curiosity, anxiety, and guilty pleasure you can imagine, together with many you can't imagine. (Common searches include "How to make my penis bigger" and "My vagina smells like fish.") Google has amassed big data on the strings that people search for in different months and

regions (though not the identity of the searchers), together with tools for analyzing them. Stephens-Davidowitz discovered that searches for the word *nigger* (mostly in pursuit of racist jokes) correlate with other indicators of racial prejudice across regions, such as vote totals for Barack Obama in 2008 that were lower than expected for a Democrat.[12] He suggests that these searches can serve as an unobtrusive indicator of private racism.

Let's use them to track recent trends in racism, and while we're at it, private sexism and homophobia as well. Well into my adolescence, jokes featuring dumb Poles, ditzy dames, and lisping, limp-wristed homosexuals were common in network television and newspaper comics. Today they are taboo in mainstream media. But do bigoted jokes remain a private indulgence, or have private attitudes changed so much that people feel offended, sullied, or bored by them? Figure 15-2 shows the results. The curves suggest that Americans are not just more abashed about confessing to prejudice than they used to be; they privately don't find it as amusing.[13] And contrary to the fear that the rise of Trump reflects (or emboldens) prejudice, the curves continue their decline through his period of notoriety in 2015–2016 and inauguration in early 2017.

Stephens-Davidowitz has pointed out to me that these curves probably *underestimate* the decline in prejudice because of a shift in who's Googling. When the records began in 2004, Googlers were mostly young and urban. Older and rural people tend to be latecomers to technology, and if they are the ones who are likelier to search for the offensive terms, that would inflate the proportion in later years and conceal the extent of the decline in bigotry. Google doesn't record the searchers' ages or levels of education, but it does record where the searches come from. In response to my query, Stephens-Davidowitz confirmed that bigoted searches tended to come from regions with older and less-educated populations. Compared with the country as a whole, retirement communities are seven times as likely to search for "nigger jokes" and thirty times as likely to search for "fag jokes." ("Google AdWords," he told me apologetically, "doesn't give data on 'bitch jokes.'") Stephens-Davidowitz also got his hands on a trove of search data from AOL, which, unlike Google, tracks the searches made by individuals

(though not, of course, their identities). These threads confirmed that racists may be a dwindling breed: someone who searches for "nigger" is likely to search for other topics that appeal to senior citizens, such as "social security" and "Frank Sinatra." The main exception was a sliver of teenagers who also searched for bestiality, decapitation videos, and child pornography—anything you're not supposed to search for. But aside from these transgressive youths (and there have always been transgressive youths), private prejudice is declining with time *and* declining with youth, which means that we can expect it to decline still further as aging bigots cede the stage to less prejudiced cohorts.

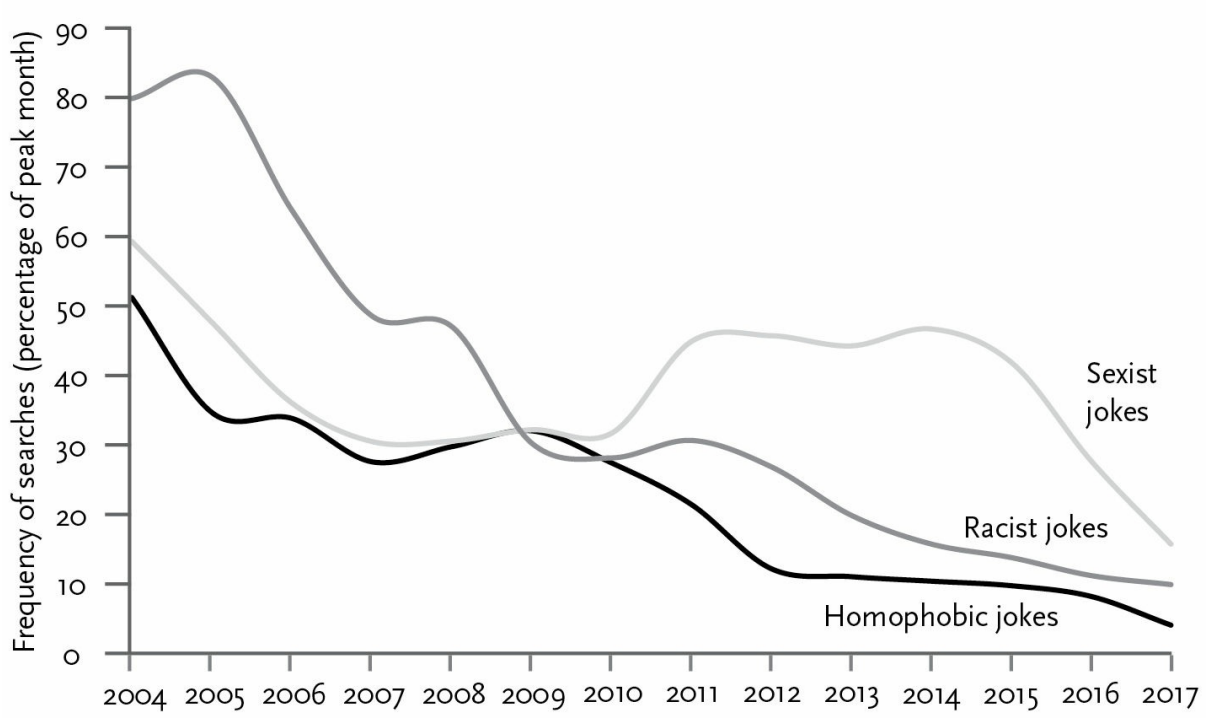


Figure 15-2: Racist, sexist, and homophobic Web searches, US, 2004–2017

Source: Google Trends (www.google.com/trends), searches for "nigger jokes," "bitch jokes," and "fag jokes," United States, 2004–2017, relative to total search volume. Data (accessed Jan. 22, 2017) are by month, expressed as a percentage of the peak month for each search term, then averaged over the months of each year, and smoothed.

Until they do, these older and less-educated people (mainly white men) may not respect the benign taboos on racism, sexism, and homophobia that have become second nature to the mainstream, and may even dismiss them as "political correctness." Today they can find each other on the Internet and coalesce under a

demagogue. As we will see in chapter 20, Trump's success, like that of right-wing populists in other Western countries, is better understood as the mobilization of an aggrieved and shrinking demographic in a polarized political landscape than as the sudden reversal of a century-long movement toward equal rights.



Progress in equal rights may be seen not just in political milestones and opinion bellwethers but in data on people's lives. Among African Americans, the poverty rate fell from 55 percent in 1960 to 27.6 percent in 2011.[14] Life expectancy rose from 33 in 1900 (17.6 years below that of whites) to 75.6 years in 2015 (less than 3 years below whites).[15] African Americans who make it to 65 have *longer* lives ahead of them than white Americans of the same age. The rate of illiteracy fell among African Americans from 45 percent in 1900 to effectively zero percent today.[16] As we will see in the next chapter, the racial gap in children's readiness for school has been shrinking. As we will see in chapter 18, so has the racial gap in happiness.[17]

Racist violence against African Americans, once a regular occurrence in night raids and lynchings (three a week at the turn of the 20th century), plummeted in the 20th century, and has fallen further since the FBI started amalgamating reports on hate crimes in 1996, as figure 15-1 shows. (Very few of these crimes are homicides, in most years one or zero.)[18] The slight uptick in 2015 (the most recent year available) cannot be blamed on Trump, since it parallels the uptick in violent crime that year (see figure 12-2), and hate crimes track rates of overall lawlessness more closely than they do remarks by politicians.[19]

Figure 15-3 shows that hate crimes against Asian, Jewish, and white targets have declined as well. And despite claims that Islamophobia has become rampant in America, hate crimes targeting Muslims have shown little change other than a one-time rise following 9/11 and upticks following other Islamist terror attacks, such as the ones in Paris and San Bernardino in 2015.[20] At the time of this writing, FBI data from 2016 are not available, so it's premature to accept the widespread claims of a Trumpist surge in hate crimes that year. The claims come from advocacy organizations, whose funding depends on whipping up fear, rather than disinterested recordkeepers; some of the incidents were ironic

hoaxes, and many were boorish outbursts rather than actual crimes.[21] Aside from post-terrorist and crime-related blips, the trend in hate crimes is downward.

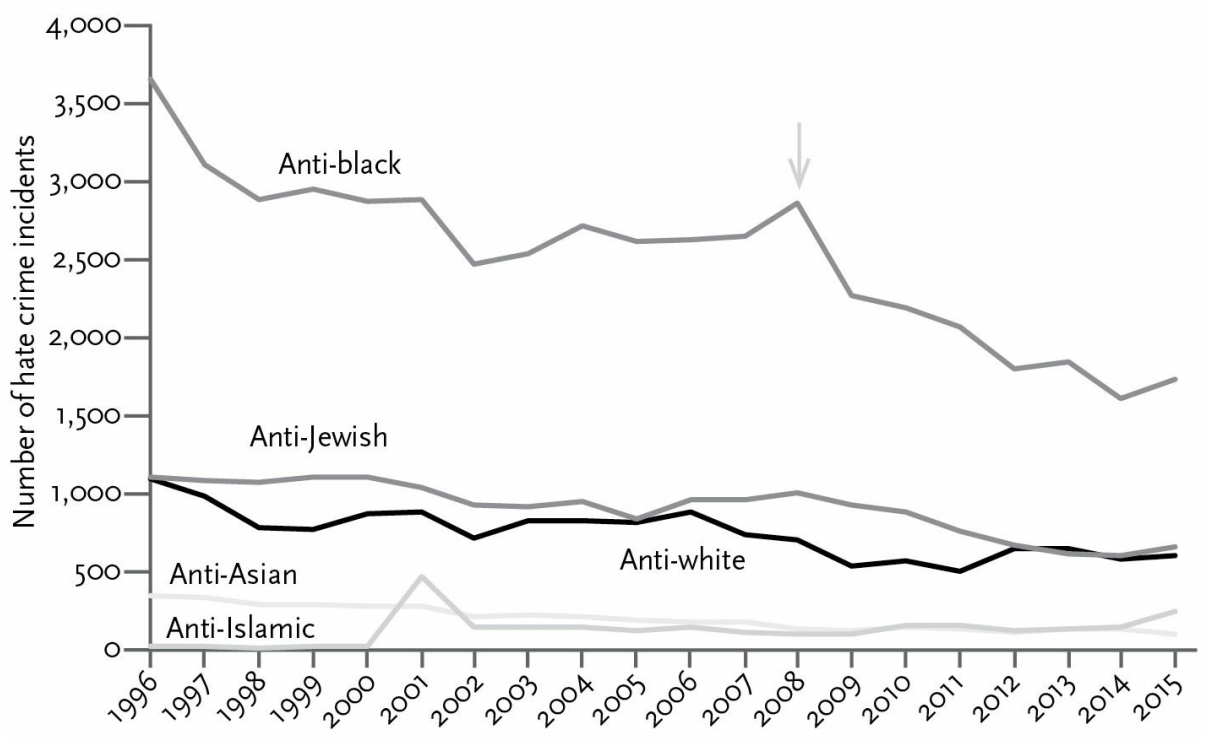


Figure 15-3: Hate crimes, US, 1996–2015

Source: Federal Bureau of Investigation 2016b. The arrow points to 2008, the last year plotted in fig. 7–4 of Pinker 2011.

Women's status, too, is ascendant. As recently as my childhood, American women in most states could not take out a loan or credit card in their own names, had to look for jobs in the HELP WANTED—FEMALE section of the classified ads, and could not press charges of rape against their husbands.[22] Today, women make up 47 percent of the labor force and a majority of university students.[23] Violence against women is best measured by victimization surveys, because they circumvent the problem of underreporting to the police; these instruments show that rates of rape and violence against wives and girlfriends have been sinking for decades and are now at a quarter or less of their peaks in the past (figure 15-4).[24] Too many of these crimes still take place, but we should be encouraged by the fact that a heightened concern about violence against women is not futile

moralizing but has brought measurable progress—which means that continuing this concern can lead to greater progress still.

No form of progress is inevitable, but the historical erosion of racism, sexism, and homophobia are more than a change in fashion. As we will see, it seems to be pushed along by the tide of modernity. In a cosmopolitan society, people rub shoulders, do business, and find themselves in the same boat with other kinds of people, and that tends to make them more sympathetic to one another.[25] Also, as people are forced to justify the way they treat other people, rather than dominating them out of instinctive, religious, or historical inertia, any justification for prejudicial treatment will crumble under scrutiny.[26] Racial segregation, male-only suffrage, and the criminalization of homosexuality are literally indefensible: people tried to defend them in their times, and they lost the argument.

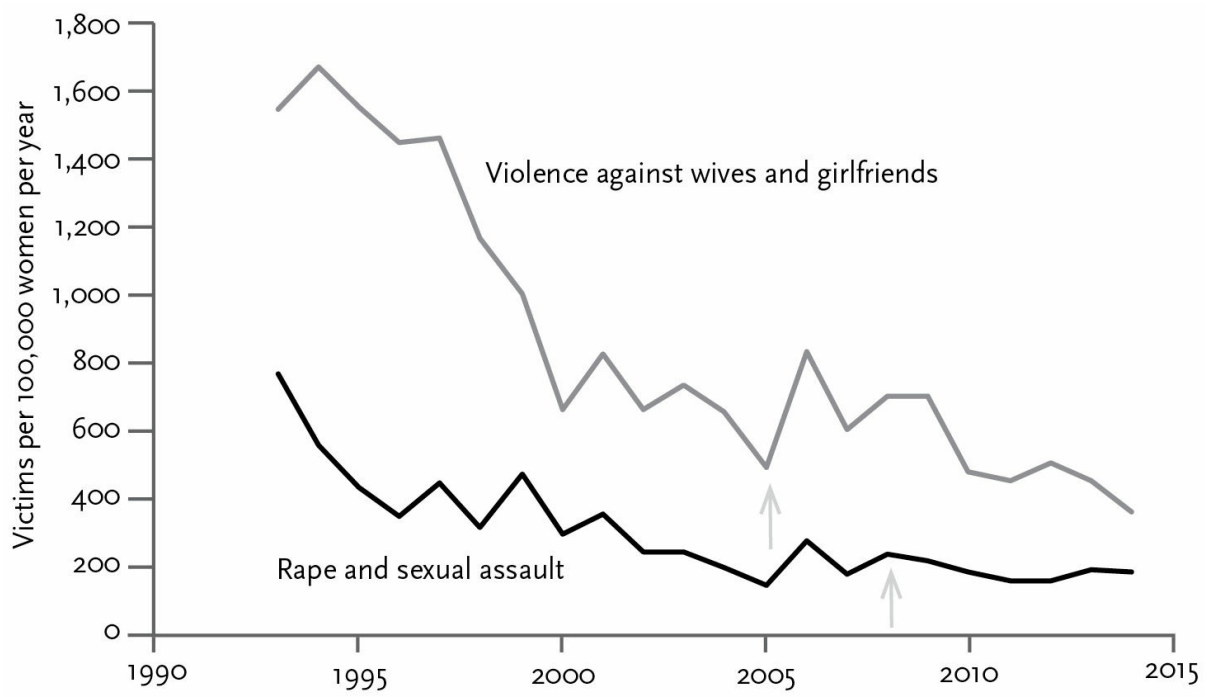


Figure 15-4: Rape and domestic violence, US, 1993–2014

Sources: US Bureau of Justice Statistics, *National Crime Victimization Survey,* Victimization Analysis Tool, http://www.bjs.gov/index.cfm?ty=nvat, with additional data provided by Jennifer Truman of BJS. The gray line represents "Intimate partner violence" with female victims. The arrows point to 2005, the last year plotted in fig. 7–13, and 2008, the last year plotted in fig. 7–10, of Pinker 2011.

These forces can prevail over the long term even against the tug of populist backlash. The global momentum toward abolition of the

death penalty (chapter 14), despite its perennial popular appeal, offers a lesson in the messy ways of progress. As indefensible or unworkable ideas fall by the wayside, they are removed from the pool of thinkable options, even among those who like to think that they think the unthinkable, and the political fringe is dragged forward despite itself. That's why even in the most regressive political movement in recent American history there were no calls for reinstating Jim Crow laws, ending women's suffrage, or recriminalizing homosexuality.



Racial and ethnic prejudice is declining not just in the West but worldwide. In 1950, almost half the world's countries had laws that discriminated against ethnic or racial minorities (including, of course, the United States). By 2003 fewer than a fifth did, and they were outnumbered by countries with affirmative action policies that *favored* disadvantaged minorities.[27] A huge 2008 survey by the World Public Opinion poll of twenty-one developed and developing nations found that in every one, large majorities of respondents (around 90 percent on average) say that it's important for people of different races, ethnicities, and religions to be treated equally.[28] Notwithstanding the habitual self-flagellation by Western intellectuals about Western racism, it's non-Western countries that are the least tolerant. But even in India, the country at the bottom of the list, 59 percent of the respondents affirmed racial equality, and 76 percent affirmed religious equality.[29]

With women's rights, too, the progress is global. In 1900, women could vote in only one country, New Zealand. Today they can vote in every country in which men can vote but one, Vatican City. Women make up almost 40 percent of the labor force worldwide and more than a fifth of the members of national parliaments. The World Opinion Poll and Pew Global Attitudes Project have each found that more than 85 percent of their respondents believe in full equality for men and women, with rates ranging from 60 percent in India, to 88 percent in six Muslim-majority countries, to 98 percent in Mexico and the United Kingdom.[30]

In 1993 the UN General Assembly adopted a Declaration on the Elimination of Violence Against Women. Since then most countries have implemented laws and public-awareness campaigns to reduce

rape, forced marriage, child marriage, genital mutilation, honor killings, domestic violence, and wartime atrocities. Though some of these measures are toothless, there are grounds for optimism over the long term. Global shaming campaigns, even when they start out as purely aspirational, have in the past led to dramatic reductions in slavery, dueling, whaling, foot-binding, piracy, privateering, chemical warfare, apartheid, and atmospheric nuclear testing.[31] Female genital mutilation is an example: though still practiced in twenty-nine African countries (together with Indonesia, Iraq, India, Pakistan, and Yemen), a majority of both men and women in those countries believe it should stop, and over the past thirty years rates have fallen by a third.[32] In 2016 the Pan-African Parliament, working with the UN Population Fund, endorsed a ban on the practice, together with child marriage.[33]

Gay rights is another idea whose time has come. Homosexual acts used to be a criminal offense in almost every country in the world.[34] The first arguments that behavior between consenting adults is no one else's business were formulated during the Enlightenment by Montesquieu, Voltaire, Beccaria, and Bentham. A smattering of countries decriminalized homosexuality soon thereafter, and the number shot up with the gay rights revolution of the 1970s. Though homosexuality is still a crime in more than seventy countries (and a capital crime in eleven Islamic ones), and despite backsliding in Russia and several African countries, the global trend, encouraged by the UN and every human rights organization, continues toward liberalization.[35] Figure 15-5 shows the time line: in the past six years, an additional eight countries have stricken homosexuality from their criminal codes.

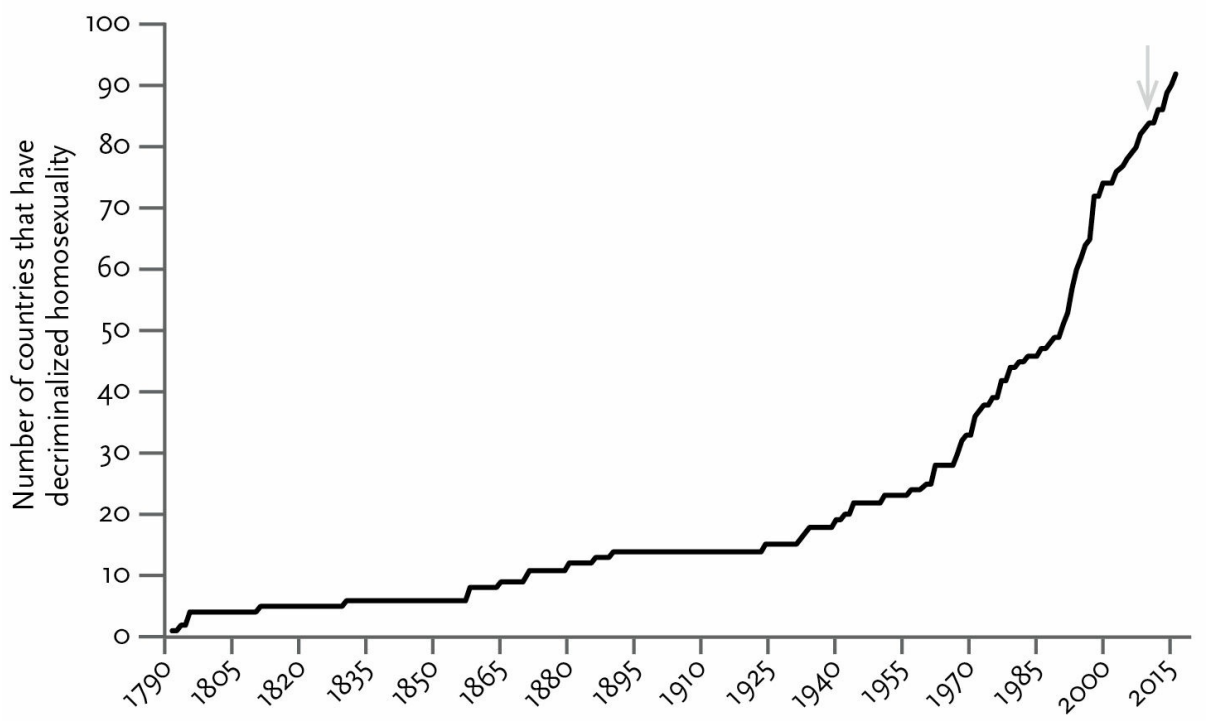


Figure 15-5: Decriminalization of homosexuality, 1791–2016

Sources: Ottosson 2006, 2009. Dates for an additional sixteen countries were obtained from "LGBT Rights by Country or Territory," *Wikipedia*, retrieved July 31, 2016. Dates for an additional thirty-six countries that currently allow homosexuality are not listed in either source. The arrow points to 2009, the last year plotted in fig. 7–23 of Pinker 2011.

The worldwide progress against racism, sexism, and homophobia, even with its bumpiness and setbacks, can feel like an overarching sweep. Martin Luther King Jr. famously quoted the abolitionist Theodore Parker's image of an arc bending toward justice. Parker confessed that he could not complete the arc by sight but could "divine it by conscience." Is there a more objective way of determining whether there is a historical arc toward justice, and if so, what bends it?

One view of the moral arc is provided by the World Values Survey, which has polled 150,000 people in more than ninety-five countries containing almost 90 percent of the world's population over a span of several decades. In his book *Freedom Rising,* the political scientist Christian Welzel (building on a collaboration with Ron Inglehart, Pippa Norris, and others) has proposed that the process of modernization has stimulated the rise of "emancipative

values."[36] As societies shift from agrarian to industrial to informational, their citizens become less anxious about fending off enemies and other existential threats and more eager to express their ideals and to pursue opportunities in life. This shifts their values toward greater freedom for themselves and others. The transition is consistent with the psychologist Abraham Maslow's theory of a hierarchy of needs from survival and safety to belonging, esteem, and self-actualization (and with Brecht's "Grub first, then ethics"). People begin to prioritize freedom over security, diversity over uniformity, autonomy over authority, creativity over discipline, and individuality over conformity. Emancipative values may also be called liberal values, in the classical sense related to "liberty" and "liberation" (rather than the sense of political leftism).

Welzel derived a way to capture a commitment to emancipative values in a single number, based on his discovery that the answers to a cluster of survey items tend to correlate across people, countries, and regions of the world with a common history and culture. The items embrace gender equality (whether people feel that women should have an equal right to jobs, political leadership, and a university education), personal choice (whether they feel that divorce, homosexuality, and abortion may be justified), political voice (whether they believe that people should be guaranteed freedom of speech and a say in government, communities, and the workplace), and childrearing philosophy (whether they feel that children should be encouraged to be obedient or independent and imaginative). The correlations among these items are far from perfect—abortion, in particular, divides people who agree on much else—but they tend to go together and collectively predict many things about a country.

Before we look at historical changes in values, we have to keep in mind that the passage of time doesn't simply flip the pages of the calendar. As time goes by, people get older, and eventually they die and are replaced by a new generation. Any secular (in the sense of historical or long-term) change in human behavior, then, can take place for three reasons.[37] The trend can be a Period Effect: a change in the times, the zeitgeist, or the national mood that lifts or lowers all the boats. It can be an Age (or Life Cycle) Effect: people change as they grow from mewling infant to whining schoolboy to sighing

lover to round-bellied justice, and so on. Since there are booms and busts in a nation's birthrate, the population average will automatically change with the changing proportion of young, middle-aged, and old people, even if the prevailing values at each age are the same. Finally, the trend can be a Cohort (or Generational) Effect: people born at a certain time may be stamped with traits they carry through their lives, and the average for the population will reflect the changing mixture of cohorts as one generation exits the stage and another enters. It's impossible to disentangle the effects of age, period, and cohort perfectly, because as one period transitions into the next, each cohort gets older. But by measuring a trait across a population in several periods, and separating the data from the different cohorts in each one, one can make reasonable inferences about the three kinds of change.

Let's first look at the history of the most developed nations, such as those of North America, Western Europe, and Japan. Figure 15-6 shows the trajectory of emancipative values over a span of a century. It plots survey data collected from adults (ranging in age from eighteen to eighty-five), at two periods (1980 and 2005), representing cohorts born between 1895 and 1980. (American cohorts are commonly divided into the GI Generation, born between 1900 and 1924; the Silent Generation, 1925–45; the Baby Boomers, 1946–64; Generation X, 1965–79; and the Millennials, 1980–2000.) The cohorts are arranged along the horizontal axis by birth year; each of the two testing years is plotted on a line. (Data from 2011 to 2014, which extend the series to late Millennials born through 1996, are similar to those of 2005.)

The graph displays a historical trend that is seldom appreciated in the hurly-burly of political debate: for all the talk about right-wing backlashes and angry white men, the values of Western countries have been getting steadily more liberal (which, as we will see, is one of the reasons those men are so angry).[38] The line for 2005 is higher than the line for 1980 (showing that everyone got more liberal over time), and both curves rise from left to right (showing that younger generations in both periods were more liberal than older generations). The rises are substantial: about three-quarters of a standard deviation apiece for the twenty-five years of passing time and for each twenty-five-year generation. (The

rises are also unappreciated: a 2016 Ipsos poll showed that in almost every developed country, people think their compatriots are more socially conservative than they really are.)[39] A critical discovery displayed in the graph is that the liberalization does *not* reflect a growing bulge of liberal young people who will backslide into conservatism as they get older. If that were true, the two curves would sit side by side instead of one floating above the other, and a vertical line representing a given cohort would impale the 2005 curve at a *lower* value, reflecting conservative old age, rather than the higher value we see, reflecting the more liberal zeitgeist. Young people take their emancipative values with them as they age, a finding we'll return to when we ponder the future of progress in chapter 20.[40]

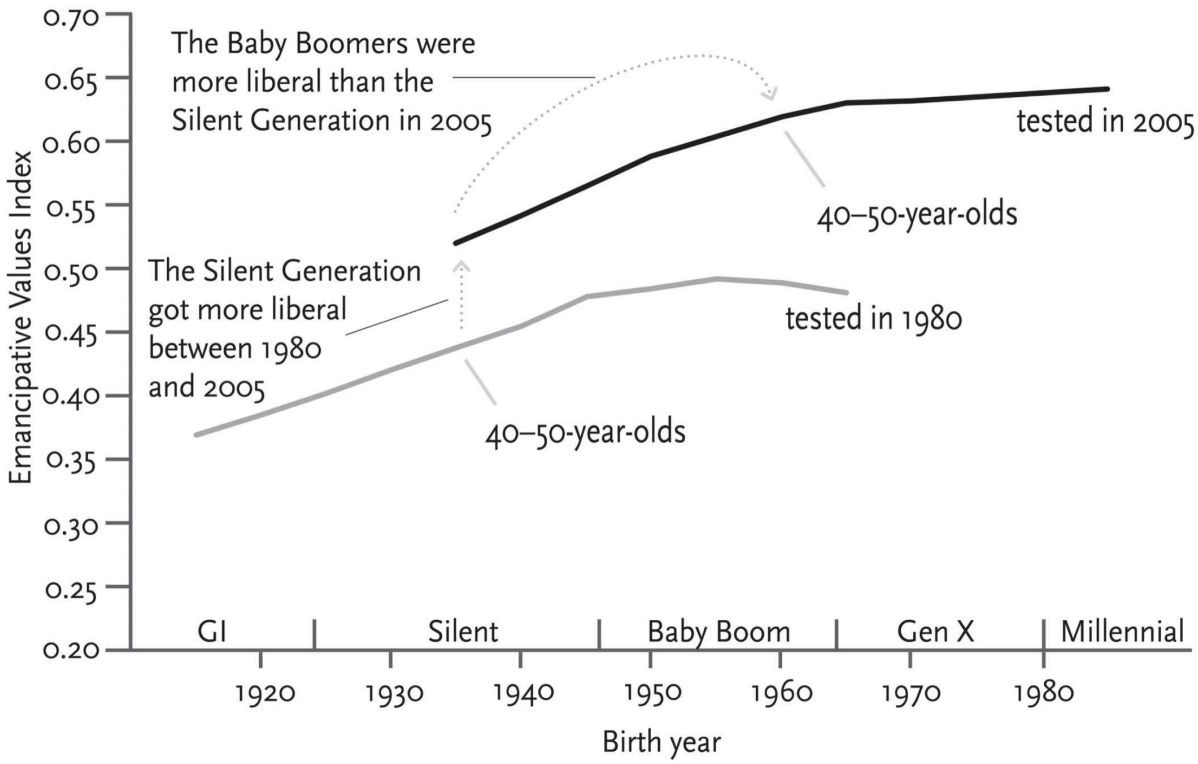


Figure 15-6: Liberal values across time and generations, developed countries, 1980–2005

Source: Welzel 2013, fig. 4.1. World Values Survey data are from Australia, Canada, France, West Germany, Italy, Japan, the Netherlands, Norway, Sweden, the United Kingdom, and the United States (each country weighted equally).

The liberalization trends shown in figure 15-6 come from the Prius-driving, chai-sipping, kale-eating populations of post-industrial Western countries. What about the rest of humanity?

Welzel grouped the ninety-five countries in the World Values Survey into ten zones with similar histories and cultures. He also took advantage of the absence of a life-cycle effect to extrapolate emancipative values backwards: the values of a sixty-year-old in 2000, adjusted for the effects of forty years of liberalization in his or her country as a whole, provide a good estimate of the values of a twenty-year-old in 1960. Figure 15-7 shows the trends in liberal values for the different parts of the world over a span of almost fifty years, combining the effects of the changing zeitgeist in each country (like the jump between curves in figure 15-6) with the changing cohorts (the rise along each curve).

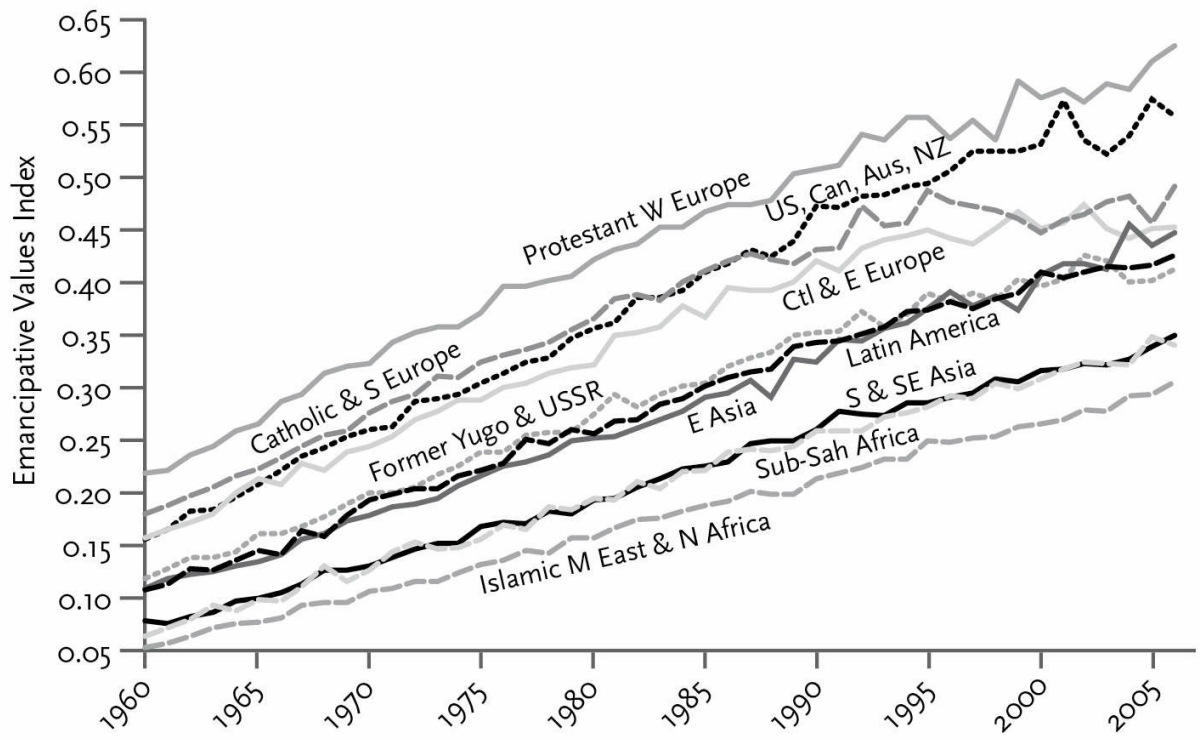


Figure 15-7: Liberal values across time (extrapolated), world's culture zones, 1960–2006

Source: World Values Survey, as analyzed in Welzel 2013, fig. 4.4, updated with data provided by Welzel. Emancipative value estimates for each country in each year are calculated for a hypothetical sample of a fixed age, based on each respondent's birth cohort, the year of testing, and a country-specific period effect. The labels are geographic mnemonics for Welzel's "culture zones" and do not literally apply to every country in a zone. I have renamed some of the zones: Protestant Western Europe corresponds to Welzel's "Reformed West." US, Canada, Australia, New Zealand = "New West." Catholic & Southern Europe = "Old West." Central & Eastern Europe = "Returned West." East Asia = "Sinic East." Former Yugoslavia & USSR = "Orthodox East." South & Southeast Asia = "Indic East." Countries in each zone are weighted equally.

The graph, unsurprisingly, reveals that differences across the world's culture zones are substantial. The Protestant countries of Western Europe, such as the Netherlands, Scandinavia, and the United Kingdom, are the world's most liberal, followed by the United States and other wealthy English-speaking countries, then Catholic and Southern Europe, then the former Communist countries of central Europe. Latin America, the industrialized countries of East Asia, and the former republics of the Soviet Union and Yugoslavia are more socially conservative, followed by South and Southeast Asia and sub-Saharan Africa. The world's most illiberal region is the Islamic Middle East.

What is surprising, though, is that *in every part of the world, people have become more liberal.* A lot more liberal: young Muslims in the Middle East, the world's most conservative culture, have values today that are comparable to those of young people in Western Europe, the world's most liberal culture, in the early 1960s. Though in every culture both the zeitgeist and the generations became more liberal, in some, like the Islamic Middle East, the liberalization was driven mainly by the generational turnover, and it played an obvious role in the Arab Spring.[41]

Can we identify the causes that differentiate the world's regions and liberalize them all over time? Many society-wide traits correlate with emancipative values, and—in a problem we encounter repeatedly—they tend to correlate with each other, a nuisance for social scientists who want to distinguish causation from correlation.[42] Prosperity (measured as GDP per capita) correlates with emancipative values, presumably because as people become healthier and more secure they can experiment with liberalizing their societies. The data show that more liberal countries are also, on average, better educated, more urban, less fecund, less inbred (with fewer marriages among cousins), more peaceful, more democratic, less corrupt, and less crime- and coup-ridden.[43] Their economies, now and in the past, tend to be built on networks of commerce rather than large plantations or the extraction of oil and minerals.

Yet the single best predictor of emancipative values is the World Bank's Knowledge Index, which combines per capita measures of education (adult literacy and enrollment in high schools and

colleges), information access (telephones, computers, and Internet users), scientific and technological productivity (researchers, patents, and journal articles), and institutional integrity (rule of law, regulatory quality, and open economies).[44] Welzel found that the Knowledge Index accounts for *seventy percent* of the variation in emancipative values across countries, making it a far better predictor than GDP.[45] The statistical result vindicates a key insight of the Enlightenment: knowledge and sound institutions lead to moral progress.



Any tour of progress in rights must look at the most vulnerable sector of humanity, children, who cannot agitate for their own interests but depend upon the compassion of others. We've already seen that children the world over have become better off: they are less likely to enter the world motherless, die before their fifth birthday, or grow up stunted for lack of food. Here we'll see that in addition to escaping these natural assaults, children are increasingly escaping human-made ones: they are safer than they were before, and likelier to enjoy a true childhood.

The well-being of children is yet another case in which lurid headlines terrify news readers even as they have less to be terrified about. Media reports of school shootings, abductions, bullying, cyberbullying, sexting, date rape, and sexual and physical abuse make it seem as if children are living in increasingly perilous times. The data say otherwise. Teenagers' retreat from dangerous drugs, mentioned in chapter 12, is just one example. In a 2014 review of the literature on violence against children in the United States, the sociologist David Finkelhor and his colleagues reported, "Of 50 trends in exposure examined, there were 27 significant declines and no significant increases between 2003 and 2011. Declines were particularly large for assault victimization, bullying, and sexual victimization."[46] Three of those trends are shown in figure 15-8.

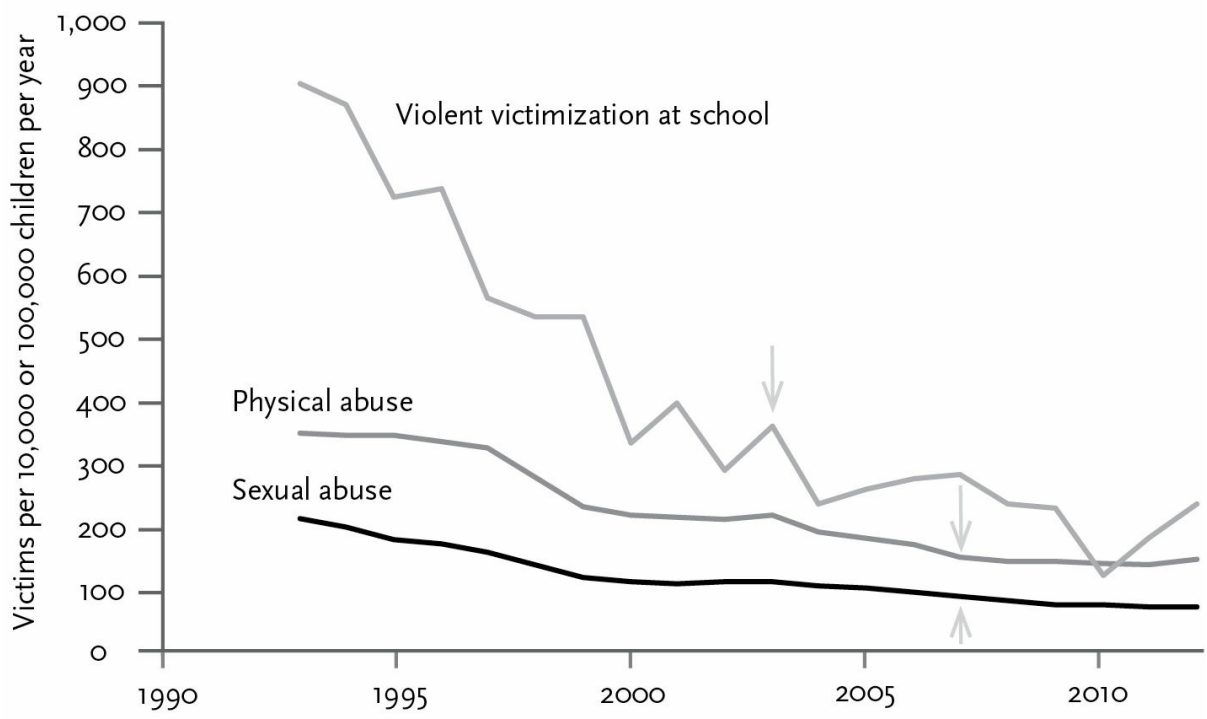


Figure 15-8: Victimization of children, US, 1993–2012

Sources: Physical abuse and **Sexual abuse** (mainly by caregivers): National Child Abuse and Neglect Data System, http://www.ndacan.cornell.edu/, analyzed by Finkelhor 2014; Finkelhor et al. 2014. **Violent victimization at school:** US Bureau of Justice Statistics, *National Crime Victimization Survey,* Victimization Analysis Tool, http://www.bjs.gov/index.cfm?ty=nvat. Rates for physical and sexual abuse are per 100,000 children younger than 18. Rates for violent victimization at school are per 10,000 children aged 12–17. The arrows point to 2003 and 2007, the last years plotted in fig. 7–22 and fig. 7–20 in Pinker 2011, respectively.

Another declining form of violence against children is corporal punishment—the spanking, smacking, paddling, birching, tanning, hiding, thrashing, and other crude methods of behavior modification that parents and teachers have inflicted on helpless children at least since the 7th-century-BCE advisory "Spare the rod and spoil the child." Corporal punishment has been condemned in several United Nations resolutions and has been outlawed in more than half the world's countries. The United States, once again, is an outlier among advanced democracies in allowing children to be paddled in schools, but even here, approval of all forms of corporal punishment is in slow but steady decline.[47]

Nine-year-old Oliver Twist's stint at picking oakum out of tarry ropes in an English workhouse is a fictional glimpse at one of the most widespread abuses of children, child labor. Together with

Dickens's novel, Elizabeth Barrett Browning's 1843 poem "The Cry of the Children" and many journalistic exposés awakened 19th-century readers to the horrific conditions under which children were forced to work in that era. Small children stood on boxes to tend dangerous machinery in mills, mines, and canneries, breathing air thick with cotton or coal dust, kept awake by splashes of cold water in their faces, collapsing into sleep after exhausting shifts with food still in their mouths.

But the cruelties of child labor did not begin in Victorian factories.[48] Children have always been set to work as farmhands and domestics, and they were commonly hired out as servants to other people or as laborers in cottage industries, often from the age when they could walk. In the 17th century, for example, children put to work in a kitchen would crank a spit with a slab of meat for hours, protected from the fire only by a bale of wet hay.[49] No one thought of child labor as exploitation; it was a form of moral education, protecting children from idleness and sloth.

Starting with influential treatises by John Locke in 1693 and Jean-Jacques Rousseau in 1762, childhood was reconceptualized.[50] A carefree youth was now considered a human birthright. Play was an essential form of learning, and the early years of life shaped the adult and determined the future of society. In the decades around the turn of the 20th century, childhood was "sacralized," as the economist Viviana Zelizer has put it, and children achieved their current status as "economically worthless, emotionally priceless."[51] Under pressure from children's advocates, and helped along by affluence, smaller families, an expanding circle of sympathy, and an increasing premium on education, Western societies gradually did away with child labor. A snapshot of these forces pushing in the same direction may be found in an advertisement for tractors in a 1921 issue of the magazine *Successful Farming* entitled "Keep the Boy in School":

> The pressure of urgent Spring work is often the cause of keeping the boy out of school for several months. It may seem necessary—but it isn't fair to the boy! You are placing a life handicap in his path if you deprive him of education. In this

age, education is becoming more and more essential for success and prestige in all walks of life, including farming.

Should you feel that your own education was neglected, through no fault of yours, then you naturally will want your children to enjoy the benefits of a real education—to have some things you may have missed.

With the help of a Case Kerosene Tractor it is possible for one man to do more work, in a given time, than a good man and an industrious boy, together, working with horses. By investing in a Case Tractor and Ground Detour Plow and Harrow outfit now, your boy can get his schooling without interruption, and the Spring work will not suffer by his absence.

Keep the boy in school—and let a Case Kerosene Tractor take his place in the field. You'll never regret either investment.[52]

In many countries the coup de grâce was legislation that made schooling compulsory and thus made child laborers conspicuously illegal. Figure 15-9 shows that the proportion of children in the labor force in England was halved between 1850 and 1910, before child labor was outlawed altogether in 1918, and the United States followed a similar trajectory.

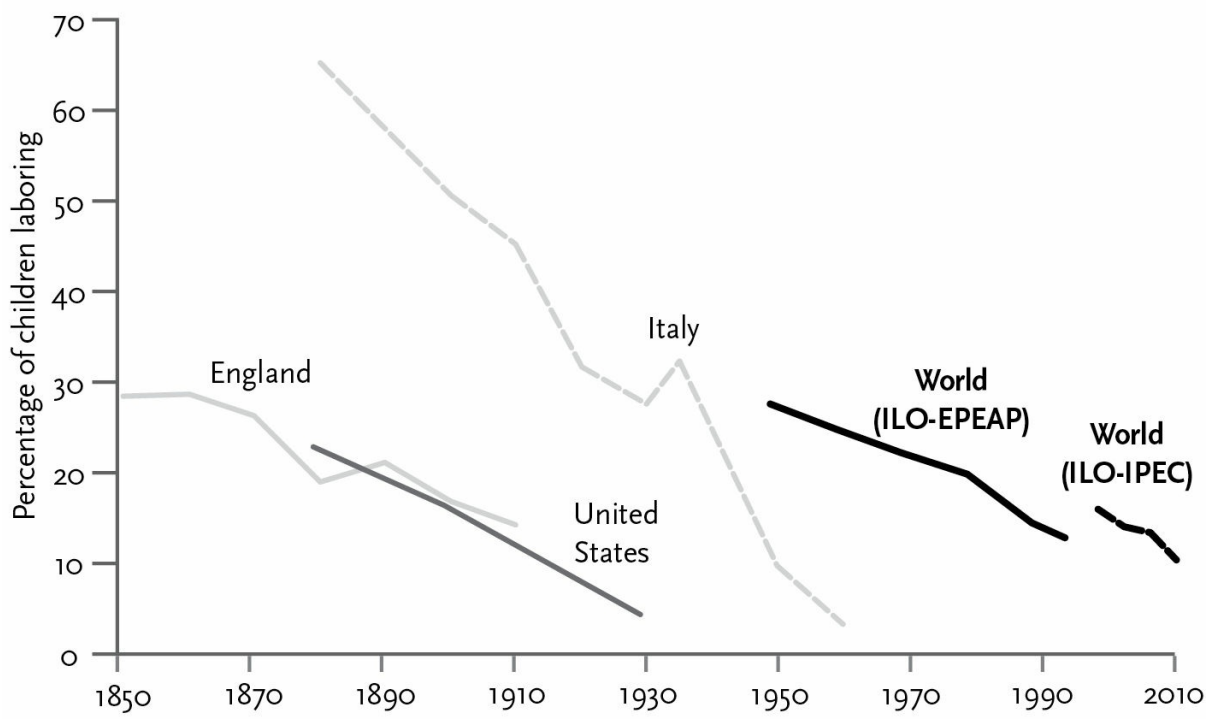


Figure 15-9: Child labor, 1850–2012

Sources: *Our World in Data,* Ortiz-Ospina & Roser 2016a, and the following. **England:** Percentage of children aged 10–14 recorded as working, Cunningham 1996. **United States:** Whaples 2005. **Italy:** Child work incidence, ages 10–14, Toniolo & Vecchi 2007. **World ILO-EPEAP** (International Labour Organization Programme on Estimates and Projections of the Economically Active Population): Child Labor, ages 10–14, Basu 1999. **World ILO-IPEC** (International Labour Organization International Programme on the Elimination of Child Labour): Child Labor, ages 5–17, International Labour Organization 2013.

The graph also shows the precipitous decline in Italy, together with two recent time series for the world. The lines are not commensurable because of differences in the age ranges and definitions of "child labor," but they show the same trend: downward. In 2012, 16.7 percent of the world's children worked an hour a week or more, 10.6 percent engaged in objectionable "child labor" (long hours or tender age), and 5.4 percent engaged in hazardous work—far too many, but less than half the rate of just a dozen years before. Child labor, now as always, is concentrated not in manufacturing but in agriculture, forestry, and fishing, and it goes with national poverty, as both cause and effect: the poorer the country, the larger the percentage of its children who work.[53] As wages rise, or when governments pay parents to send their children

to school, child labor plummets, which suggests that poor parents send their children to work out of desperation rather than greed.[54]

As with other crimes and tragedies of the human condition, progress in ending child labor has been powered both by the global rise of affluence and by humanistic moral campaigns. In 1999, 180 countries ratified the Worst Forms of Child Labour Convention. The "worst forms" that were banned include hazardous labor and the exploitation of children in slavery, human trafficking, debt bondage, prostitution, pornography, drug trafficking, and war. Though the International Labour Organization's target of eliminating the worst forms by 2016 was not met, the momentum is unmistakable. The cause was symbolically ratified in 2014 when the Nobel Peace Prize was awarded to Kailash Satyarthi, the activist against child labor, who had been instrumental in the adoption of the 1999 resolution. He shared the prize with Malala Yousafzai, the heroic advocate for girls' education. And that brings us to yet another advance in human flourishing, the expansion of access to knowledge.

CHAPTER 16

KNOWLEDGE

H*omo sapiens,* "knowing man," is the species that uses information to resist the rot of entropy and the burdens of evolution. Humans everywhere acquire knowledge about their landscape, its flora and fauna, the tools and weapons that can subdue them, and the networks and norms that entangle them with kin, allies, and enemies. They accumulate and share that knowledge with the use of language, gesture, and face-to-face tutelage.[1]

At a few times in history, people have hit on technologies that multiply, indeed, exponentiate, the growth of knowledge, such as writing, printing, and electronic media. The supernova of knowledge continuously redefines what it means to be human. Our understanding of who we are, where we came from, how the world works, and what matters in life depends on partaking of the vast and ever-expanding store of knowledge. Though unlettered hunters, herders, and peasants are fully human, anthropologists often comment on their orientation to the present, the local, the physical.[2] To be aware of one's country and its history, of the diversity of customs and beliefs across the globe and through the ages, of the blunders and triumphs of past civilizations, of the microcosms of cells and atoms and the macrocosms of planets and galaxies, of the ethereal reality of number and logic and pattern—such awareness truly lifts us to a higher plane of consciousness. It is a gift of belonging to a brainy species with a long history.

It's been a long time since our culture's store of knowledge could be passed along by storytelling and apprenticeship. Formal schools are millennia old; I grew up with the Talmudic story of the 1st-century Rabbi Hillel who as a young man nearly froze to death after he climbed onto the roof of a school whose tuition he could not

afford so that he could eavesdrop on lessons through the skylight. At various times, schools have been charged with instilling practical, religious, or patriotic wisdom in the young, but the Enlightenment, with its apotheosis of knowledge, would broaden their remit. "With the coming of the modern age," the educational theorist George Counts observes, "formal education assumed a significance far in excess of anything that the world had yet seen. The school, which had been a minor social agency in most of the societies of the past, directly affecting the lives of but a small fraction of the population, expanded horizontally and vertically until it took its place along with the state, the church, the family and property as one of society's most powerful institutions."[3] Today, education is compulsory in most countries, and it is recognized as a fundamental human right by the 170 members of the United Nations that signed the 1966 International Covenant on Economic, Social and Cultural Rights.[4]

The mind-altering effects of education extend to every sphere of life, in ways that range from the obvious to the spooky. At the obvious end of the range, we saw in chapter 6 that a little knowledge about sanitation, nutrition, and safe sex can go a long way toward improving health and extending life. Also obvious is that literacy and numeracy are the foundations of modern wealth creation. In the developing world a young woman can't even work as a household servant if she is unable to read a note or count out supplies, and higher rungs of the occupational ladder require ever-increasing abilities to understand technical material. The first countries that made the Great Escape from universal poverty in the 19th century, and the countries that have grown the fastest ever since, are the countries that educated their children most intensely.[5]

As with every question in social science, correlation is not causation. Do better-educated countries get richer, or can richer countries afford more education? One way to cut the knot is to take advantage of the fact that a cause must precede its effect. Studies that assess education at Time 1 and wealth at Time 2, holding all else constant, suggest that investing in education really does make countries richer. At least it does if the education is secular and rationalistic. Until the 20th century, Spain was an economic laggard among Western countries, even though Spaniards were highly

schooled, because Spanish education was controlled by the Catholic Church, and "the children of the masses received only oral instruction in the Creed, the catechism, and a few simple manual skills. . . . Science, mathematics, political economy, and secular history were considered too controversial for anyone but trained theologians."[6] Clerical meddling has similarly been blamed for the economic lag of parts of the Arab world today.[7]

At the more spiritual end of the range, education brings gifts that go well beyond practical know-how and economic growth: better education today makes a country more democratic and peaceful tomorrow.[8] The wide-ranging effects of education make it hard to discern the intervening links in the causal chain from formal schooling to social harmony. Some of the links may simply be demographic and economic. Better-educated girls grow up to have fewer babies, and so are less likely to beget youth bulges with their surfeit of troublemaking young men.[9] And better-educated countries are richer, and as we saw in chapters 11 and 14, richer countries tend to be more peaceful and democratic.

But some of the causal pathways vindicate the values of the Enlightenment. So much changes when you get an education! You unlearn dangerous superstitions, such as that leaders rule by divine right, or that people who don't look like you are less than human. You learn that there are other cultures that are as tied to their ways of life as you are to yours, and for no better or worse reason. You learn that charismatic saviors have led their countries to disaster. You learn that your own convictions, no matter how heartfelt or popular, may be mistaken. You learn that there are better and worse ways to live, and that other people and other cultures may know things that you don't. Not least, you learn that there are ways of resolving conflicts without violence. All these epiphanies militate against knuckling under the rule of an autocrat or joining a crusade to subdue and kill your neighbors. Of course, none of this wisdom is guaranteed, particularly when authorities promulgate their own dogmas, alternative facts, and conspiracy theories—and, in a backhanded compliment to the power of knowledge, stifle the people and ideas that might discredit them.

Studies of the effects of education confirm that educated people really are more enlightened. They are less racist, sexist, xenophobic,

homophobic, and authoritarian.[10] They place a higher value on imagination, independence, and free speech.[11] They are more likely to vote, volunteer, express political views, and belong to civic associations such as unions, political parties, and religious and community organizations.[12] They are also likelier to trust their fellow citizens—a prime ingredient of the precious elixir called social capital which gives people the confidence to contract, invest, and obey the law without fearing that they are chumps who will be shafted by everyone else.[13]

For all these reasons, the growth of education—and its first dividend, literacy—is a flagship of human progress. And as with so many other dimensions of progress, we see a familiar narrative: until the Enlightenment, almost everyone was abject; then, a few countries started to pull away from the pack; recently, the rest of the world has been catching up; soon, the bounty will be near-universal. Figure 16-1 shows that before the 17th century, literacy was the privilege of a small elite in Western Europe, less than an eighth of the population, and that was true for the world as a whole well into the 19th century. The world's literacy rate doubled in the next century and quadrupled in the century after that, so now 83 percent of the world is literate. Even that figure understates the literatization of the world, because the illiterate fifth is mostly middle-aged or elderly. In many Middle Eastern and North African countries, more than three-quarters of the people over sixty-five are illiterate, whereas the rate for those in their teens and twenties is in the single digits.[14] The literacy rate for young adults (aged fifteen to twenty-four) in 2010 was 91 percent—about the same as for the entire population of the United States in 1910.[15] Not surprisingly, the lowest rates of literacy are found in the world's poorest and most war-torn countries, such as South Sudan (32 percent), Central African Republic (37 percent), and Afghanistan (38 percent).[16]

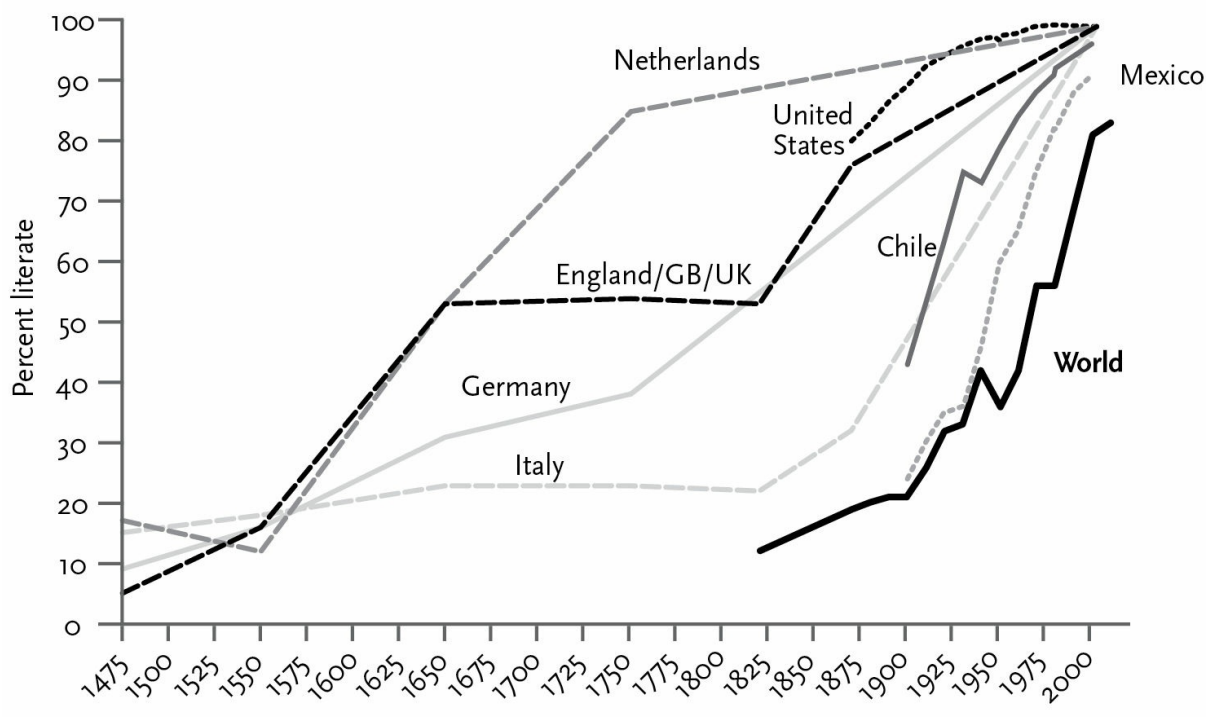


Figure 16-1: Literacy, 1475–2010

Source: *Our World in Data,* Roser & Ortiz-Ospina 2016b, including data from the following. **Before 1800:** Buringh & van Zanden 2009. World**:** van Zanden et al. 2014. **US:** National Center for Education Statistics. **After 2000:** Central Intelligence Agency 2016.

Literacy is the foundation for the rest of education, and figure 16-2 shows the world's progress in sending children to school.[17] The time line is familiar: in 1820, more than 80 percent of the world was unschooled; by 1900, a large majority of Western Europe and the Anglosphere had the benefit of a basic education; today, that's true of more than 80 percent of the world. The least fortunate region, sub-Saharan Africa, has a rate comparable to that of the world in 1980, Latin America in 1970, East Asia in the 1960s, Eastern Europe in 1930, and Western Europe in 1880. According to current projections, by the middle of this century, only five countries will have more than a fifth of their population uneducated, and by the end of the century the worldwide proportion will fall to zero.[18]

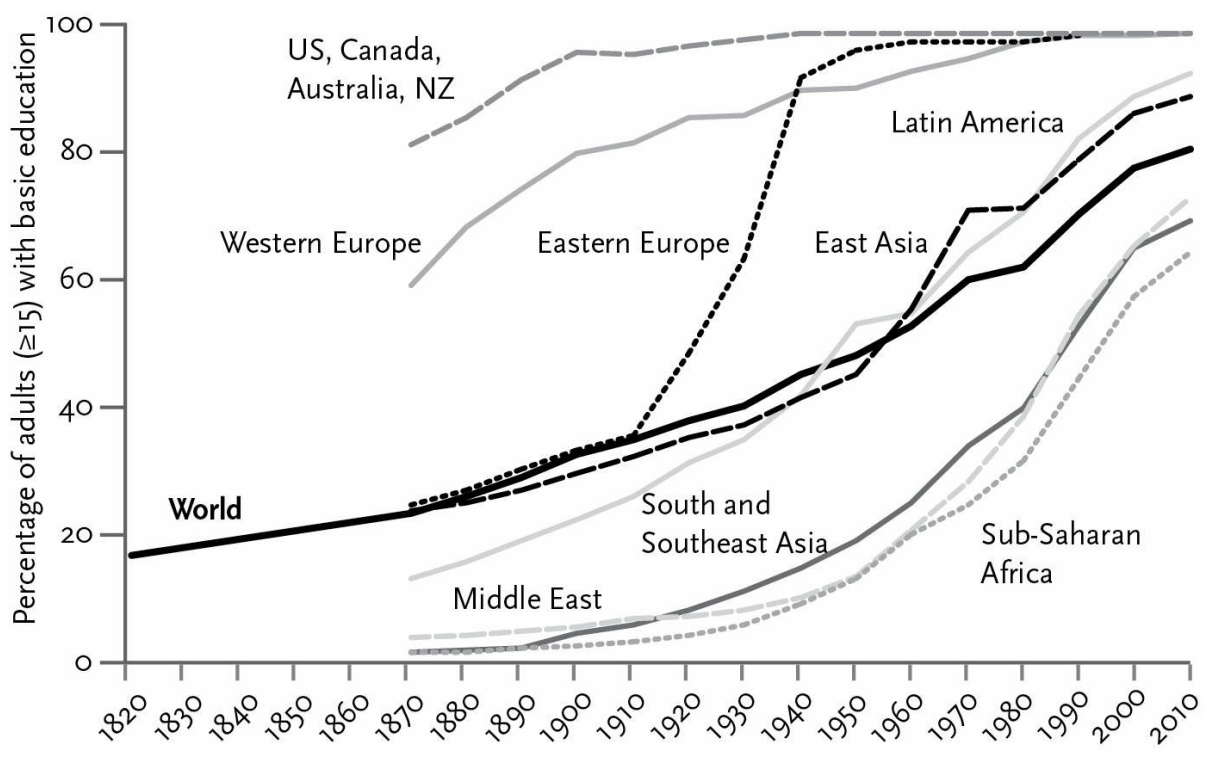


Figure 16-2: Basic education, 1820–2010

Source: *Our World in Data,* Roser & Ortiz-Ospina 2018, based on data from van Zanden et al. 2014. The graphs indicate the share of the population aged 15 or older that had completed at least a year of education (more in later eras); see van Leeuwen & van Leewen-Li 2014, pp. 88–93.

"Of making many books there is no end; and much study is a weariness of the flesh."[19] Unlike measures of well-being that have a natural floor of zero, like war and disease, or a natural ceiling of a hundred percent, like nutrition and literacy, the quest for knowledge is unbounded. Not only does knowledge itself expand indefinitely, but the premium for knowledge in an economy that is driven by technology has been soaring.[20] While global rates of literacy and basic education are converging to their natural ceiling, the number of years of schooling, extending into tertiary and postgraduate education in colleges and universities, continues to grow in every country. In 1920, just 28 percent of American teenagers between fourteen and seventeen were in high school; by 1930, the proportion had grown to almost half, and by 2011, 80 percent graduated, of whom almost 70 percent went on to college.[21] In 1940, less than 5 percent of Americans held a bachelor's degree; by 2015, almost a third did.[22] Figure 16-3 shows the parallel trajectories of the length of schooling in a sample of countries, with

recent highs ranging from four years in Sierra Leone to thirteen years (some college) in the United States. According to one projection, by the end of the century more than 90 percent of the world's population will have some secondary education, and 40 percent some college.[23] Since educated people tend to have fewer children, the growth of education is a major reason that, later in this century, world population is expected to peak and then decline (figure 10-1).

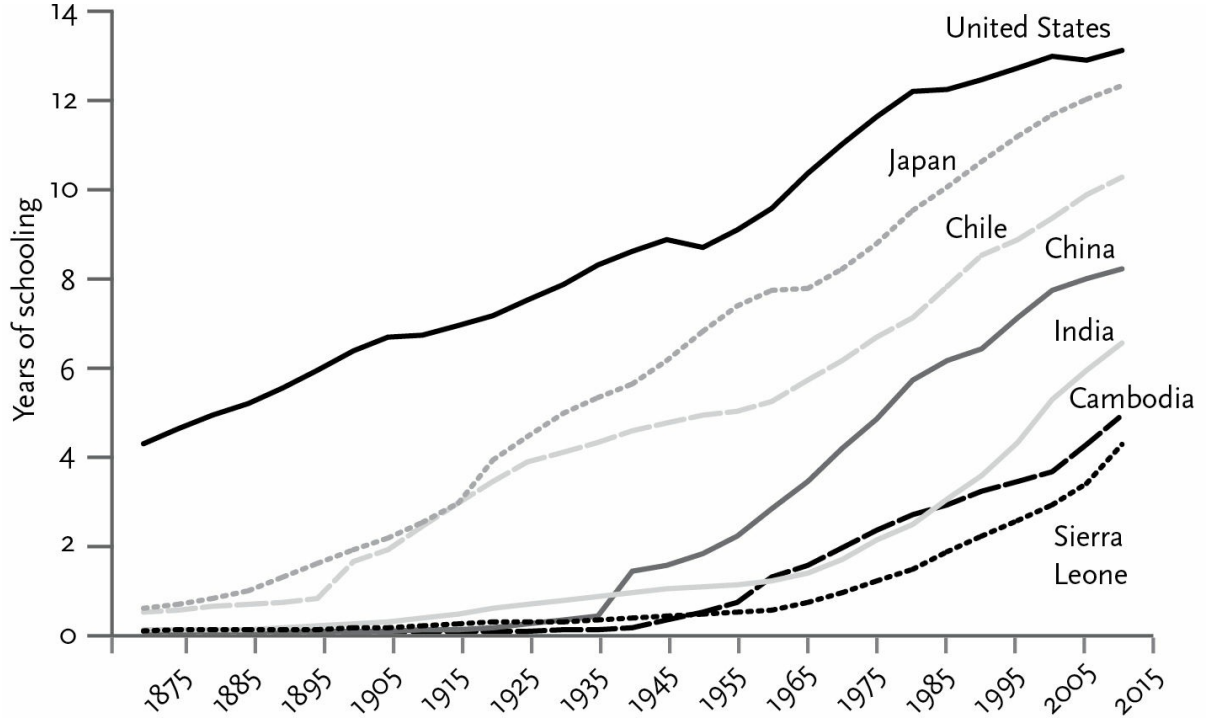


Figure 16-3: Years of schooling, 1870–2010

Source: *Our World in Data,* Roser & Ortiz-Ospina 2016a, based on data from Lee & Lee 2016. Data are for the population aged 15–64.

Though we see little or no global convergence in the length of formal schooling, an ongoing revolution in the dissemination of knowledge makes the gap less relevant. Most of the world's knowledge is now online rather than locked in libraries (much of it free), and massive open online courses (MOOCs) and other forms of distance learning are becoming available to anyone with a smartphone.

Other disparities in education are shrinking as well. In the United States, measures of school readiness among low-income, Hispanic, and African American children increased substantially

between 1998 and 2010, possibly because free preschool programs are more widely available, and because poor families today have more books, computers, and Internet access and the parents spend more time interacting with their children.[24]

Even more consequentially, the ultimate form of sex discrimination—keeping girls out of school—is in decline. The change is consequential not just because women make up half the population, so educating them doubles the size of the skill pool, but because the hand that rocks the cradle rules the world. When girls are educated, they are healthier, have fewer and healthier children, and are more productive—and so are their countries.[25] It took the West centuries to figure out that educating the whole population, not just the half with testicles, was a good idea: the line for England in figure 16-4 shows that Englishwomen did not become as literate as Englishmen until 1885. The world as a whole caught on even later but quickly made up for lost time, going from teaching only two-thirds as many girls as boys to read in 1975 to teaching them in equal numbers in 2014. The United Nations has announced that the world has met the 2015 Millennium Development Goal of achieving gender parity in primary, secondary, and tertiary education.[26]

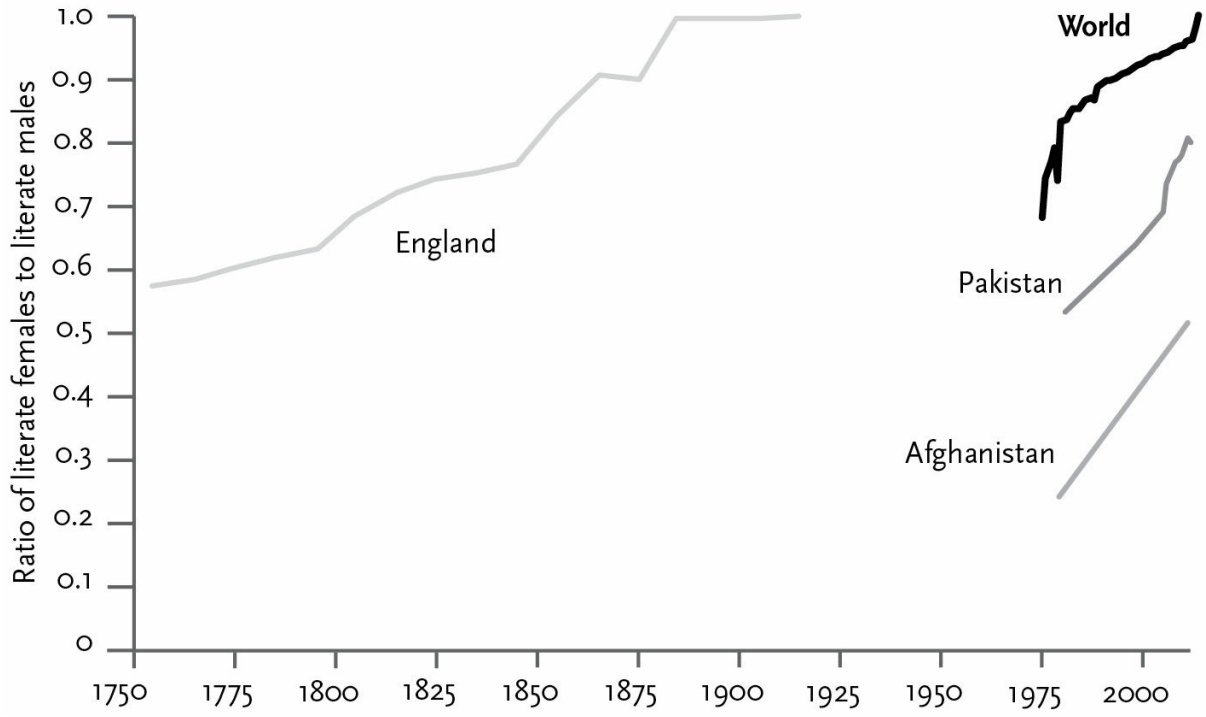


Figure 16-4: Female literacy, 1750–2014

Sources: England (all adults): Clark 2007, p. 179. **World, Pakistan, & Afghanistan (ages 15–24):** *HumanProgress,* http://www.humanprogress.org/f1/2101, based on data from UNESCO Institute for Statistics, summarized in World Bank 2016f. Data for the world are averaged over slightly different sets of countries in different years.

The other two lines tell their own story. The country with the worst gender ratio for literacy is Afghanistan. Not only is Afghanistan near the bottom in almost every measure of human development (including its overall literacy rate, which in 2011 stood at an abysmal .52), but from 1996 to 2001 it was under the control of the Taliban, the Islamic fundamentalist movement that, among other atrocities, forbade girls and women from attending school. The Taliban has continued to intimidate girls from getting an education in the regions of Afghanistan and neighboring Pakistan it controls. Starting in 2009 the twelve-year-old Malala Yousafzai, whose family ran a chain of schools in the Swat district of Pakistan, publicly spoke out for girls' right to an education. On a day that will live in infamy, October 9, 2012, a Taliban gunman boarded her school bus and shot her in the head. She survived to become the youngest winner of the Nobel Peace Prize and one of the world's most admired women. Yet even in these benighted parts of the world, progress can be seen.[27] In the past three decades the literacy gender ratio has doubled in Afghanistan and increased by half in Pakistan, whose ratio now matches that for the world in 1980 and for England in 1850. Nothing is certain, but the global tide of activism, economic development, common sense, and common decency are likely to push the ratio to its natural ceiling.



Could the world be getting not just more literate and knowledgeable but actually smarter? Might people be increasingly adept at learning new skills, grasping abstract ideas, and solving unforeseen problems? Amazingly, the answer is yes. Intelligence Quotient (IQ) scores have been rising for more than a century, in every part of the world, at a rate of about three IQ points (a fifth of a standard deviation) per decade. When the philosopher James Flynn first brought this phenomenon to psychologists' attention in 1984, many thought it must have been a mistake or trick.[28] For one thing, we know that intelligence is highly heritable, and the world has not

engaged in a massive eugenics project in which smarter people have had more babies generation after generation.[29] Nor have people been marrying outside their clan and tribe (thus avoiding inbreeding and increasing hybrid vigor) in great enough numbers for a long enough time to explain the rise.[30] Also, it beggars belief to think that an average person of 1910, if he or she had entered a time machine and materialized today, would be borderline retarded by our standards, while if Joe and Jane Average made the reverse journey, they would outsmart 98 percent of the befrocked and bewhiskered Edwardians who greeted them as they emerged. Yet surprising as it is, the Flynn effect is no longer in doubt, and it has recently been confirmed in a meta-analysis of 271 samples from thirty-one countries with four million people.[31] Figure 16-5 plots the "secular rise in IQ scores," as psychologists call it (*secular* in the sense of long-term rather than irreligious).

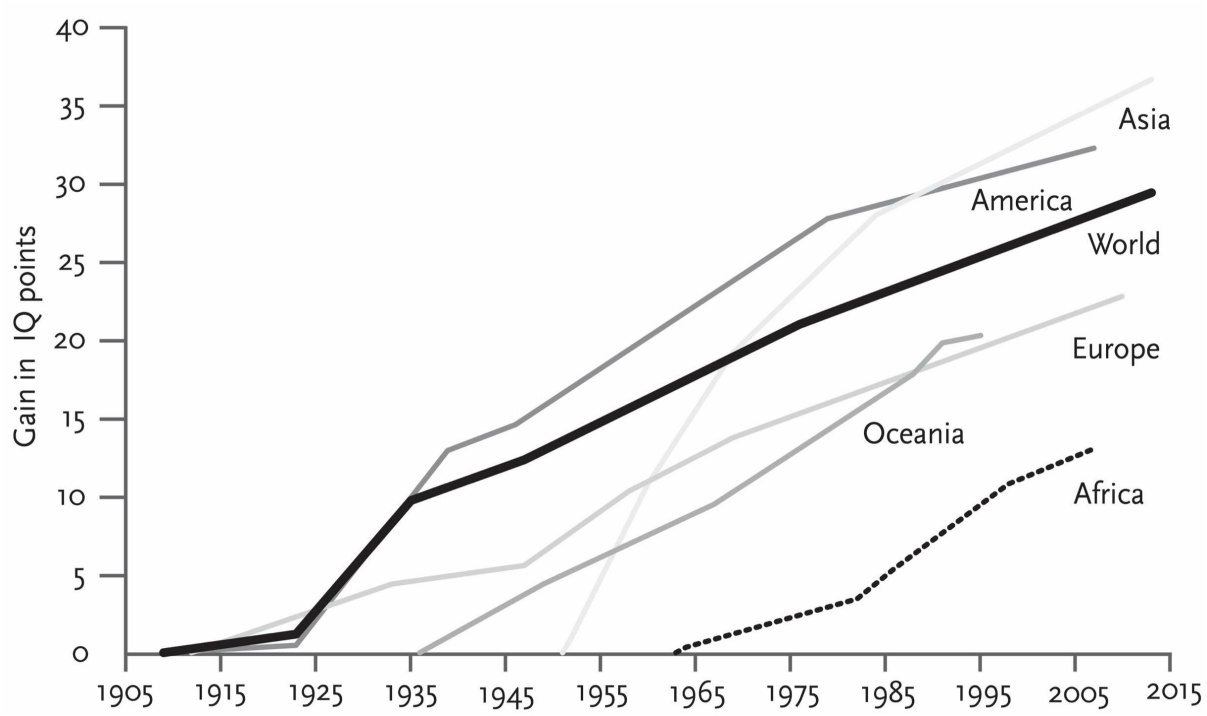


Figure 16-5: IQ gains, 1909–2013

Source: Pietschnig & Voracek 2015, supplemental online material. The lines display changes in IQ measured by different tests starting at different times and cannot be compared with one another.

Note that each line plots the *change* in IQ scores in a continent relative to the average score in the earliest year for which data are

available, which is arbitrarily set to 0 because the tests and periods for the different continents are not directly commensurable. We cannot read the graph as we did the previous ones and infer, for example, that the IQ of Africa in 2007 is equivalent to the IQ of Australia and New Zealand in 1970. Not surprisingly, the rise in IQ scores obeys Stein's Law: Things that can't go on forever don't. The Flynn effect is now petering out in some of the countries in which it has been going on the longest.[32]

Though it's not easy to pinpoint the causes of the rise in IQ scores, it's no paradox that a heritable trait can be boosted by changes in the environment. That's what happened with height, a trait that also is highly heritable and has increased over the decades, and for some of the same reasons: better nutrition and less disease. Brains are greedy organs, consuming about a fifth of the body's energy, and they are made of fats and proteins that are demanding for the body to produce. Fighting off infections is metabolically expensive, and the immune system of a sick child may commandeer resources that would otherwise go to brain development. Also helping with brain development is a cleaner environment, with lower levels of lead and other toxins. Food, health, and environmental quality are among the perquisites of a richer society, and not surprisingly, the Flynn effect is correlated with increases in GDP per capita.[33]

But nutrition and health can explain only a part of the Flynn effect.[34] For one thing, their benefits should be concentrated in pulling up the lower half of the bell curve of IQ scores, populated by the duller people who had been held back by poor food and health. (After all, past a certain point, additional food makes people fatter, not smarter.) Indeed, in some times and places the Flynn effect *is* concentrated in the lower half, bringing the duller closer to the average. But in other times and places the entire curve crept rightward: the smart got smarter too, even though they started out healthy and well-fed. Second, improvements in health and nutrition should affect children most of all, and then the adults they grow into. But the Flynn effect is stronger for adults than for children, suggesting that experiences on the way to adulthood, not just biological constitution in early childhood, have pushed IQ scores higher. (The most obvious of these experiences is education.) Also,

while IQ has risen over the decades, and nutrition, health, and height have risen over the decades, their various ascents and plateaus don't track each other particularly closely.

But the main reason that health and nutrition aren't enough to explain the IQ rise is that what has risen over time is not overall brainpower. The Flynn effect is not an increase in *g,* the general intelligence factor that underlies every subtype of intelligence (verbal, spatial, mathematical, memory, and so on) and is the aspect of intelligence most directly affected by the genes.[35] While overall IQ has risen, and scores on each intelligence subtest have risen, some subtest scores have risen more rapidly than others in a pattern different from the pattern linked to the genes. That's another reason the Flynn effect does not cast doubt on the high heritability of IQ.

So which kinds of intellectual performance have been pushed upward by the better environments of recent decades? Surprisingly, the steepest gains have not been found in the concrete skills that are directly taught in school, such as general knowledge, arithmetic, and vocabulary. They have been found in the abstract, fluid kinds of intelligence, the ones tapped by similarity questions ("What do an hour and a year have in common?"), analogies ("BIRD is to EGG as TREE is to what?"), and visual matrices (where the test-taker has to choose a complex geometric figure that fits into a rule-governed sequence). What has increased the most, then, is an analytic mindset: putting concepts into abstract categories (an hour and a year are "units of time"), mentally dissecting objects into their parts and relationships rather than absorbing them as wholes, and placing oneself in a hypothetical world defined by certain rules and exploring its logical implications while setting aside everyday experience ("Suppose that in Country X everything is made of plastic. Are the ovens made of plastic?").[36] An analytic mindset is inculcated by formal schooling, even if a teacher never singles it out in a lesson, as long as the curriculum requires understanding and reasoning rather than rote memorization (and that has been the trend in education since the early decades of the 20th century).[37] Outside the schoolhouse, analytic thinking is encouraged by a culture that trades in visual symbols (subway maps, digital displays), analytic tools (spreadsheets, stock reports), and academic concepts that trickle down into common parlance (*supply and*

demand, on average, human rights, win-win, correlation versus causation, false positive).

Does the Flynn effect matter in the real world? Almost certainly. A high IQ is not just a number that you can brag about in a bar or that gets you into Mensa; it is a tailwind in life.[38] People with high scores on intelligence tests get better jobs, perform better in their jobs, enjoy better health and longer lives, are less likely to get into trouble with the law, and have a greater number of noteworthy accomplishments like starting companies, earning patents, and creating respected works of art—all holding socioeconomic status constant. (The myth, still popular among leftist intellectuals, that IQ doesn't exist or cannot be reliably measured was refuted decades ago.) We don't know whether these bonuses come from *g* alone or also from the Flynn component of intelligence, but the answer is probably both. Flynn has speculated, and I agree, that abstract reasoning can even hone the moral sense. The cognitive act of extricating oneself from the particulars of one's life and pondering "There but for fortune go I" or "What would the world be like if everyone did this?" can be a gateway to compassion and ethics.[39]

Since intelligence brings good things, and intelligence has been increasing, can we see a dividend from increasing intelligence in improvements to the world? Some skeptics (including, at the outset, Flynn himself) doubted whether the 20th century really produced more brilliant ideas than the ages of Hume, Goethe, and Darwin.[40] Then again, the geniuses of the past had the advantage of exploring virgin territory. Once someone discovers the analytic-synthetic distinction or the theory of natural selection, no one can ever discover it again. Today the intellectual landscape is well trodden, and it's harder for a solitary genius to tower above the crowd of hypereducated and networked thinkers who are mapping every nook and cranny. Still, there have been some signs of a smarter populace, such as the fact that the world's top-ranked chess and bridge players have been getting younger. And no one can second-guess the warp speed of advances in science and technology of the past half-century.

Most dramatically, an increase in one kind of abstract intelligence is visible all over the world: mastery of digital technology. Cyberspace is the ultimate abstract realm, in which

goals are achieved not by pushing matter around in space but by manipulating intangible symbols and patterns. When people were first confronted with digital interfaces in the 1970s, like videocassette recorders and ticket machines in new subway systems, they were baffled. It was a running joke of the 1980s that most VCRs eternally flashed "12:00" at owners who couldn't figure out how to set the time. But Generation X and the Millennials have famously thrived in the digital realm. (In one cartoon of the new millennium, a father says to his young boy, "Son, your mother and I have bought software to control what you see on the Internet. Um . . . Could you install it for us?") The developing world has thrived in that realm as well, often leapfrogging the West in its adoption of smartphones and of applications for them such as mobile banking, education, and real-time market updates.[41]

Could the Flynn effect help explain the other rises in well-being we have seen in these chapters? An analysis by the economist R. W. Hafer suggests it could. Holding all the usual confounding variables constant—education, GDP, government spending, even a country's religious makeup and its history of colonization—he found that a country's average IQ predicted its subsequent growth in GDP per capita, together with growth in noneconomic measures of well-being like longevity and leisure time. An 11-point increase in IQ, he estimated, would accelerate a country's growth rate enough to double well-being in just nineteen years rather than twenty-seven. Policies that hurry the Flynn effect along, namely investments in health, nutrition, and education, could make a country richer, better governed, and happier down the road.[42]



What's good for humanity is not always good for social science, and it may be impossible to unsnarl the bundle of correlations among all the ways that life has improved and trace the causal arrows with certainty. But let's stop fretting for a moment about how hard it is to disentangle the strands and instead take note of their common direction. The very fact that so many dimensions of well-being are correlated across countries and decades suggests there may be a coherent phenomenon lurking beneath them—what statisticians call a general factor, a principal component, or a hidden, latent, or

intervening variable.[43] We even have a name for that factor: progress.

No one has calculated this vector of progress underlying all the dimensions of human flourishing, but the United Nations Development Programme, inspired by the economists Mahbub ul Haq and Amartya Sen, offers a Human Development Index that is a composite of three of the major ones: life expectancy, GDP per capita, and education (being healthy, wealthy, and wise).[44] With this chapter we have now examined all of these goods, and it's an appropriate point to step back and take in the history of quantifiable human progress before we turn to its more qualitative aspects in the next two chapters.

Two economists have developed their own versions of a human development index that can be estimated retroactively into the 19th century, each of which aggregates measures of longevity, income, and education in different ways. Leandro Prados de la Escosura's Historical Index of Human Development, which goes back to 1870, averages the three measures with a geometric rather than an arithmetic mean (so that an extreme value on one measure cannot swamp the other two), and transforms the longevity and education measures to compensate for diminishing returns at their high end. Auke Rijpma of the "How Was Life?" project (whose data have appeared in a number of graphs in this book) developed a Well-Being Composite that goes back to 1820; together with the big three, it throws in measures of height (a proxy for health), democracy, homicide, income inequality, and biodiversity. (The latter two are the only ones that don't systematically improve over the past two centuries.) The grades for the world on these two report cards are shown in figure 16-6.

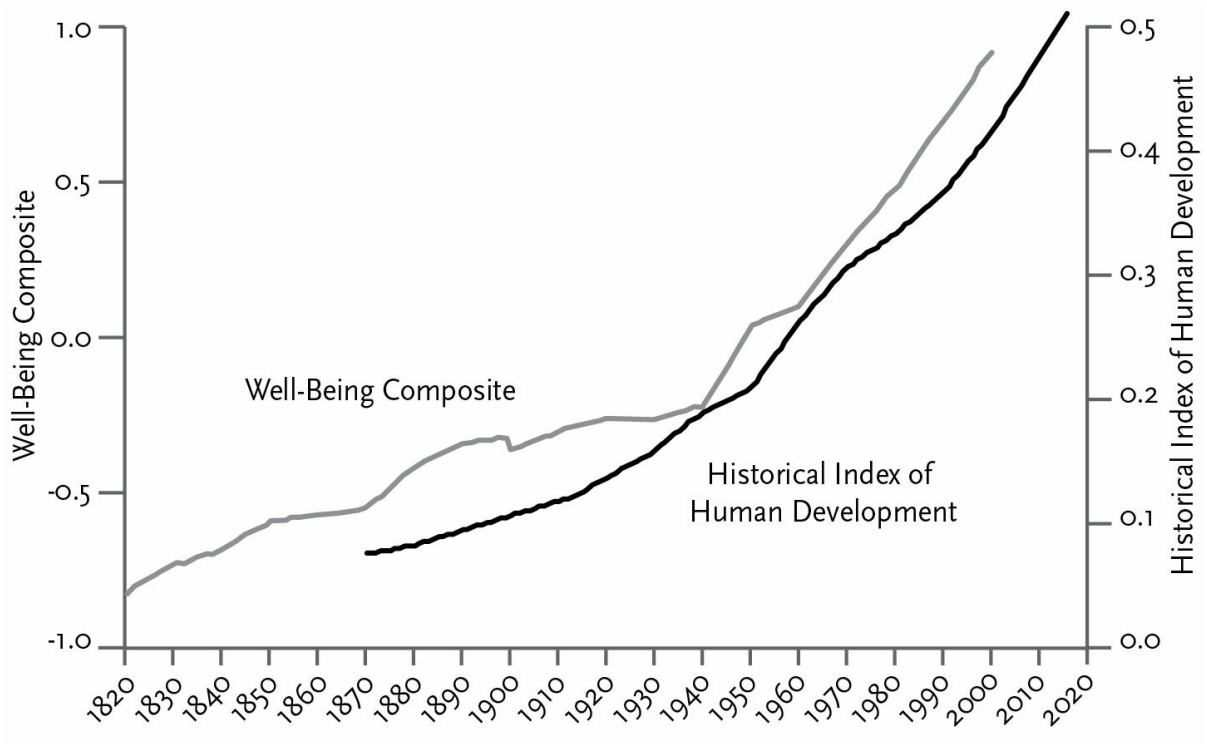


Figure 16-6: Global well-being, 1820–2015

Sources: Historical Index of Human Development: Prados de la Escosura 2015, 0–1 scale, available at *Our World in Data,* Roser 2016h. **Well-Being Composite:** Rijpma 2014, p. 259, standard deviation scale over country-decades.

To behold this graph is to apprehend human progress at a glance. And packed into the lines are two vital subplots. One is that although the world remains highly unequal, every region has been improving, and the worst-off parts of the world today are better off than the best-off parts not long ago.[45] (If we divide the world into the West and the Rest, we find that the Rest in 2007 had reached the level of the West in 1950.) The other is that while almost every indicator of human well-being correlates with wealth, the lines don't just reflect a wealthier world: longevity, health, and knowledge have increased even in many of the times and places where wealth has not.[46] The fact that all aspects of human flourishing tend to improve over the long run even when they are not in perfect sync vindicates the idea that there is such a thing as progress.

CHAPTER 17

QUALITY OF LIFE

Though only the callous would deny that the conquests of disease, hunger, and illiteracy are stupendous achievements, one can still wonder whether continuous improvements in the kinds of things that economists measure should count as genuine progress. Once basic needs are satisfied, doesn't additional affluence just encourage people to indulge in shallow consumerism? And weren't increases in health and literacy trumpeted by the Five-Year Planners in the Soviet Union, China, and Cuba, all of which were rather grim places to live? People can be healthy, solvent, and literate and still not lead rich and meaningful lives.

Some of these reservations have already been answered. We've seen that totalitarianism, the main impediment to the good life in communist so-called utopias, has been receding. We've also seen that a major dimension of flourishing that is not captured by the standard metrics—the rights of women, children, and minorities—is on a steady rise. This chapter is about a broader cultural pessimism: the worry that all that extra healthy life span and income may not have increased human flourishing after all if they just consign people to a rat race of frenzied careerism, hollow consumption, mindless entertainment, and soul-deadening anomie.

To be sure, one can object to the objection, which comes from a long tradition of cultural and religious elites sneering at the supposedly empty lives of the bourgeoisie and proletariat. Cultural criticism can be a thinly disguised snobbery that shades into misanthropy. In *The Intellectuals and the Masses,* the critic John Carey shows how the British literary intelligentsia in the first decades of the 20th century harbored a contempt for the common person which bordered on the genocidal.[1] In practice,

"consumerism" often means "consumption by the other guy," since the elites who condemn it tend themselves to be conspicuous consumers of exorbitant luxuries like hardcover books, good food and wine, live artistic performances, overseas travel, and Ivy-class education for their children. If more people can afford *their* preferred luxuries, even if they are frivolous by the lights of their cultural betters, that has to be counted as a good thing. In an old joke, a soapbox orator addresses a crowd on the glories of communism: "Come the revolution, everyone will eat strawberries and cream!" A man at the front whimpers, "But I don't like strawberries and cream." The speaker thunders, "Come the revolution, you *will* like strawberries and cream!"[2]

In *Development as Freedom,* Amartya Sen sidesteps this trap by proposing that the ultimate goal of development is to enable people to make choices: strawberries and cream for those who want them. The philosopher Martha Nussbaum has taken the idea a step further and laid out a set of "fundamental capabilities" that all people should be given the opportunity to exercise.[3] One can think of them as the justifiable sources of satisfaction and fulfillment that human nature makes available to us. Her list begins with capabilities that, as we have seen, the modern world increasingly allows people to realize: longevity, health, safety, literacy, knowledge, free expression, and political participation. It goes on to include aesthetic experience, recreation and play, enjoyment of nature, emotional attachments, social affiliations, and opportunities to reflect on and engage in one's own conception of the good life.

In this chapter I'll show how modernity is increasingly allowing people to exercise these capabilities, too—that life is getting better even beyond the standard economists' metrics like longevity and wealth. Admittedly, many people still don't like strawberries and cream, and they may exercise one capability—enjoying their freedom to watch television and play video games—to forgo others, such as aesthetic appreciation and enjoyment of nature. (When Dorothy Parker was challenged to use the word *horticulture* in a sentence, she answered, "You can lead a horticulture, but you can't make her think.") But an expansive cafeteria of opportunities to enjoy the aesthetic, intellectual, social, cultural, and natural delights

of the world, regardless of which ones people put on their trays, is the ultimate form of progress.



Time is what life is made of, and one metric of progress is a reduction in the time people must devote to keeping themselves alive at the expense of the other, more enjoyable things in life. “In the sweat of thy face shalt thou eat bread,” said the ever-merciful God as he exiled Adam and Eve from Eden, and for most people throughout history, sweat they did. Farming is a sunup-to-sundown occupation, and though foragers hunt and gather just a few hours a day, they spend many more hours processing the food (for example, smashing rock-hard nuts), in addition to gathering firewood, carrying water, and laboring at other chores. The San of the Kalahari, once called “the original affluent society,” turn out to work at least eight hours a day, six to seven days a week, on food alone.[4]

The 60-hour workweek of Bob Cratchit, with only one day off a year (Christmas, of course), was in fact lenient by the standards of his era. Figure 17-1 shows that in 1870 Western Europeans worked an average of 66 hours a week (the Belgians worked 72), while Americans worked 62 hours. Over the past century and a half, workers have increasingly been emancipated from their wage slavery, more dramatically in social-democratic Western Europe (where they now work 28 fewer hours a week) than in the go-getter United States (where they work 22 fewer hours).[5] As late as the 1950s, my paternal grandfather worked behind the cheese counter in an unheated Montreal market day and night, seven days a week, afraid to ask for shorter hours lest he be replaced. When my young parents protested on his behalf, he was given sporadic days off (which the owner no doubt perceived, like Scrooge, as “a poor excuse for picking a man’s pocket”), until better labor-law enforcement gave him a predictable six-day workweek.

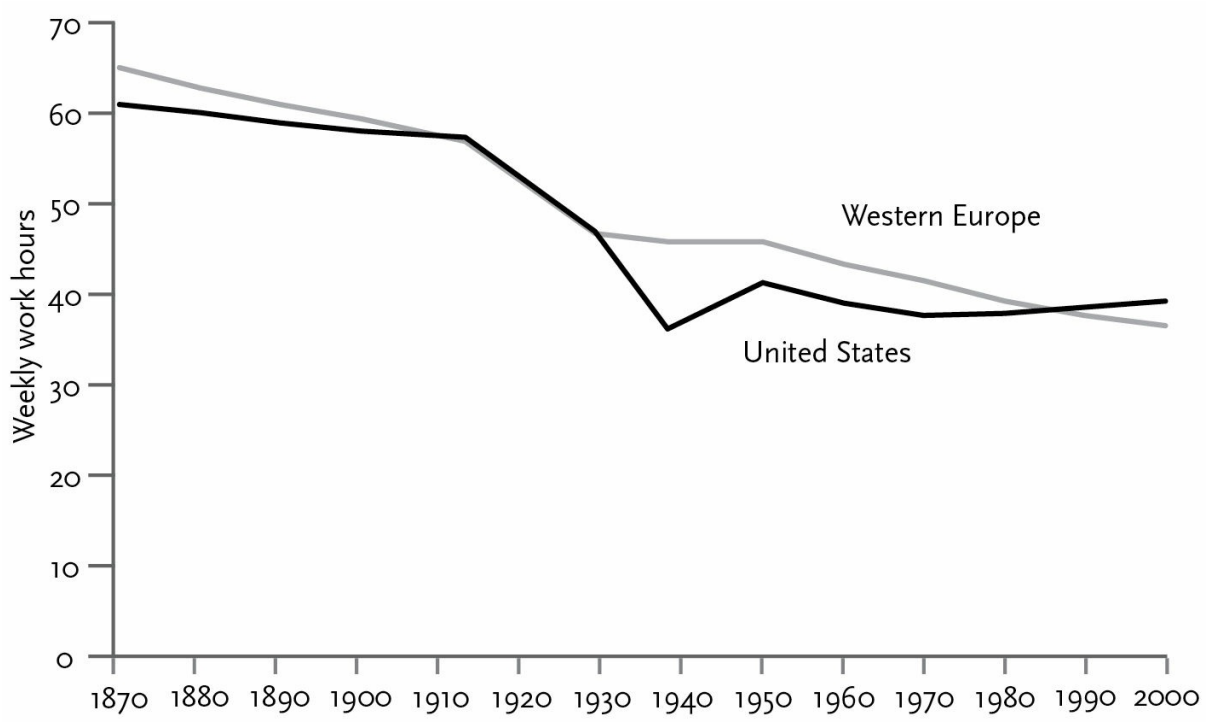


Figure 17-1: Work hours, Western Europe and US, 1870–2000

Source: Roser 2016t, based on data from Huberman & Minns 2007 on full-time production workers (both sexes) in nonagricultural activities.

Though a lucky few of us are paid to exercise our fundamental capabilities and willingly put in Victorian hours, most workers are grateful for the two dozen extra hours a week they have available to fulfill themselves in other ways. (On his hard-won day off, my grandfather would read the Yiddish papers, dress up in a jacket, tie, and fedora, and visit his sisters or my family.)

Likewise, though many of my fellow professors end their careers carried out of their offices feet first, workers in many other jobs are happy to spend their golden years reading, taking courses, seeing the national parks in a Winnebago, or dandling Vera, Chuck, and Dave in a cottage on the Isle of Wight. This, too, is a gift of modernity. As Morgan Housel notes, "We constantly worry about the looming 'retirement funding crisis' in America without realizing that the entire concept of retirement is unique to the last five decades. It wasn't long ago that the average American man had two stages of life: work and death. . . . Think of it this way: The average American now retires at age 62. One hundred years ago, the average American died at age 51."[6] Figure 17-2 shows that in 1880, almost 80 percent of American men of what we now consider retirement

age were still in the workforce, and that by 1990 the proportion had fallen to less than 20 percent.

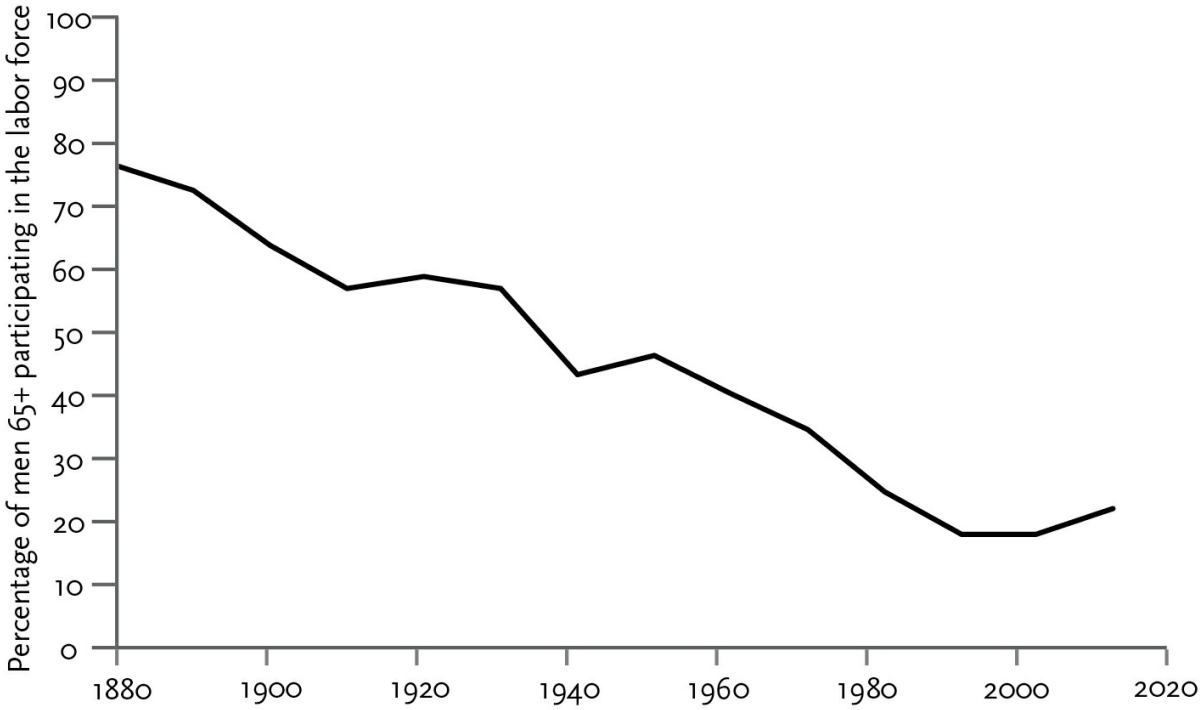


Figure 17-2: Retirement, US, 1880–2010

Source: Housel 2013, based on data from the Bureau of Labor Statistics, and Costa 1998.

Rather than looking forward to retirement, people used to dread the injury or frailty that would keep them from work and send them to the almshouse—the "haunting fear in the winter of life," as it was known.[7] Even after the Social Security Act of 1935 protected the elderly from utter destitution, poverty was a common end to a working life, and I grew up with the image (possibly an urban legend) of pensioners who subsisted on dog food. But with stronger public and private safety nets in place, senior citizens today are richer than people of working age: the poverty rate for people over 65 plunged from 35 percent in 1960 to less than 10 percent in 2011, well below the national rate of 15 percent.[8]

Thanks to the labor movement, legislation, and increased worker productivity, another once-crazy pipe dream has become a reality: paid vacations. Today an average American worker with five years on the job receives 22 days of paid time off a year (compared with 16 days in 1970), and that is miserly by the standards of Western

Europe.[9] The combination of a shorter workweek, more paid time off, and a longer retirement means that the fraction of a person's life that is taken up by work has fallen by a quarter just since 1960.[10] Trends for the developing world vary by country, but as these countries get richer they are likely to follow those of the West.[11]

There is yet another way in which thick tranches of life have been freed up for people to pursue higher callings. In chapter 9 we saw that appliances such as refrigerators, vacuum cleaners, washing machines, and microwave ovens have become common or universal, even among the American poor. In 1919, an average American wage earner had to work 1,800 hours to pay for a refrigerator; in 2014, he or she had to work fewer than 24 hours (and the new fridge was frost-free and came with an icemaker).[12] Mindless consumerism? Not when you remember that food, clothing, and shelter are the three necessities of life, that entropy degrades all three, and that the time it takes to keep them usable is time that could be devoted to other pursuits. Electricity, running water, and appliances (or as they used to be called, "labor-saving devices") give us that time back—the many hours our grandmothers spent pumping, canning, churning, pickling, curing, sweeping, waxing, scrubbing, wringing, sudsing, drying, stitching, mending, knitting, darning, and, as they used to remind us, "slaving over a hot stove, working our fingers to the bone." Figure 17-3 shows that as utilities and appliances penetrated American households during the 20th century, the amount of life that people lost to housework—which, not surprisingly, people say is their least favorite way to spend their time—fell almost fourfold, from 58 hours a week in 1900 to 15.5 hours in 2011.[13] Time spent on laundry alone fell from 11.5 hours a week in 1920 to 1.5 in 2014.[14] For returning "washday" to our lives, Hans Rosling suggests, the washing machine deserves to be called the greatest invention of the Industrial Revolution.[15]

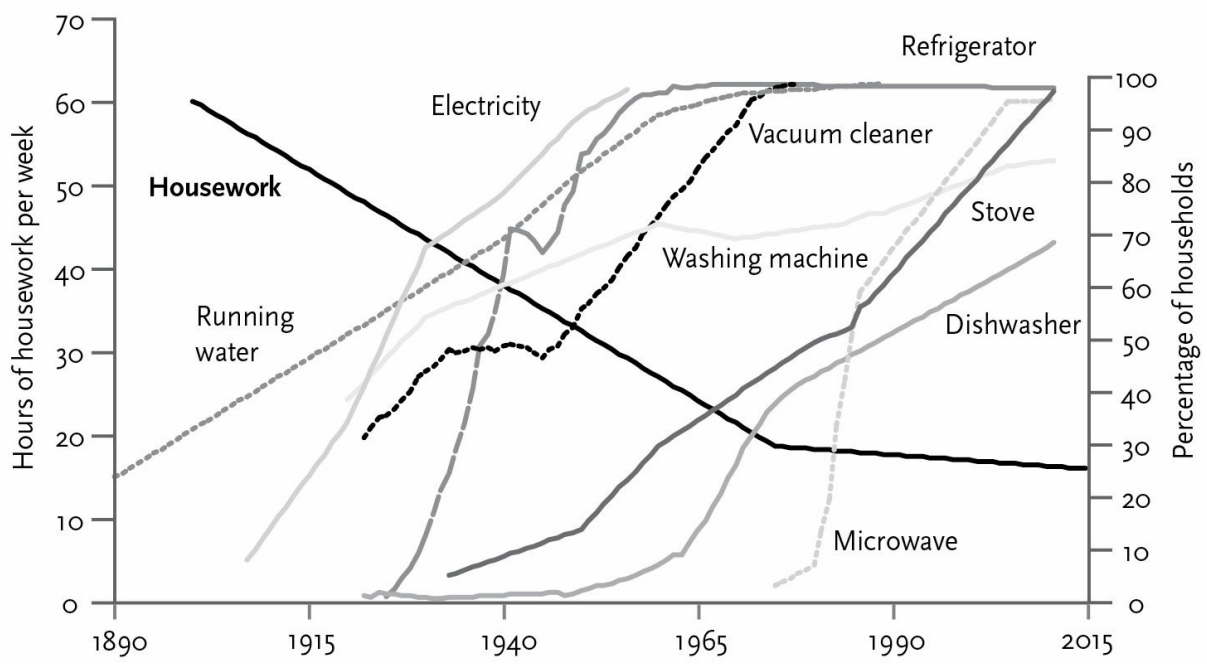


Figure 17-3: Utilities, appliances, and housework, US, 1900–2015

Sources: Before 2005: Greenwood, Seshadri, & Yorukoglu 2005. **Appliances, 2005 and 2011:** US Census Bureau, Siebens 2013. **Housework, 2015:** *Our World in Data,* Roser 2016t, based on the American Time Use Survey, Bureau of Labor Statistics 2016b.

As a feminist-era husband I can truthfully use the first-person plural in celebrating this gain. But in most times and places housework is gendered, so the liberation of humankind from household labor is in practice the liberation of *women* from household labor. Perhaps the liberation of women in general. Arguments for the equality of women go back to Mary Astell's 1700 treatise and are irrefutable, so why did they take centuries to catch on? In a 1912 interview in *Good Housekeeping* magazine, Thomas Edison prophesied one of the great social transformations of the 20th century:

> The housewife of the future will be neither a slave to servants nor herself a drudge. She will give less attention to the home, because the home will need less; she will be rather a domestic engineer than a domestic laborer, with the greatest of all handmaidens, electricity, at her service. This and other mechanical forces will so revolutionize the woman's world that a large portion of the aggregate of woman's energy will be conserved for use in broader, more constructive fields.[16]

Time is not the only life-enriching resource granted to us by technology. Another is light. Light is so empowering that it serves as the metaphor of choice for a superior intellectual and spiritual state: *enlightenment*. In the natural world we are plunged into darkness for half of our existence, but human-made light allows us to take back the night for reading, moving about, seeing people's faces, and otherwise engaging with our surroundings. The economist William Nordhaus has cited the plunging price (and hence the soaring availability) of this universally treasured resource as an emblem of progress. Figure 17-4 shows that the inflation-adjusted price of a million lumen-hours of light (about what you would need to read for two and a half hours a day for a year) has fallen *twelve thousandfold* since the Middle Ages (once called the Dark Ages), from around £35,500 in 1300 to less than £3 today. These days (and nights), if you aren't reading, conversing, getting out, or otherwise edifying yourself, it's not because you can't afford the light.



Figure 17-4: Cost of light, England, 1300–2006

Source: *Our World in Data,* Roser 2016o, based on data from Fouquet & Pearson 2012. Cost of one million lumen-hours (about 833 hours from an 80-watt incandescent bulb), in pounds sterling (inflation-adjusted to the year 2000).

The plunging cash value of artificial light actually understates the progress, because, as Adam Smith pointed out, "The real price of every thing . . . is the toil and trouble of acquiring it."[17] Nordhaus estimated how many hours a person would have to work to earn an hour of light to read by at different times in history.[18] A Babylonian in 1750 BCE would have had to labor fifty hours to spend one hour reading his cuneiform tablets by a sesame-oil lamp. In 1800, an Englishman had to toil for six hours to burn a tallow candle for an hour. (Imagine planning your family budget around that—you might settle for darkness.) In 1880, you'd need to work fifteen minutes to burn a kerosene lamp for an hour; in 1950, eight seconds for the same hour from an incandescent bulb; and in 1994, a *half-second* for the same hour from a compact fluorescent bulb—a 43,000-fold leap in affordability in two centuries. And the progress wasn't finished: Nordhaus published his article before LED bulbs flooded the market. Soon, cheap, solar-powered LED lamps will transform the lives of the more than one billion people without access to electricity, allowing them to read the news or do their homework without huddling around an oil drum filled with burning garbage.

The declining proportion of our lives we have to forfeit for light, appliances, and food may be part of a general law. The technology expert Kevin Kelly has proposed that "over time, if a technology persists long enough, its costs begin to approach (but never reach) zero."[19] As the necessities of life get cheaper, we waste fewer of our waking hours obtaining them, and have more time and money left over for everything else—and the "everything else" gets cheaper, too, so we can experience more of them. Figure 17-5 shows that in 1929 Americans spent more than 60 percent of their disposable income on necessities; by 2016 that had fallen to a third.

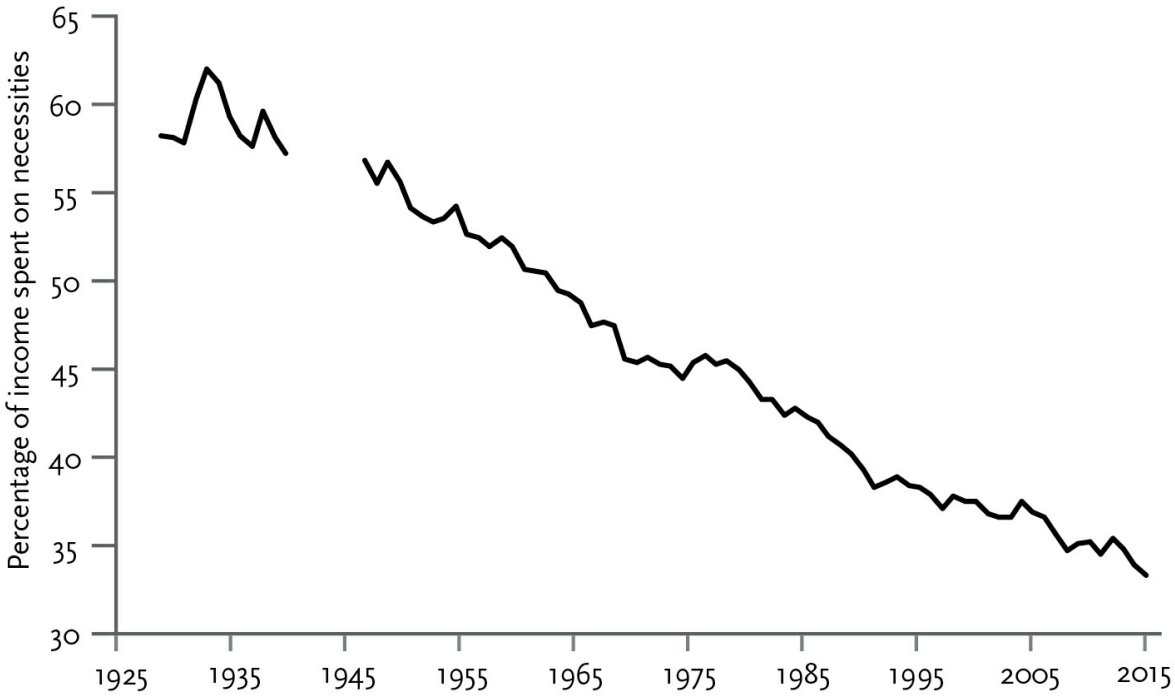


Figure 17-5: Spending on necessities, US, 1929–2016

Source: *HumanProgress,* http://humanprogress.org/static/1937, adapted from a graph by Mark Perry, using data from the Bureau of Economic Analysis, https://www.bea.gov/iTable/index_nipa.cfm. Proportion of disposable income spent on food at home, cars, clothing, household furnishings, housing, utilities, and gasoline. Data from 1941 to 1946 are omitted because they are distorted by rationing and soldiers' salaries during World War II.

What are people doing with that extra time and money? Are they truly enriching their lives, or are they just buying more golf clubs and designer handbags? Though it's presumptuous to pass judgment on how people choose to spend their days, we can focus on the pursuits that almost everyone would agree are constituents of a good life: connecting with loved ones and friends, experiencing the richness of the natural and cultural worlds, and having access to the fruits of intellectual and artistic creativity.

With the rise of two-career couples, overscheduled kids, and digital devices, there is a widespread belief (and recurring media panic) that families are caught in a time crunch that's killing the family dinner. (Both Al Gore and Dan Quayle lamented its demise in the run-up to the 2000 presidential election—and that was before smartphones and social media.) But the new tugs and distractions have to be weighed against the 24 extra hours that modernity has granted to breadwinners every week and the 42 extra hours it has

granted to homemakers. Though people increasingly complain about how crazy-busy they are ("yuppie kvetching," as one team of economists put it), a different picture emerges when they are asked to keep track of their time. In 2015, men reported 42 hours of leisure per week, around 10 more than their counterparts did fifty years earlier, and women reported 36 hours, more than 6 hours more (figure 17-6).[20] (To be fair, the yuppies might have something to kvetch about: less-educated people reported having more leisure, and this inequality-in-reverse has grown over these fifty years.) Similar trends have been reported in Western Europe.[21]

Nor are Americans consistently feeling more harried. A review by the sociologist John Robinson shows some ups and downs between 1965 and 2010 in the percentage who say they feel "always rushed" (with a low of 18 percent in 1976 and a high of 35 percent in 1998), but no consistent trend over forty-five years.[22] And at the end of the day, the family dinner is alive and well. Several studies and polls agree that the number of dinners families have together changed little from 1960 through 2014, despite the iPhones, PlayStations, and Facebook accounts.[23] Indeed, over the course of the 20th century, typical American parents spent more time, not less, with their children.[24] In 1924, only 45 percent of mothers spent two or more hours a day with their children (7 percent spent *no* time with them), and only 60 percent of fathers spent at least an hour a day with them. By 1999, the proportions had risen to 71 and 83 percent.[25] In fact, single and working mothers today spend more time with their children than stay-at-home married mothers did in 1965.[26] (An increase in hours spent caring for children is the main reason for the dip in leisure time visible in figure 17-6.)[27] But time-use studies are no match for Norman Rockwell and *Leave It to Beaver,* and many people misremember the mid-20th century as a golden age of family togetherness.



Figure 17-6: Leisure time, US, 1965–2015

Sources: 1965–2003: Aguiar & Hurst 2007, table III, Leisure Measure 1. **2015:** American Time Use Survey, Bureau of Labor Statistics 2016c, summing Leisure and Sports, Lawn and Garden Care, and Volunteering for commensurability with Aguiar & Hurst's Measure 1.

Electronic media are commonly cited as a threat to human relationships, and certainly Facebook friends are a poor substitute for face-to-face contact with flesh-and-blood companions.[28] Yet overall, electronic technology has been a priceless gift to human closeness. A century ago, if family members moved to a distant city, one might never hear their voices or see their faces again. Grandchildren grew up without their grandparents laying eyes on them. Couples separated by study, work, or war would reread a letter dozens of times and tumble into despair if the next one was late, not knowing whether the postal service had lost it or whether the lover was angry, faithless, or dead (an agony recounted in songs like the Marvelettes' and Beatles' "Please Mr. Postman" and Simon & Garfunkel's "Why Don't You Write Me?"). Even when long-distance telephony allowed people to reach out and touch someone, the exorbitant cost put a strain on intimacy. People of my generation remember the awkwardness of speed-talking on a pay phone while feeding it quarters between bongs, or the breakneck sprint when called to the family phone ("IT'S LONG

DISTANCE!!!"), or the sinking feeling of the rent money evaporating as a pleasant conversation unfolded. "Only connect," advised E. M. Forster, and electronic technology is allowing us to connect as never before. Today, almost half of the world's population has Internet access, and three-quarters have access to a mobile phone. The marginal cost of a long-distance conversation is essentially zero, and the conversants can now see as well as hear each other.

And speaking of seeing, the plunging cost of photography is another gift to the richness of experience. In past eras people had only a mental image to remind them of a family member, living or dead. Today, like billions of others, I get a wave of gratitude for my blessings several times a day as my eyes alight on a photo of my loved ones. Affordable photography also allows the high points of life to be lived many times, not just once: the precious occasions, the stunning sights, the long-gone cityscapes, the elderly in their prime, the grown-ups as children, the children as babies.

Even in the future, when we have 3-D holographic surround-sound virtual reality with haptic exoskeleton gloves, we will still want to be within touching distance of the people we love, so the shrinking cost of transportation is another boon to humanity. Trains, buses, and cars have multiplied the opportunities for us to get together, and the remarkable democratization of plane travel has removed the barriers of distance and oceans. The term *jet set* for chic celebrities is an anachronism from the 1960s, when no more than a fifth of Americans had ever flown in a plane. Despite soaring fuel costs, the real price of plane travel in the United States has fallen by more than half since the late 1970s, when the airlines were deregulated (figure 17-7). In 1974, it cost $1,442 (in 2011 dollars) to fly from New York to Los Angeles; today it can be done for less than $300. As prices fell, more people flew: in 2000 more than half of Americans took at least one round-trip flight. You might have to spread-eagle while a guard slides a wand up your crotch, you may have an elbow in your ribs and a seatback in your chin, but long-distance lovers get to see each other, and if your mother gets sick you can be there the next day.

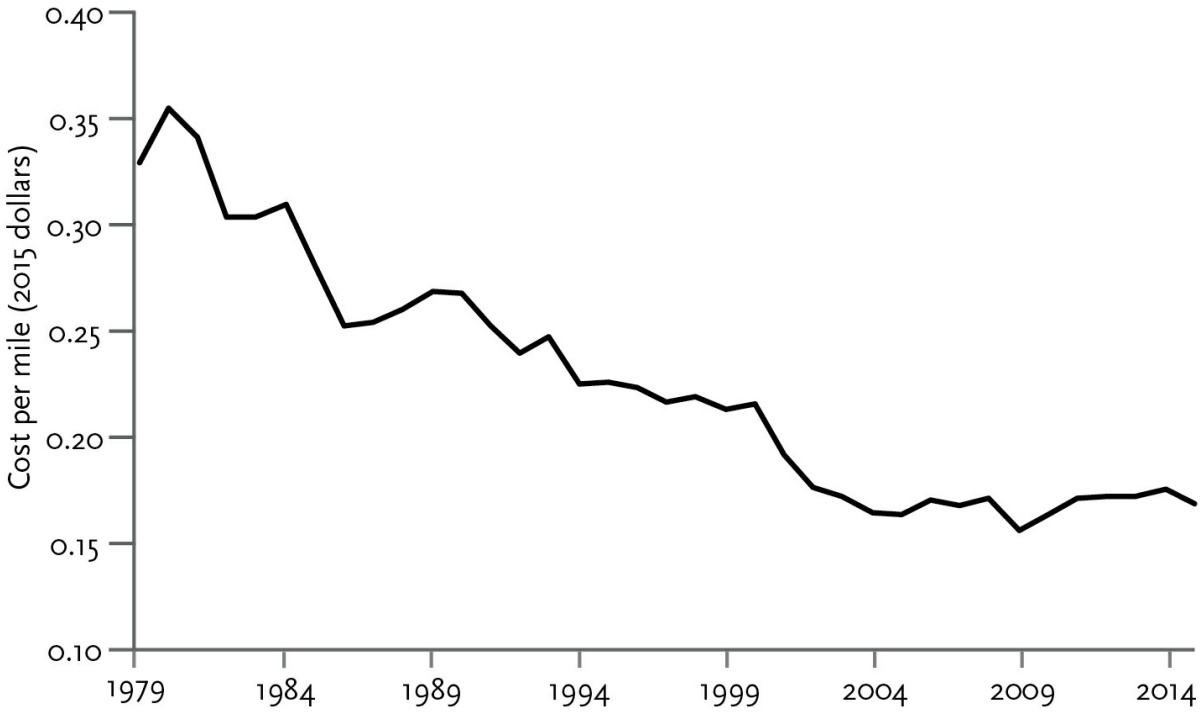


Figure 17-7: Cost of air travel, US, 1979–2015

Source: Thompson 2013, updated with data from Airlines for America, http://airlines.org/dataset/annual-round-trip-fares-and-fees-domestic/. Domestic travel, excluding checked baggage fees (which would raise the average cost for baggage-checking passengers by about a half-cent per mile since 2008).

Affordable transportation does more than reunite people. It also allows them to sample the phantasmagoria of Planet Earth. This is the pastime that we exalt as "travel" when we do it and revile as "tourism" when someone else does it, but it surely has to count as one of the things that make life worth living. To see the Grand Canyon, New York, the Aurora Borealis, Jerusalem—these are not just sensuous pleasures but experiences that widen the scope of our consciousness, allowing us to take in the vastness of space, time, nature, and human initiative. Though we bristle at the motor coaches and tour guides, the selfie-shooting throngs in their tacky shorts, we must concede that life is better when people can expand their awareness of our planet and species rather than being imprisoned within walking distance of their place of birth. With the rise of disposable income and the declining cost of plane travel, more people have been exploring the world, as we see in figure 17-8.

And no, the travelers aren't just lining up for wax museums and rides at Disney World. The number of areas in the world that are protected from development and economic exploitation exceeds

160,000 and increases daily. As we saw in figure 10-6, far more of the natural world is being set aside in nature preserves.

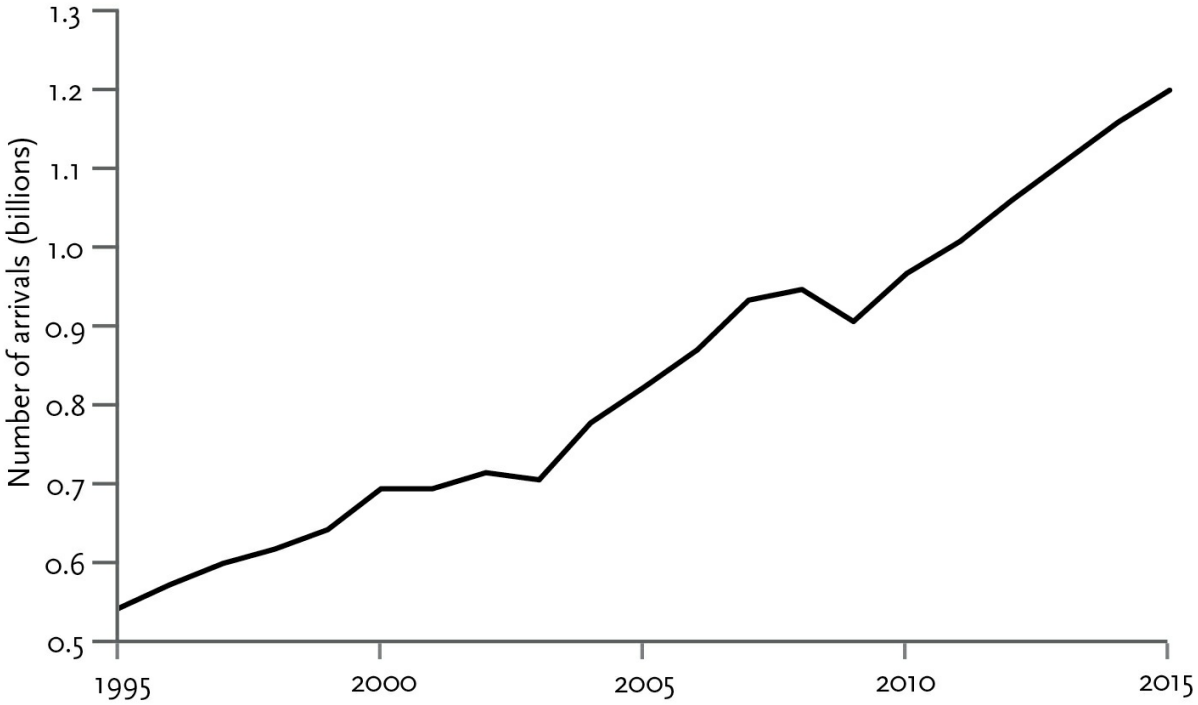


Figure 17-8: International tourism, 1995–2015

Source: World Bank 2016e, based on data from the World Tourism Organization, *Yearbook of Tourism Statistics*.

Another way in which the scope of our aesthetic experience has been magnified is food. The late 19th-century American diet consisted mainly of pork and starch.[29] Before refrigeration and motorized transport, most fruits and vegetables would have spoiled before they reached a consumer, so farmers grew nonperishables like turnips, beans, and potatoes. Apples were the only fruit, most of which went into cider. (As recently as the 1970s, Florida souvenir shops sold bags of oranges for tourists to take home as gifts.) The American diet was called "white bread" and "meat-and-potatoes" for good reason. Adventurous cooks might whip up some Spam fritters, mock apple pie made from Ritz crackers, or "Perfection Salad" (coleslaw in lemon Jell-O). New cuisines introduced by immigrants were so exotic that they became the butt of jokes, including Italian ("Mamma mia, that's a spicy meatball!"), Mexican ("Solves the gas shortage"), Chinese ("An hour later and you're hungry again"), and Japanese ("Bait, not food"). Today, even small towns and shopping

mall food courts offer a cosmopolitan menu, sometimes with all these cuisines plus Greek, Thai, Indian, Vietnamese, and Middle Eastern. Grocers have broadened their offerings as well, from a few hundred items in the 1920s to 2,200 in the 1950s, 17,500 in the 1980s, and 39,500 in 2015.[30]

Last but not least, access to the finest products of the human mind has been fabulously broadened and democratized. It's hard for us to reconstruct the gnawing boredom of the isolated rural households of yesteryear.[31] In the late 19th century there was not only no Internet but no radio, television, movies, or musical recordings, and for the majority of households not even a book or newspaper. For entertainment, men would go to the saloon to drink.[32] The writer and editor William Dean Howells (1837–1920) entertained himself as a boy by rereading the pages of an old newspaper which his father had used to wallpaper their Ohio cabin.

A country-dweller today can choose from among hundreds of television channels and half a billion Web sites, embracing every newspaper and magazine in the world (including their archives going back more than a century), every great work of literature that is out of copyright, an encyclopedia more than seventy times the size of *Britannica* with about the same level of accuracy, and every classic work of art and music.[33] He could fact-check rumors on *Snopes,* teach himself math and science at *Khan Academy,* build his word power with the *American Heritage Dictionary,* enlighten himself with the *Stanford Encyclopedia of Philosophy,* and watch lectures by the world's great scholars, writers, and critics, many long dead. Today an impoverished Hillel would not have to pass out from cold while eavesdropping on lessons through the skylight of a schoolhouse.

Even for wealthy Western urbanites, who always had the run of the palaces of culture, access to arts and letters has expanded tremendously. When I was a student, a movie buff had to wait years for a classic film to be shown at a local repertory theater or on late-night television, if it was shown at all; today it can be streamed on demand. I can listen to any of thousands of songs while jogging, washing the dishes, or waiting in line at the Registry of Motor Vehicles. With a few keystrokes, I could lose myself in the complete works of Caravaggio, the original trailer for *Rashomon,* Dylan

Thomas reciting “And Death Shall Have No Dominion,” Eleanor Roosevelt reading aloud the Universal Declaration of Human Rights, Maria Callas singing “O mio babbino caro,” Billie Holiday singing “My Man Don’t Love Me,” and Solomon Linda singing “Mbube”—experiences I could not have had for love or money just a few years ago. Cheap hi-fi headphones and, soon, cardboard virtual-reality glasses enhance the aesthetic experience well beyond the tinny speakers and muddy black-and-white reproductions of my youth. And those who like paper can buy a used copy of Doris Lessing’s *The Golden Notebook,* Vladimir Nabokov’s *Pale Fire,* or Wole Soyinka’s *Aké: The Years of Childhood* for a dollar apiece.

A combination of Internet technology and crowdsourcing from thousands of volunteers has led to flabbergasting access to the great works of humankind. There can be no question of which was the greatest era for culture; the answer has to be today, until it is superseded by tomorrow. The answer does not depend on invidious comparisons of the quality of the works of today and those of the past (which we are in no position to make, just as many of the great works of the past were not appreciated in their time). It follows from our ceaseless creativity and our fantastically cumulative cultural memory. We have, at our fingertips, virtually all the works of genius prior to our time, together with those of our own time, whereas the people who lived before our time had neither. Better still, the world’s cultural patrimony is now available not just to the rich and well-located but to anyone who is connected to the vast web of knowledge, which means most of humanity and soon all of it.

CHAPTER 18

HAPPINESS

But are we any happier? If we have a shred of cosmic gratitude, we ought to be. An American in 2015, compared with his or her counterpart a half-century earlier, will live nine years longer, have had three more years of education, earn an additional $33,000 a year per family member (only a third of which, rather than half, will go to necessities), and have an additional eight hours a week of leisure. He or she can spend that leisure time reading on the Web, listening to music on a smartphone, streaming movies on high-definition TV, Skyping with friends and relatives, or dining on Thai food instead of Spam fritters.

But if popular impressions are a guide, today's Americans are not one and a half times happier (as they would be if happiness tracked income), or a third happier (if it tracked education), or even an eighth happier (if it tracked longevity). People seem to bitch, moan, whine, carp, and kvetch as much as ever, and the proportion of Americans who tell pollsters that they are happy has remained steady for decades. Popular culture has noticed the ingratitude in the Internet meme and Twitter hashtag #firstworldproblems and in a monologue by the comedian Louis C.K. known as "Everything's Amazing and Nobody's Happy":

> When I read things like, "The foundations of capitalism are shattering," I'm like, maybe we need some time where we're walking around with a donkey with pots clanging on the sides. . . . 'Cause now we live in an amazing world, and it's wasted on the crappiest generation of spoiled idiots. . . . Flying is the worst one, because people come back from flights, and they tell you their story. . . . They're like, "It was the worst day

> of my life. . . . We get on the plane and they made us sit there on the runway for forty minutes." . . . Oh really, then what happened next? Did you *fly* through the *air*, incredibly, like a bird? Did you soar into the clouds, impossibly? Did you partake in the *miracle* of human flight, and then land softly on giant tires that you couldn't even conceive how they fuckin' put air in them? . . . You're sitting in a *chair* in the *sky*. You're like a Greek myth right now! . . . People say there's delays? . . . Air travel's too slow? New York to California in five hours. That used to take thirty years! And a bunch of you would die on the way there, and you'd get shot in the neck with an arrow, and the other passengers would just bury you and put a stick there with your hat on it and keep walking. . . . The Wright Brothers would kick us all in the [crotch] if they knew.[1]

Writing in 1999, John Mueller summed up the common understanding of modernity at the time: "People seem simply to have taken the remarkable economic improvement in stride and have deftly found new concerns to get upset about. In an important sense, then, things never get better."[2] The understanding was based on more than just impressions of American malaise. In 1973 the economist Richard Easterlin identified a paradox that has since been named for him.[3] Though in comparisons *within* a country richer people are happier, in comparisons *across* countries the richer ones appeared to be no happier than poorer ones. And in comparisons *over time,* people did not appear to get happier as their countries got richer.

The Easterlin paradox was explained with two theories from psychology. According to the theory of the hedonic treadmill, people adapt to changes in their fortunes, like eyes adapting to light or darkness, and quickly return to a genetically determined baseline.[4] According to the theory of social comparison (or reference groups, status anxiety, or relative deprivation, which we examined in chapter 9), people's happiness is determined by how well they think they are doing relative to their compatriots, so as the country as a whole gets richer, no one feels happier—indeed, if their country becomes more unequal, then even if they get richer they may feel worse.[5]

If, in this sense, things never get better, one can wonder whether all that economic, medical, and technological so-called progress was worth it. Many argue that it was not. We have been spiritually impoverished, they say, by the rise of individualism, materialism, consumerism, and decadent wealth, and by the erosion of traditional communities with their hearty social bonds and their sense of meaning and purpose bestowed by religion. That is why, one often reads, depression, anxiety, loneliness, and suicide have been soaring, and why Sweden, that secular paradise, has a famously high rate of suicide. In 2016 the activist George Monbiot prosecuted the cultural pessimist's time-honored campaign against modernity in an op-ed entitled "Neoliberalism Is Creating Loneliness. That's What's Wrenching Society Apart." The tag line was, "Epidemics of mental illness are crushing the minds and bodies of millions. It's time to ask where we are heading and why." The article itself warned, "The latest, catastrophic figures for children's mental health in England reflect a global crisis."[6]

If all those extra years of life and health, all that additional knowledge and leisure and breadth of experience, all those advances in peace and safety and democracy and rights, have really left us no happier but just lonelier and more suicidal, it would be history's greatest joke on humanity. But before we start walking around with a donkey with pots clanging on the sides, we had better take a closer look at the facts about human happiness.



At least since the Axial Age, thinkers have deliberated about what makes for a good life, and today happiness has become a major topic in social science.[7] Some intellectuals are incredulous, even offended, that happiness has become a subject for economists rather than just poets, essayists, and philosophers. But the approaches are not opposed. Social scientists often begin their studies of happiness with ideas that were first conceived by artists and philosophers, and they can pose questions about historical and global patterns that cannot be answered by solitary reflection, no matter how insightful. That is especially true for the question of whether progress has left people happier. To answer it, we must first assuage the critics' incredulity over the possibility that happiness can even be measured.

Artists, philosophers, and social scientists agree that well-being is not a single dimension. People can be better off in some ways and worse off in others. Let's distinguish the major ones.

We can begin with objective aspects of well-being: the gifts we deem intrinsically worthwhile whether or not their possessors appreciate them. At the top of that list is life itself; also on it are health, education, freedom, and leisure. That is the mindset behind Louis C.K.'s social criticism and, in part, behind Amartya Sen's and Martha Nussbaum's conceptions of fundamental human capabilities.[8] In this sense we can say that people who live long, healthy, and stimulating lives are truly better off even if they have a morose temperament or are in a bad mood or are spoiled idiots and fail to count their blessings. One rationale for this apparent paternalism is that life, health, and freedom are prerequisites to everything else, including the very act of pondering what is worthwhile in life, and so they are worthy by their very nature. Another is that the people who have the luxury of failing to appreciate their good fortune make up a biased sample of lucky survivors. If we could canvass the souls of the dead children and mothers and the victims of war and starvation and disease, or if we went back in time and gave them a choice between proceeding with their lives in a premodern or modern world, we might uncover an appreciation of modernity that is more commensurate with its objective benefits. These dimensions of well-being have been the topics of the preceding chapters, and the verdict on whether they have improved over time is in.

Among these intrinsic goods is freedom or autonomy: the availability of options to lead a good life (positive freedom) and the absence of coercion that prevents a person from choosing among them (negative freedom). Sen gave a shout-out to this value in the title of his book on the ultimate goal of the development of nations: *Development as Freedom*. Positive freedom is related to the economist's notion of utility (what people want; what they spend their wealth on), and negative freedom to the political scientist's notions of democracy and human rights. As I mentioned, freedom (together with life and reason) is a prerequisite to the very act of evaluating what is good in life. Unless we are impotently lamenting or celebrating our fate, then whenever we assess our condition we

are presupposing that people in the past could have chosen otherwise. And when we ask where we should be heading, we presuppose that we have choices about what to pursue. For these reasons, freedom itself is inherently worthy.

In theory, freedom is independent of happiness. People can surrender to fatal attractions, crave pleasures that are bad for them, regret a choice the morning after, or ignore advice to be careful what they wish for.[9] In practice, freedom and the other good things in life go together. Whether assessed objectively through a democracy index for a country as a whole, or subjectively through people's ratings of whether they feel they have "free choice and control over their lives," the level of happiness in a country is correlated with the level of freedom.[10] Also, people single out freedom as a component of a *meaningful* life, whether or not it leads to a happy life.[11] Like Frank Sinatra, they may have regrets, they may take blows, but they do it their way. People can even value autonomy *over* happiness: many who have gone through a painful divorce, for example, would still not choose to return to a time when their parents would have arranged their marriages.

What about happiness itself? How can a scientist measure something as subjective as well-being? The best way to find out how happy people are is to ask them. Who could be a better judge? An old *Saturday Night Live* skit has Gilda Radner in a postcoital conversation with a nervous lover (played by Chevy Chase) who is worried she didn't have an orgasm, and she consoles him by saying, "Sometimes I do and I don't even know it." We laugh because when it comes to subjective experience, the experiencer herself is the ultimate authority. But we don't have to take people's word for it: self-reports of well-being turn out to correlate with everything else we think of as indicating happiness, including smiles, a buoyant demeanor, activity in the parts of the brain that respond to cute babies, and, Gilda and Chevy notwithstanding, judgments by other people.[12]

Happiness has two sides, an experiential or emotional side, and an evaluative or cognitive side.[13] The experiential component consists of a balance between positive emotions like elation, joy, pride, and delight, and negative emotions like worry, anger, and sadness. Scientists can sample these experiences in real time by

having people wear a beeper that goes off at random times and prompts them to indicate how they are feeling. The ultimate measure of happiness would consist of a lifetime integral or weighted sum of how happy people are feeling and how long they feel that way. Though experience sampling is the most direct way of assessing subjective well-being, it's laborious and expensive, and there are no good datasets that compare people in different countries or track them over the years. The next best thing is to ask people how they are feeling at the time, or how they remember having felt during the day or week before.

This brings us to the other side of well-being, people's *evaluations* of how they are living their lives. People can be asked to reflect on how satisfied they feel "these days" or "as a whole" or "taking all things together," or to render the almost philosophical judgment of where they stand on a ten-rung ladder ranging from "the worst possible life for you" to "the best possible life for you." People find these questions hard (not surprisingly, since they *are* hard), and their responses may be warped by the weather, their current mood, and what they were asked about immediately beforehand (with questions to college students about their dating life, or to anyone about politics, having a reliably depressive effect). Social scientists have become resigned to the fact that happiness, satisfaction, and best-versus-worst-possible life are blurred in people's minds and that it's often easiest just to average them together.[14]

Emotions and evaluations are, of course, related, though imperfectly: an abundance of happiness makes for a better life, but an absence of worry and sadness does not.[15] And this brings us to the final dimension of a good life, meaning and purpose. This is the quality that, together with happiness, goes into Aristotle's ideal of *eudaemonia* or "good spirit."[16] Happiness isn't everything. We can make choices that leave us unhappy in the short term but fulfilled over the course of a life, such as raising a child, writing a book, or fighting for a worthy cause.

Though no mortal can stipulate what *really* makes a life meaningful, the psychologist Roy Baumeister and his colleagues probed for what makes people *feel* their lives are meaningful. The respondents separately rated how happy and how meaningful their

lives were, and they answered a long list of questions about their thoughts, activities, and circumstances. The results suggest that many of the things that make people happy also make their lives meaningful, such as being connected to others, feeling productive, and not being alone or bored. But other things can make lives happier while leaving them no more meaningful or even less so.

People who lead happy but not necessarily meaningful lives have all their needs satisfied: they are healthy, have enough money, and feel good a lot of the time. People who lead meaningful lives may enjoy none of these boons. Happy people live in the present; those with meaningful lives have a narrative about their past and a plan for the future. Those with happy but meaningless lives are takers and beneficiaries; those with meaningful but unhappy lives are givers and benefactors. Parents get meaning from their children, but not necessarily happiness. Time spent with friends makes a life happier; time spent with loved ones makes it more meaningful. Stress, worry, arguments, challenges, and struggles make a life unhappier but more meaningful. It's not that people with meaningful lives masochistically go looking for trouble but that they pursue ambitious goals: "Man plans and God laughs." Finally, meaning is about expressing rather than satisfying the self: it is enhanced by activities that define the person and build a reputation.

We can see happiness as the output of an ancient biological feedback system that tracks our progress in pursuing auspicious signs of fitness in a natural environment. We are happier, in general, when we are healthy, comfortable, safe, provisioned, socially connected, sexual, and loved. The function of happiness is to goad us into seeking the keys to fitness: when we are unhappy, we scramble for things that would improve our lot; when we are happy, we cherish the status quo. Meaning, in contrast, registers the novel and expansive goals that are opened up for us as social, brainy, and talkative occupants of the uniquely human cognitive niche. We consider goals that are rooted in the distant past and stretch far into the future, that affect people beyond our circle of acquaintance, and that must be ratified by our fellows, based on our ability to persuade them of their worth and on our reputation for benevolence and efficacy.[17]

An implication of the circumscribed role of happiness in human psychology is that the goal of progress cannot be to increase happiness indefinitely, in the hope that more and more people will become more and more euphoric. But there is plenty of unhappiness that can be reduced, and no limit as to how meaningful our lives can become.



Let's agree that the citizens of developed countries are not as happy as they ought to be, given the fantastic progress in their fortunes and freedom. But are they not happier at all? Have their lives become so empty that they are choosing to end them in record numbers? Are they suffering through an epidemic of loneliness, in defiance of the mind-boggling number of opportunities to connect with one another? Is the younger generation, ominously for our future, crippled by depression and mental illness? As we shall see, the answer to each of these questions is an emphatic *no*.

Evidence-free pronouncements about the misery of mankind are an occupational hazard of the social critic. In the 1854 classic *Walden,* Henry David Thoreau famously wrote, "The mass of men lead lives of quiet desperation." How a recluse living in a cabin on a pond could know this was never made clear, and the mass of men beg to differ. Eighty-six percent of those who are asked about their happiness in the World Values Survey say they are "rather happy" or "very happy," and on average the respondents in the 150-country *World Happiness Report 2016* judged their lives to be on the top half of the ladder from worst to best.[18] Thoreau was a victim of the Optimism Gap (the "I'm OK, They're Not" illusion), which for happiness is more like a canyon. People in every country underestimate the proportion of their compatriots who say they are happy, by an average of 42 percentage points.[19]

What about the historical trajectory? Easterlin identified his intriguing paradox in 1973, decades before the era of big data. Today we have much more evidence on wealth and happiness, and it shows there is no Easterlin paradox. Not only are richer people in a given country happier, but people in richer countries are happier, and as countries get richer over time, their people get happier. The new understanding has come from several independent analyses, including ones by Angus Deaton, the World Values Survey, and the

World Happiness Report 2016.[20] My favorite comes from the economists Betsey Stevenson and Justin Wolfers and may be summarized in a graph. Figure 18-1 plots ratings of average life satisfaction against average income (on a logarithmic scale) for 131 countries, each represented by a dot, together with the relationship of life satisfaction to income among the citizens of each country, represented by an arrow impaling the dot.

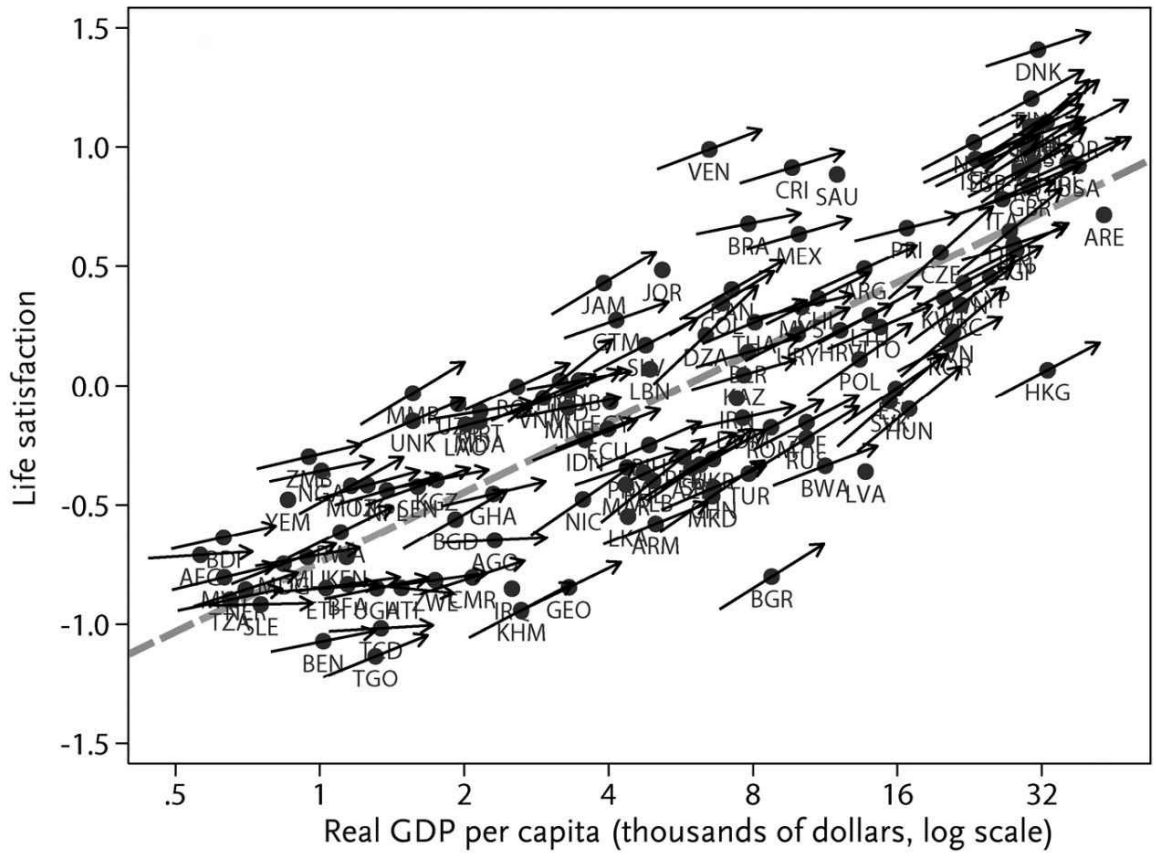


Figure 18-1: Life satisfaction and income, 2006

Source: Stevenson & Wolfers 2008a, fig. 11, based on data from the Gallup World Poll 2006. Credit: Betsey Stevenson and Justin Wolfers.

Several patterns jump out. The most immediate is the absence of a cross-national Easterlin paradox: the cloud of arrows is stretched along a diagonal, which indicates that the richer the country, the happier its people. Bear in mind that the income scale is logarithmic; on a standard linear scale, the same cloud would rise steeply from the left end and bend over toward the right. This means that a given number of extra dollars boosts the happiness of

people in a poor country more than the happiness of people in a rich country, and that the richer a country is, the more additional money its people need to become happier still. (It's one of the reasons that the Easterlin paradox appeared in the first place: with the noisier data of the era, it was hard to spot the relatively small rise in happiness at the high end of the income scale.) But with either scale, the line never flattens out, as it would if people needed only some minimum amount of income to see to their basic needs and anything extra made them no happier. As far as happiness is concerned, Wallis Simpson was half-right when she said, "You can't be too rich or too thin."

Most strikingly, the slopes of the arrows are similar to each other, and identical to the slope for the swarm of arrows as a whole (the dashed gray line lurking behind the swarm). That means that a raise for an individual relative to that person's compatriots adds as much to his or her happiness as the same increase for their country across the board. This casts doubt on the idea that people are happy or unhappy only in comparison to the Joneses. Absolute income, not relative income, is what matters most for happiness (a conclusion that's consistent with the finding discussed in chapter 9 on the irrelevance of inequality to happiness).[21] These are among a number of findings that weaken the old belief that happiness adapts to ambient conditions like the eye, returns to a set point, or remains stationary as people vainly stride on a hedonic treadmill. Though people often do rebound from setbacks and pocket their good fortune, their happiness takes a sustained hit from trials like unemployment or disability, and a sustained boost from gifts like a good marriage or immigrating to a happier country.[22] And contrary to an earlier belief, winning the lottery does, over the long term, make people happier.[23]

Since we know that countries get *richer* over time (chapter 8), we can think of figure 18-1 as a freeze-frame in a movie showing humanity getting *happier* over time. This increase in happiness is yet another indicator of human progress, and among the most important of all. Of course this snapshot is not an actual longitudinal chronicle in which people all over the world are polled for centuries and we plot their happiness over time; such data do not exist. But Stevenson and Wolfers scoured the literature for what

longitudinal studies there were, and found that in eight out of nine European countries, happiness increased between 1973 and 2009 in tandem with the country's rise in GDP per capita.[24] A confirmation for the world as a whole comes from the World Values Survey, which found that in forty-five out of fifty-two countries, happiness increased between 1981 and 2007.[25] The trends over time close the books on the Easterlin paradox: we now know that richer people within a country are happier, that richer countries are happier, and that people get happier as their countries get richer (which means that people get happier over time).

Happiness, of course, depends on much more than income. This is true not just among individuals, who differ in their life histories and their innate temperaments, but among nations, as we see from the scatter of dots around the gray line in the graph. Nations are happier when their people are in better health (holding income constant), and, as I mentioned, they are happier when their citizens feel they are free to choose what to do with their lives.[26] Culture and geography also matter: true to stereotype, Latin American countries are happier than they should be given their income, and the ex-Communist countries of Eastern Europe are less happy.[27] The *World Happiness Report 2016* found three other traits that go with national happiness: social support (whether people say they have friends or relatives they can count on in times of trouble), generosity (whether they donate money to charity), and corruption (whether they perceive the businesses in their country as corrupt).[28] We cannot conclude, though, that these traits *cause* greater happiness. One reason is that happy people see the world through rose-tinted glasses, and may give generous assessments of the good things both in their lives and in their societies. The other is that happiness is, as social scientists say, endogenous: being happy might make people supportive, generous, and conscientious rather than the other way around.

~

Among the countries that punch below their wealth in happiness is the United States. Americans are by no means unhappy: almost 90 percent rate themselves as at least "pretty happy," almost a third rate themselves as "very happy," and when they are asked to place themselves on the ten-rung ladder from the worst to the best

possible life, they choose the seventh rung.[29] But in 2015 the United States came in at thirteenth place among the world's nations (trailing eight countries in Western Europe, three in the Commonwealth, and Israel), even though it had a higher average income than all of them but Norway and Switzerland.[30] (The United Kingdom, whose citizens place themselves at a happy 6.7 rungs up from the worst possible life, came in at twenty-third place.)

Also, the United States hasn't gotten systematically happier over the years (another decoy that led to the premature announcement of the Easterlin paradox, because the United States is also the country with happiness data that stretch back the farthest). American happiness has fluctuated within a narrow band since 1947, deflecting in response to various recessions, recoveries, malaises, and bubbles, but with no consistent rise or fall. One dataset shows a slight decline in American happiness from 1955 to 1980, followed by a rise through 2006; another shows a slight decline in the proportion saying they are "very happy" starting in 1972 (though even there the sum of those who say they are "very happy" and "pretty happy" has not changed).[31]

The American happiness stagnation doesn't falsify the global trend in which happiness increases with wealth, because when we look at changes in a rich country over a few decades we're peeping at a restricted range of the scale. As Deaton points out, a trend that is obvious when you look at the effects of a fiftyfold difference in income between, say, Togo and the United States, representing a quarter-millennium of economic growth, may be submerged in the noise when you look for the effects of, say, a twofold difference in income within a single country over just twenty years of economic growth.[32] Also, the United States has seen a greater rise in income inequality than the countries of Western Europe (chapter 9), and its growth in GDP may have been enjoyed by a smaller proportion of the populace.[33] Speculating about American exceptionalism is an endlessly fascinating pastime, but whatever the reason, happyologists agree that the United States is an outlier from the global trend in subjective well-being.[34]

Another reason it can be hard to make sense of happiness trends for individual countries is that a country is a collection of tens of millions of human beings who just happen to occupy a patch of

land. It's remarkable that we can find *anything* in common when we average them, and we shouldn't be surprised to find that as time passes, different segments of the population go in different directions, sometimes jerking the average around, sometimes canceling each other out. Over the past thirty-five years African Americans have been getting much happier while American whites have gotten a bit less happy.[35] Women tend to be happier than men, but in Western countries the gap has shrunk, with men getting happier at a faster rate than women. In the United States it has reversed outright, as women got unhappier while men stayed more or less the same.[36]

The biggest complication in making sense of historical trends, though, is one that we came across in chapter 15: the distinction between changes across the life cycle (age), in the zeitgeist (period), and over the generations (cohort).[37] Without a time machine, it's logically impossible to disentangle the effects of age, cohort, and period completely, to say nothing of their interactions. If, for example, fifty-year-olds were miserable in 2005, we couldn't tell whether the Baby Boomers had a hard time dealing with middle age, the Baby Boomers had a hard time dealing with the new millennium, or the new millennium was a hard time to be middle-aged. But with a dataset that embraces multiple generations and decades, together with a few assumptions about how quickly people and times can change, one can average the scores for a generation over the years, for the entire population at each year, and for the population at each age, and make reasonably independent estimates of the trajectory of the three factors over time. That in turn allows us to look for two different versions of progress: people of all ages can become better off in recent periods, or younger cohorts can be better off than older ones, lifting the population as they replace them.

People tend to get happier as they get older (an age effect), presumably because they overcome the hurdles of embarking on adulthood and develop the wisdom to cope with setbacks and to put their lives in perspective.[38] (They may pass through a midlife crisis on the way, or take a final slide in the last years of old age.)[39] Happiness fluctuates with the times, especially the changing economy—not for nothing do economists call a composite of the

inflation rate and the unemployment rate the Misery Index—and Americans have just dug themselves out of a trough that followed the Great Recession.[40]

The pattern across the generations also has ups and downs. In two large samples, Americans born in every decade from the 1900s through the 1940s lived happier lives than those in the preceding cohort, presumably because the Great Depression left a scar on the generations who came of age as it deepened. The rise leveled off and then declined a bit with the Baby Boomers and early Generation X, the last generation that was old enough to allow the researchers to disentangle cohort from period.[41] In a third study which continues to the present (the General Social Survey), happiness also dipped among the Baby Boomers but fully rebounded in Gen X and the Millennials.[42] So while every generation agonizes about the kids today, younger Americans have in fact been getting happier. (As we saw in chapter 12, they have also become less violent and less druggy.) That makes three segments of the population that have become happier amid the American happiness stagnation: African Americans, the successive cohorts leading up to the Baby Boom, and young people today.

The age-period-cohort tangle means that every historical change in well-being is at least three times as complicated as it appears. With that caveat in mind, let's take a look at the claims that modernity has unleashed an epidemic of loneliness, suicide, and mental illness.



To hear the observers of the modern world tell it, Westerners have been getting lonelier. In 1950 David Riesman (together with Nathan Glazer and Reuel Denney) wrote the sociological classic *The Lonely Crowd*. In 1966 the Beatles wondered where all the lonely people come from, and where they all belong. In a 2000 bestseller the political scientist Robert Putnam noted that Americans were increasingly *Bowling Alone*. And in 2010 the psychiatrists Jacqueline Olds and Richard Schwartz wrote of *The Lonely American* (subtitle: *Drifting Apart in the Twenty-First Century*). For a member of gregarious *Homo sapiens,* social isolation is a form of torture, and the stress of loneliness a major risk to health and

life.[43] So it would be another joke on modernity if our newfound connectivity has left us lonelier than ever.

One might think that social media could make up for whatever alienation and isolation came with the decline of large families and small communities. Today, after all, Eleanor Rigby and Father McKenzie could be Facebook friends. But in *The Village Effect* the psychologist Susan Pinker reviews research showing that digital friendships don't provide the psychological benefits of face-to-face contact.

This only heightens the mystery of why people would be getting lonelier. Among the world's problems, social isolation would seem to be one of the easier ones to solve: just invite someone you know for a chat at a neighborhood Starbucks or around the kitchen table. Why would people fail to notice the opportunities? Have people today, especially the ever-maligned younger generation, become so addicted to digital crack cocaine that they forgo vital human contact and sentence themselves to needless and perhaps lethal loneliness? Could it really be true, as one social critic put it, that "we have given our hearts to machines, and are now turning into machines"? Has the Internet created, in the words of another, "an atomized world without human contact or emotion"?[44] To anyone who believes there is such a thing as human nature, it seems unlikely, and the data show it is false: there is no loneliness epidemic.

In *Still Connected* (2011), the sociologist Claude Fischer reviewed forty years of surveys that asked people about their social relationships. "The most striking thing about the data," he noted, "is how consistent Americans' ties to family and friends were between the 1970s and 2000s. We rarely find differences of more than a handful of percentage points either way that might describe lasting alterations in behavior with lasting personal consequences—yes, Americans entertained less at home and did more phone calling and emailing, but they did not change much on the fundamentals."[45] Though people have reallocated their time because families are smaller, more people are single, and more women work, Americans today spend as much time with relatives, have the same median number of friends and see them about as often, report as much emotional support, and remain as satisfied with the number and quality of their friendships as their counterparts in the decade of

Gerald Ford and *Happy Days*. Users of the Internet and social media have *more* contact with friends (though a bit less face-to-face contact), and they feel that the electronic ties have enriched their relationships. Fischer concluded that human nature rules: "People try to adapt to changing circumstances so as to protect their most highly valued ends, which include sustaining the volume and quality of their personal relationships—time with children, contact with relatives, a few sources of intimate support."[46]

What about subjective feelings of loneliness? Surveys of the entire population are sparse; the data Fischer found suggested that "Americans' expressions of loneliness remained the same or perhaps increased slightly," mainly because more people were single.[47] But surveys of students, a captive audience, are plentiful, and for decades they have indicated whether they agree with statements like "I am unhappy doing so many things alone" and "I have nobody to talk to." The trends are summarized in the title of a 2015 article, "Declining Loneliness over Time," and are shown in figure 18-2.

Since these students were not tracked after they left school, we don't know whether the decline in loneliness is a period effect, in which it has become steadily easier for young people to satisfy their social needs, or a cohort effect, in which recent generations are more socially satisfied and will remain so. What we do know is that young Americans are not suffering from "toxic levels of emptiness and aimlessness and isolation."

Together with "the kids today," the perennial target of cultural pessimists is technology. In 2015 the sociologist Keith Hampton and his coauthors introduced a report on the psychological effects of social media by noting:

> For generations, commentators have worried about the impact of technology on people's stress. Trains and industrial machinery were seen as noisy disruptors of pastoral village life that put people on edge. Telephones interrupted quiet times in homes. Watches and clocks added to the dehumanizing time pressures on factory workers to be productive. Radio and television were organized around the advertising that enabled

modern consumer culture and heightened people's status anxieties.[48]

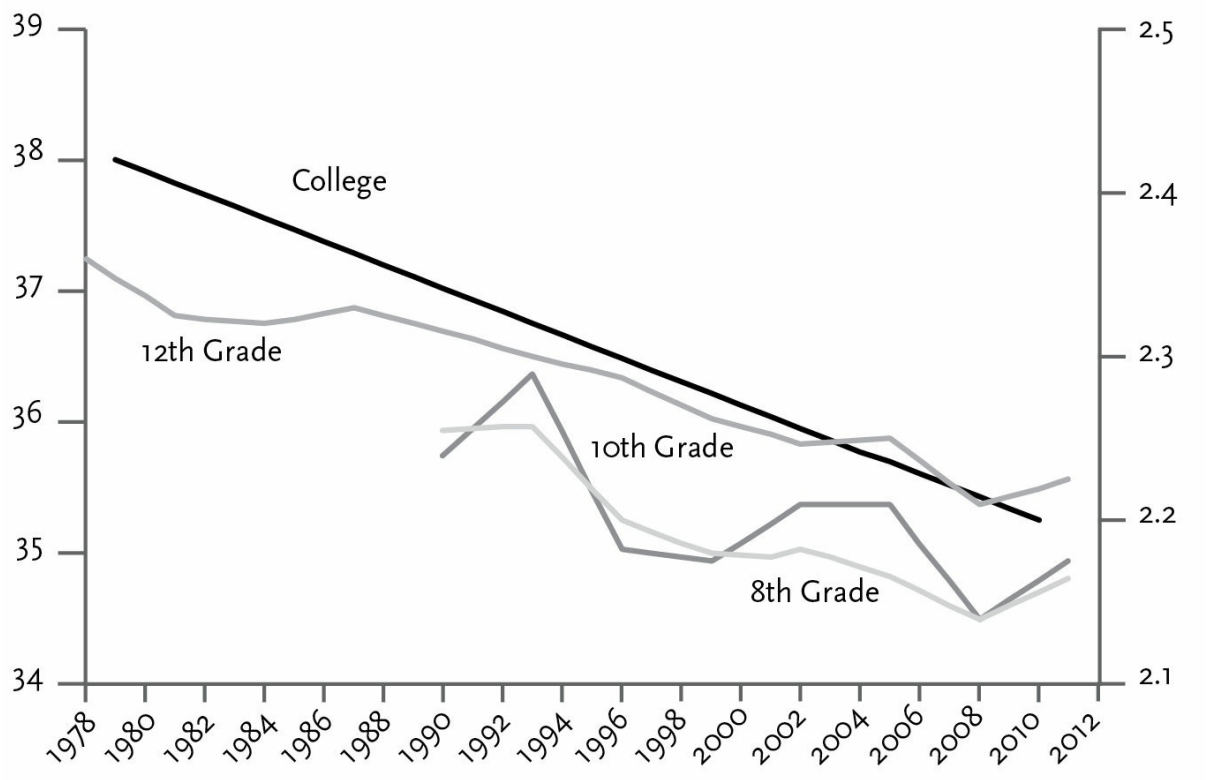


Figure 18-2: Loneliness, US students, 1978–2011

Source: Clark, Loxton, & Tobin 2015. **College students** (left axis): Revised UCLA Loneliness Scale, trend line across many samples, taken from their fig. 1. **High school students** (right axis): Mean rating of six loneliness items from the Monitoring the Future survey, triennial means, taken from their fig. 4. Each axis spans half a standard deviation, so the slopes of the college and high school curves are commensurable, but their relative heights are not.

And so it was inevitable that the critics would shift their focus to social media. But social media can be neither credited nor blamed for the changes in loneliness among American students shown in figure 18-2: the decline proceeded from 1977 through 2009, and the Facebook explosion did not come until 2006. Nor, according to the new surveys, have adults become isolated because of social media. Users of social media have more close friends, express more trust in people, feel more supported, and are more politically involved.[49] And notwithstanding the rumor that they are drawn into an anxious competition to keep up with the furious rate of enjoyable activities of their digital faux-friends, social media users do not report higher

levels of stress than non-users.[50] On the contrary, the women among them are *less* stressed, with one telling exception: they get upset when they learn that someone they care about has suffered an illness, a death in the family, or some other setback. Social media users care too much, not too little, about other people, and they empathize with them over their troubles rather than envying them their successes.

Modern life, then, has not crushed our minds and bodies, turned us into atomized machines suffering from toxic levels of emptiness and isolation, or set us drifting apart without human contact or emotion. How did this hysterical misconception arise? Partly it came out of the social critic's standard formula for sowing panic: Here's an anecdote, therefore it's a trend, therefore it's a crisis. But partly it came from genuine changes in how people interact. People see each other less in traditional venues like clubs, churches, unions, fraternal organizations, and dinner parties, and more in informal gatherings and via digital media. They confide in fewer distant cousins but in more co-workers. They are less likely to have a large number of friends but also less likely to *want* a large number of friends.[51] But just because social life looks different today from the way it looked in the 1950s, it does not mean that humans, that quintessentially social species, have become any less social.



Suicide, one might think, is the most reliable measure of societal unhappiness, in the same way that homicide is the most reliable measure of societal conflict. A person who has died by suicide must have suffered from unhappiness so severe that he or she decided that a permanent end to consciousness was preferable to enduring it. Also, suicides can be tabulated objectively in a way that the experience of unhappiness cannot.

But in practice, suicide rates are often inscrutable. The very sadness and agitation from which suicide would be a release also addles a person's judgment, so what ought to be the ultimate existential decision often hinges on the mundane matter of how easy it is to carry out the act. Dorothy Parker's macabre poem "Resumé" (which ends, "Guns aren't lawful; Nooses give; Gas smells awful; You might as well live") is disconcertingly close to the mindset of a person contemplating suicide. A country's suicide rate

can soar or plummet when a convenient and effective method is widely available or taken away, such as coal gas in England in the first half of the 20th century, pesticides in many developing countries, and guns in the United States.[52] Suicides increase during economic downturns and political turmoil, not surprisingly, but they are also affected by the weather and the number of daylight hours, and they increase when the media normalize or romanticize recent instances.[53] Even the innocuous idea that suicide is an assay for unhappiness may be questioned. A recent study documented a "happiness-suicide paradox" in which happier American states and happier Western countries have slightly *higher,* rather than lower, suicide rates.[54] (The researchers speculate that misery loves company: a personal setback is more painful when everyone around you is happy.) Suicide rates can be capricious for yet another reason. Suicides are often hard to distinguish from accidents (particularly when the cause is a poisoning or drug overdose, but also when it is a fall, a car crash, or a gunshot), and coroners may tilt their classifications in times and places in which suicide is stigmatized or criminalized.

We do know that suicide is a major cause of death. In the United States there are more than 40,000 suicides a year, making it the tenth-leading cause of death, and worldwide there are about 800,000, making it the fifteenth-leading cause.[55] Yet the trends over time and the differences among countries are hard to fathom. In addition to the age-cohort-period snarl, the lines for men and women often go in different directions. Though the suicide rate for women in developed countries fell by more than 40 percent between the mid-1980s and 2013, men kill themselves at around four times the rate of women, so the numbers for men tend to push the overall trends around.[56] And no one knows why, for example, the world's most suicidal countries are Guyana, South Korea, Sri Lanka, and Lithuania, nor why France's rate shot up from 1976 to 1986 and fell back down by 1999.

But we know enough to debunk two popular beliefs. The first is that suicide has been steadily rising and has now reached historically high, unprecedented, crisis, or epidemic proportions. Suicide was common enough in the ancient world to have been debated by the Greeks and to have figured in the biblical stories of

Samson, Saul, and Judas. Historical data are scarce, not least because suicide, also called "self-murder," used to be a crime in many countries, including England until 1961. But the data go back more than a century in England, Switzerland, and the United States, and I have plotted them in figure 18-3.

The annual suicide rate in England was 13 per 100,000 in 1863; it hit peaks of around 19 in the first decade of the 20th century and more than 20 during the Great Depression, plunged during World War II and again in the 1960s, and then fell more gradually to 7.4 in 2007. Switzerland, too, saw a decline of more than twofold, from 24 in 1881 and 27 during the Depression to 12.2 in 2013. The United States suicide rate peaked at around 17 in the early 20th century and again during the Depression before falling to 10.5 at the turn of the millennium, followed by a rise after the recent Great Recession to 13.

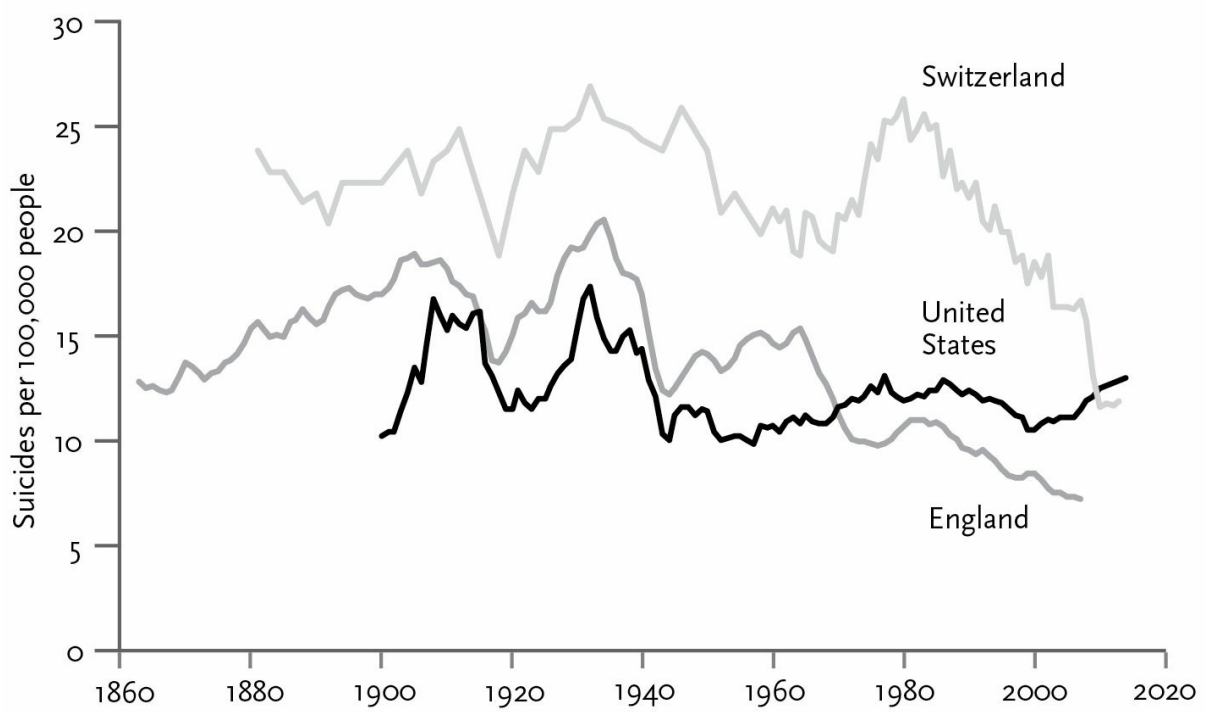


Figure 18-3: Suicide, England, Switzerland, and US, 1860–2014

Sources: England (including Wales): Thomas & Gunnell 2010, fig. 1, average of male and female rates, provided by Kylie Thomas. The series has not been extended because the data are not commensurable with current records. **Switzerland, 1880–1959:** Ajdacic-Gross et al. 2006, fig. 1. **Switzerland, 1960–2013:** WHO Mortality Database, OECD 2006. **United States, 1900–1998:** Centers for Disease Control, Carter et al. 2006, table Ab950. **United States, 1999–2014:** Centers for Disease Control 2015.

So in all three countries for which we have historical data, suicide was more common in the past than it is today. The visible crests and troughs are the surface of a churning sea of ages, cohorts, periods, and sexes.[57] Suicide rates rise sharply during adolescence and then more gently into middle age, where they peak for females (perhaps because they face menopause and an empty nest) and then fall back down, while staying put for males before shooting up in their retirement years (perhaps because they face an end to their traditional role as providers). Part of the recent increase in the American suicide rate can be attributed to the aging of the population, with the large cohort of Boomer males moving into their most suicide-prone years. But the cohorts themselves matter as well. The GI and Silent generations were more reluctant to kill themselves than the Victorian cohorts that preceded them and the Boomers and Gen-Xers that followed them. The Millennials appear to be slowing or reversing the generational rise; adolescent suicide rates fell between the early 1990s and the first decades of the 21st century.[58] The times themselves (adjusting for ages and cohorts) have become less conducive to suicide since the peaks around the turn of the 20th century, the 1930s, and the late 1960s to early 1970s; they dropped to a forty-year low in 1999, though we have seen a slight rise again since the Great Recession. This complexity belies the alarmism of the recent *New York Times* headline "U.S. Suicide Rate Surges to a 30-Year High," which could also have been titled "Despite the Recession and an Aging Population, U.S. Suicide Rate Is a Third Lower Than Previous Peaks."[59]

Together with the belief that modernity makes people want to kill themselves, the other great myth about suicide is that Sweden, that paragon of Enlightenment humanism, has the world's highest suicide rate. This urban legend originated (according to what might be another urban legend) in a speech by Dwight Eisenhower in 1960 in which he called out Sweden's high suicide rate and blamed it on the country's paternalistic socialism.[60] I myself would have blamed the bleak existential films of Ingmar Bergman, but both theories are explanations in search of a fact to explain. Though Sweden's suicide rate in 1960 was higher than that of the United States (15.2 versus 10.8 per 100,000), it was never the world's highest, and it has since fallen to 11.1, which is below the world average (11.6) and the rate

for the United States (12.1) and in fifty-eighth place overall.[61] A recent review of suicide rates across the world noted that "generally the suicide trend has been downward in Europe and there are currently no Western European welfare states in the world top ten for suicide rates."[62]



Everyone occasionally suffers from depression, and some people are stricken with major depression, in which the sadness and hopelessness last more than two weeks and interfere with carrying on with life. In recent decades, more people have been diagnosed with depression, especially in younger cohorts, and the conventional wisdom is captured in the tag line of a recent public television documentary: "A silent epidemic is ravaging the nation and killing our kids." We have just seen that the nation is not suffering from an epidemic of unhappiness, loneliness, or suicide, so an epidemic of depression seems unlikely, and it turns out to be an illusion.

Consider one oft-cited study, which implausibly claimed that every cohort from the GI Generation through the Baby Boomers was more depressed than the one before.[63] The investigators reached that conclusion by asking people of different ages to recall times when they had been depressed. But that made the study a hostage to memory: the longer ago an episode took place, the less likely it is that a person will recall it, especially (as we saw in chapter 4) if the episode was unpleasant. That creates an illusion that recent periods and younger cohorts are more vulnerable to depression. Such a study is also hostage to mortality. As the decades pass, depressed people are more likely to die of suicide and other causes, so the old people who remain in a sample are the mentally healthier ones, making it seem as if everyone who was born long ago is mentally healthier.

Another distorter of history is a change in attitudes. Recent decades have seen outreach programs and media campaigns designed to increase awareness and decrease the stigma of depression. Drug companies have advertised a pharmacopoeia of antidepressants directly to consumers. Bureaucracies demand that people be diagnosed with some disorder before they can receive entitlements such as therapy, government services, and a right

against discrimination. All these inducements could make people more likely to report that they are depressed.

At the same time, the mental health professions, and perhaps the culture at large, has been lowering the bar for what counts as a mental illness. The list of disorders in the *Diagnostic and Statistical Manual* (*DSM*) of the American Psychiatric Association tripled between 1952 and 1994, when it included almost three hundred disorders, including Avoidant Personality Disorder (which applies to many people who formerly were called shy), Caffeine Intoxication, and Female Sexual Dysfunction. The number of symptoms needed to justify a diagnosis has fallen, and the number of stressors that may be credited with triggering one has increased. As the psychologist Richard McNally has noted, "Civilians who underwent the terror of World War II, especially Nazi death factories . . . , would surely be puzzled to learn that having a wisdom tooth extracted, encountering obnoxious jokes at work, or giving birth to a healthy baby after an uncomplicated delivery can cause Post-Traumatic Stress Disorder."[64] By the same shift, the label "depression" today may be applied to conditions that in the past were called grief, sorrow, or sadness.

Psychologists and psychiatrists have begun to sound the alarm against this "disease mongering," "concept creep," "selling sickness," and "expanding empire of psychopathology."[65] In her 2013 article "Abnormal Is the New Normal," the psychologist Robin Rosenberg noted that the latest version of the *DSM* could diagnose half the American population with a mental disorder over the course of their lives.[66]

The expanding empire of psychopathology is a first-world problem, and in many ways is a sign of moral progress.[67] Recognizing a person's suffering, even with a diagnostic label, is a form of compassion, particularly when the suffering can be alleviated. One of psychology's best-kept secrets is that cognitive behavior therapy is demonstrably effective (often more effective than drugs) in treating many forms of distress, including depression, anxiety, panic attacks, PTSD, insomnia, and the symptoms of schizophrenia.[68] With mental disorders making up more than 7 percent of the global burden of disability (major depression alone making up 2.5 percent), that's a lot of reducible

suffering.[69] The editors of the journal *Public Library of Science: Medicine* recently called attention to "the paradox of mental health": over-medicalization and over-treatment in the wealthy West, and under-recognition and under-treatment in the rest of the world.[70]

With the widening net of diagnosis, the only way to tell whether more people are depressed these days is to administer a standardized test of depressive symptoms to nationally representative samples of people of different ages over many decades. No study has met this gold standard, but several have applied a constant yardstick to more circumscribed populations.[71] Two intensive, long-term studies in rural counties (one in Sweden, one in Canada) signed up people born between the 1870s and the 1990s and tracked them from the middle to the late 20th century, embracing staggered lives that spanned more than a century. Neither found signs of a long-term rise in depression.[72]

There have also been several meta-analyses (studies of studies). Twenge found that from 1938 to 2007, college students scored increasingly higher on the Depression scale of the MMPI, a common personality test.[73] That doesn't necessarily mean that more of the students suffered from major depression, though, and the increase may have been inflated by the broader range of people who went to college over those decades. Moreover, other studies (some by Twenge herself) have found no change or even a decline in depression, especially for younger ages and cohorts and in later decades.[74] A recent one entitled "Is There an Epidemic of Child or Adolescent Depression?" vindicated Betteridge's Law of Headlines: Any headline that ends in a question mark can be answered with the word *no*. The authors explain, "Public perception of an 'epidemic' may arise from heightened awareness of a disorder that was long under-diagnosed by clinicians."[75] And the title of the biggest meta-analysis to date, which looked at the prevalence of anxiety and depression between 1990 and 2010 in *the entire world,* did not leave readers in suspense: "Challenging the Myth of an 'Epidemic' of Common Mental Disorders." The authors concluded, "When clear diagnostic criteria are applied, there is no evidence that the prevalence of common mental disorders is increasing."[76]

Depression is "comorbid" with anxiety, as epidemiologists morbidly call the correlation, which raises the question of whether the world has become more anxious. One answer was contained in the title of a long narrative poem published in 1947 by W. H. Auden, *The Age of Anxiety*. In the introduction to a recent reprint, the English scholar Alan Jacobs observed that "many cultural critics over the decades . . . have lauded Auden for his acuity in naming the era in which we live. But given the poem's difficulty few of them have managed to figure out precisely why he thinks our age is characterized primarily by anxiety—or even whether he is really saying that at all."[77] Whether he was saying that or not, Auden's name for our era has stuck, and it provided the obvious title for a meta-analysis by Twenge which showed that scores on a standard anxiety test administered to children and college students between 1952 and 1993 rose by a full standard deviation.[78] Things that can't go on forever don't, and as best we can tell, the increase among college students leveled off after 1993.[79] Nor have other demographic sectors become more anxious. Longitudinal studies of high school students and of adults conducted from the 1970s through the first decades of the 21st century find no rise across the cohorts.[80] Though in some surveys people have reported more symptoms of distress, anxiety that crosses the line into pathology is not at epidemic levels, and has shown no global increase since 1990.[81]



Everything is amazing. Are we really so unhappy? Mostly we are not. Developed countries are actually pretty happy, a majority of all countries have gotten happier, and as long as countries get richer they should get happier still. The dire warnings about plagues of loneliness, suicide, depression, and anxiety don't survive fact-checking. And though every generation has worried that the next one is in trouble, as younger generations go the Millennials seem to be in pretty good shape, happier and mentally healthier than their helicoptering parents.

Still, when it comes to happiness, many people are underachievers. Americans are laggards among their first-world peers, and their happiness has stagnated in the era sometimes called the American Century. The Baby Boomers, despite growing

up in peace and prosperity, have proved to be a troubled generation, to the mystification of their parents, who lived through the Great Depression, World War II, and (for many of my peers) the Holocaust. American women have become unhappier just as they have been making unprecedented gains in income, education, accomplishment, and autonomy, and in other developed countries where everyone has gotten happier, the women have been outpaced by the men. Anxiety and some depressive symptoms may have increased in the postwar decades, at least in some people. And none of us are as happy as we ought to be, given how amazing our world has become.

Let me end this chapter with a reflection on these happiness shortfalls. For many commentators they are an occasion to second-guess modernity.[82] Our unhappiness, they say, is payback for our worship of the individual and material wealth and for our acquiescence in the corrosion of family, tradition, religion, and community.

But there is a different way to understand the legacy of modernity. Those who are nostalgic for traditional folkways have forgotten how hard our forebears fought to escape them. Though no one gave happiness questionnaires to the people who lived in the close-knit communities that were loosened by modernity, much of the great art composed during the transition brought to life their dark side: the provincialism, conformity, tribalism, and Taliban-like restrictions on women's autonomy. Many novels from the mid-18th to the early 20th century played out the struggles of individuals to overcome the suffocating norms of aristocratic, bourgeois, or rural regimes, including works by Richardson, Thackeray, Charlotte Brontë, Eliot, Fontane, Flaubert, Tolstoy, Ibsen, Alcott, Hardy, Chekhov, and Sinclair Lewis. After urbanized Western society had become more tolerant and cosmopolitan, the tensions were played out again in popular culture's treatment of small-town American life, such as in songs by Paul Simon ("In my little town I never meant nothin' / I was just my father's son"), Lou Reed ("When you're growing up in a small town / You know you'll grow down in a small town"), and Bruce Springsteen ("Baby, this town rips the bones from your back / It's a death trap, a suicide rap"). It was played out yet again in the literature of immigrants, including works

by Isaac Bashevis Singer, Philip Roth, and Bernard Malamud and then by Amy Tan, Maxine Hong Kingston, Jhumpa Lahiri, Bharati Mukherjee, and Chitra Banerjee Divakaruni.

Today we enjoy a world of personal freedom these characters could only fantasize about, a world in which people can marry, work, and live as they please. One can imagine a social critic of today warning Anna Karenina or Nora Helmer that a tolerant cosmopolitan society isn't all it's cracked up to be, that without the bonds of family and village they'll have moments of anxiety and unhappiness. I can't speak for them, but my guess is they'd think it was a pretty good deal.

A modicum of anxiety may be the price we pay for the uncertainty of freedom. It is another word for the vigilance, deliberation, and heart-searching that freedom demands. It's not entirely surprising that as women gained in autonomy relative to men they also slipped in happiness. In earlier times, women's list of responsibilities rarely extended beyond the domestic sphere. Today young women increasingly say that their life goals include career, family, marriage, money, recreation, friendship, experience, correcting social inequities, being a leader in their community, and making a contribution to society.[83] That's a lot of things to worry about, and a lot of ways to be frustrated: Woman plans and God laughs.

It's not just the options opened up by personal autonomy that place a weight on the modern mind; it's also the great questions of existence. As people become better educated and increasingly skeptical of received authority, they may become unsatisfied with traditional religious verities and feel unmoored in a morally indifferent cosmos. Here is our modern avatar of anxiety, Woody Allen, playing out the 20th-century generational divide in a conversation with his parents in *Hannah and Her Sisters* (1986):

> MICKEY: Look, you're getting on in years, right? Aren't you afraid of dying?
> FATHER: Why should I be afraid?
> MICKEY: Oh! 'Cause you won't exist!
> FATHER: So?
> MICKEY: That thought doesn't terrify you?

FATHER: Who thinks about such nonsense? Now I'm alive. When I'm dead, I'll be dead.
MICKEY: I don't understand. Aren't you frightened?
FATHER: Of what? I'll be unconscious.
MICKEY: Yeah, I know. But never to exist again!
FATHER: How do you know?
MICKEY: Well, it certainly doesn't look promising.
FATHER: Who knows what'll be? I'll either be unconscious or I won't. If not, I'll deal with it then. I'm not gonna worry now about what's gonna be when I'm unconscious.
MOTHER [OFFSCREEN]: Of course there's a God, you idiot! You don't believe in God?
MICKEY: But if there's a God, then wh-why is there so much evil in the world? Just on a simplistic level. Why-why were there Nazis?
MOTHER: Tell him, Max.
FATHER: How the hell do I know why there were Nazis? I don't know how the can opener works.[84]

People have also lost their comforting faith in the goodness of their institutions. The historian William O'Neill entitled his history of the Baby Boomers' childhood years *American High: The Years of Confidence, 1945–1960*. In that era, everything seemed great. Belching smokestacks were a sign of prosperity. America had a mission to spread democracy around the world. The atom bomb was proof of Yankee ingenuity. Women enjoyed domestic bliss, and Negroes knew their place. Though much about America was indeed good during those years (the economic growth rate was high; rates of crime and other social pathologies were low), today we see it as a fool's paradise. It may not be a coincidence that two of the sectors that underperform in happiness—Americans and Baby Boomers—were the sectors that were most set up for disillusionment in the 1960s. In retrospect we can see that a concern with the environment, nuclear war, American foreign-policy blunders, and racial and gender equality could not be put off forever. Even if they make us more anxious, we are better for being aware of them.

As we become aware of our collective responsibilities, each of us may add a portion of the world's burdens to our own worry list.

Another icon of late 20th-century anxiety, the movie *Sex, Lies, and Videotape* (1989), opens with the baby-boomer protagonist sharing her angst with a psychotherapist:

> Garbage. All I've been thinking about all week is garbage. I can't stop thinking about it. I just . . . I've gotten real concerned over what's gonna happen with all the garbage. I mean, we've got so much of it. You know? I mean, we have to run out of places to put this stuff eventually. The last time I started feeling this way is when that barge was stranded and, you know, it was going around the island and nobody would claim it.

"That barge" refers to a 1987 media frenzy over a barge filled with three thousand tons of New York garbage that was turned away by landfills up and down the Atlantic coast. The therapy scene is by no means fanciful: an experiment in which people watched news stories that had been doctored to have a positive or negative spin found that "participants who watched the negatively valenced bulletin showed increases in both anxious and sad mood, and also showed a significant increase in the tendency to catastrophize a personal worry."[85] Three decades later I suspect that many therapists are listening to patients sharing their fears about terrorism, income inequality, and climate change.

A bit of anxiety is not a bad thing if it motivates people to support policies that would help solve major problems. In earlier decades people might have offloaded their worries to a higher authority, and some still do. In 2000, sixty religious leaders endorsed the Cornwall Declaration on Environmental Stewardship, which addressed the "so-called climate crisis" and other environmental problems by affirming that "God in His mercy has not abandoned sinful people or the created order but has acted throughout history to restore men and women to fellowship with Him and through their stewardship to enhance the beauty and fertility of the earth."[86] I imagine that they and the other 1,500 signatories do not visit therapists to air anxieties about the future of the planet. But as George Bernard Shaw observed, "The fact that a

believer is happier than a skeptic is no more to the point than the fact that a drunken man is happier than a sober one."

Though some amount of anxiety will inevitably attend the contemplation of our political and existential conundrums, it need not drive us to pathology or despair. One of the challenges of modernity is how to grapple with a growing portfolio of responsibilities without worrying ourselves to death. As with all new challenges, we are groping toward the right mixture of old-fashioned and novel stratagems, including human contact, art, meditation, cognitive behavioral therapy, mindfulness, small pleasures, judicious use of pharmaceuticals, reinvigorated service and social organizations, and advice from wise people on how to lead a balanced life.

The media and commentariat, for their part, could reflect on their own role in keeping the country's anxiety at a boil. The trash barge story is emblematic of the media's anxiogenic practices. Lost in the coverage at the time was the fact that the barge was forced on its peregrination not by a shortage of landfill space but by paperwork errors and the media frenzy itself.[87] In the decades since, there have been few follow-ups that debunk misconceptions about a solid-waste crisis (the country actually has plenty of landfills, and they are environmentally sound).[88] Not every problem is a crisis, a plague, or an epidemic, and among the things that happen in the world is that people solve the problems confronting them.

And speaking of panics, what do you think are the greatest threats to the human species? In the 1960s several thinkers advised that they were overpopulation, nuclear war, and boredom.[89] One scientist warned that although the first two might be survivable, the third definitely was not. Boredom, really? You see, as people no longer have to work all day and think about where their next meal is coming from, they will be at a loss as to how to fill their waking hours, and will be vulnerable to debauchery, insanity, suicide, and the sway of religious and political fanatics. Fifty years later it seems to me that we have solved the boredom crisis (or was it an epidemic?) and are instead experiencing the (apocryphal) Chinese curse of living in interesting times. But don't take my word for it. Since 1973 the General Social Survey has asked Americans whether they find life "exciting," "routine," or "dull." Figure 18-4 shows that

over the decades in which fewer Americans said they were “very happy,” more of them said that “life is exciting.”

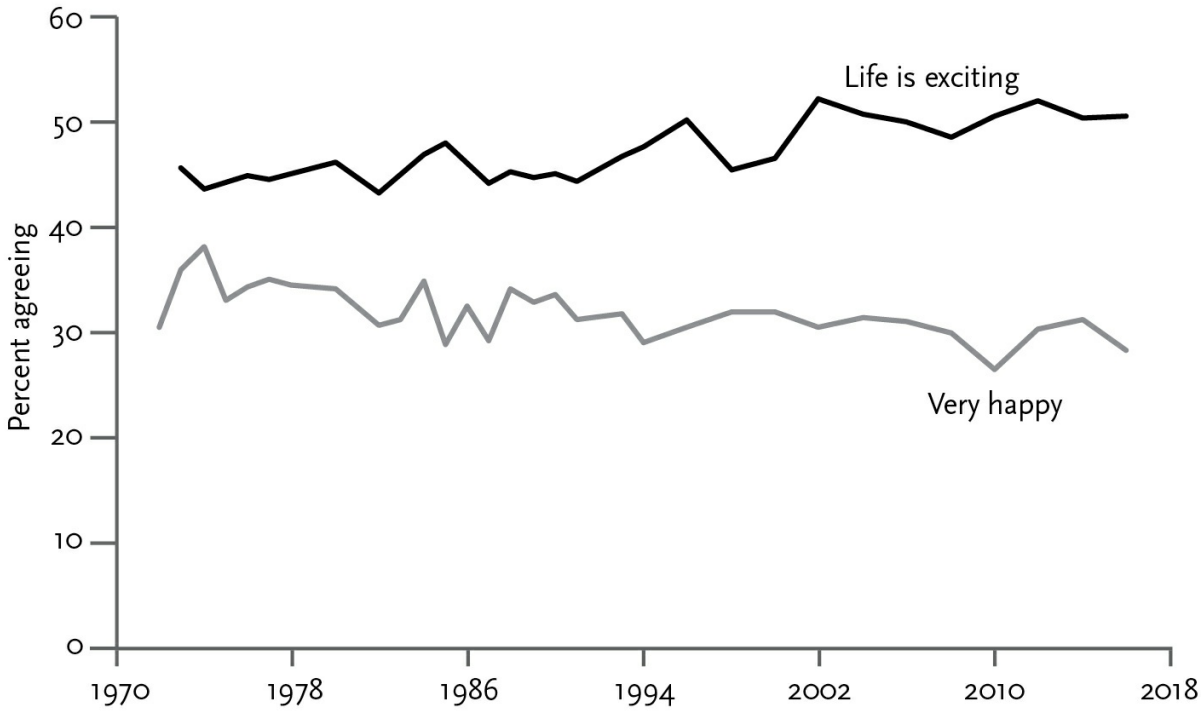


Figure 18-4: Happiness and excitement, US, 1972–2016

Source: “General Social Survey,” Smith, Son, & Schapiro 2015, figs. 1 and 5, updated for 2016 from https://gssdataexplorer.norc.org/projects/15157/variables/438/vshow. Data exclude nonresponses.

The divergence of the curves is not a paradox. Recall that people who feel they lead meaningful lives are more susceptible to stress, struggle, and worry.[90] Consider as well that anxiety has always been a perquisite of adulthood: it rises steeply from the school-age years to the early twenties as people take on adult responsibilities, and then falls steadily over the rest of the life course as they learn to cope with them.[91] Perhaps that is emblematic of the challenges of modernity. Though people today are happier, they are not as happy as one might expect, perhaps because they have an adult’s appreciation of life, with all its worry and all its excitement. The original definition of Enlightenment, after all, was “humankind’s emergence from its self-incurred immaturity.”

CHAPTER 19

EXISTENTIAL THREATS

But are we flirting with disaster? When pessimists are forced to concede that life has been getting better and better for more and more people, they have a retort at the ready. We are cheerfully hurtling toward a catastrophe, they say, like the man who fell off the roof and says "So far so good" as he passes each floor. Or we are playing Russian roulette, and the deadly odds are bound to catch up to us. Or we will be blindsided by a black swan, a four-sigma event far along the tail of the statistical distribution of hazards, with low odds but calamitous harm.

For half a century the four horsemen of the modern apocalypse have been overpopulation, resource shortages, pollution, and nuclear war. They have recently been joined by a cavalry of more exotic knights: nanobots that will engulf us, robots that will enslave us, artificial intelligence that will turn us into raw materials, and Bulgarian teenagers who will brew a genocidal virus or take down the Internet from their bedrooms.

The sentinels for the familiar horsemen tended to be romantics and Luddites. But those who warn of the higher-tech dangers are often scientists and technologists who have deployed their ingenuity to identify ever more ways in which the world will soon end. In 2003 the eminent astrophysicist Martin Rees published a book entitled *Our Final Hour* in which he warned that "humankind is potentially the maker of its own demise" and laid out some dozen ways in which we have "endangered the future of the entire universe." For example, experiments in particle colliders could create a black hole that would annihilate the Earth, or a "strangelet" of compressed quarks that would cause all matter in the cosmos to bind to it and disappear. Rees tapped a rich vein of catastrophism.

The book's Amazon page notes, "Customers who viewed this item also viewed *Global Catastrophic Risks; Our Final Invention: Artificial Intelligence and the End of the Human Era; The End: What Science and Religion Tell Us About the Apocalypse;* and *World War Z: An Oral History of the Zombie War*." Techno-philanthropists have bankrolled research institutes dedicated to discovering new existential threats and figuring out how to save the world from them, including the Future of Humanity Institute, the Future of Life Institute, the Centre for the Study of Existential Risk, and the Global Catastrophic Risk Institute.

How should we think about the existential threats that lurk behind our incremental progress? No one can prophesy that a cataclysm will never happen, and this chapter contains no such assurance. But I will lay out a way to think about them, and examine the major menaces. Three of the threats—overpopulation, resource depletion, and pollution, including greenhouse gases—were discussed in chapter 10, and I will take the same approach here. Some threats are figments of cultural and historical pessimism. Others are genuine, but we can treat them not as apocalypses in waiting but as problems to be solved.



At first glance one might think that the more thought we give to existential risks, the better. The stakes, quite literally, could not be higher. What harm could there be in getting people to think about these terrible risks? The worst that could happen is that we would take some precautions that turn out in retrospect to have been unnecessary.

But apocalyptic thinking has serious downsides. One is that false alarms to catastrophic risks can themselves be catastrophic. The nuclear arms race of the 1960s, for example, was set off by fears of a mythical "missile gap" with the Soviet Union.[1] The 2003 invasion of Iraq was justified by the uncertain but catastrophic possibility that Saddam Hussein was developing nuclear weapons and planning to use them against the United States. (As George W. Bush put it, "We cannot wait for the final proof—the smoking gun—that could come in the form of a mushroom cloud.") And as we shall see, one of the reasons the great powers refuse to take the common-sense pledge that they won't be the first to use nuclear weapons is that they want

to reserve the right to use them against other supposed existential threats such as bioterror and cyberattacks.[2] Sowing fear about hypothetical disasters, far from safeguarding the future of humanity, can endanger it.

A second hazard of enumerating doomsday scenarios is that humanity has a finite budget of resources, brainpower, and anxiety. You can't worry about everything. Some of the threats facing us, like climate change and nuclear war, are unmistakable, and will require immense effort and ingenuity to mitigate. Folding them into a list of exotic scenarios with minuscule or unknown probabilities can only dilute the sense of urgency. Recall that people are poor at assessing probabilities, especially small ones, and instead play out scenarios in their mind's eye. If two scenarios are equally imaginable, they may be considered equally probable, and people will worry about the genuine hazard no more than about the science-fiction plotline. And the more ways people can imagine bad things happening, the higher their estimate that something bad *will* happen.

And that leads to the greatest danger of all: that people will think, as a recent *New York Times* article put it, "These grim facts should lead any reasonable person to conclude that humanity is screwed."[3] If humanity is screwed, why sacrifice *anything* to reduce potential risks? Why forgo the convenience of fossil fuels, or exhort governments to rethink their nuclear weapons policies? Eat, drink, and be merry, for tomorrow we die! A 2013 survey in four English-speaking countries showed that among the respondents who believe that our way of life will probably end in a century, a majority endorsed the statement "The world's future looks grim so we have to focus on looking after ourselves and those we love."[4]

Few writers on technological risk give much thought to the cumulative psychological effects of the drumbeat of doom. As Elin Kelsey, an environmental communicator, points out, "We have media ratings to protect children from sex or violence in movies, but we think nothing of inviting a scientist into a second grade classroom and telling the kids the planet is ruined. A quarter of (Australian) children are so troubled about the state of the world that they honestly believe it will come to an end before they get older."[5] According to recent polls, so do 15 percent of people worldwide, and between a quarter and a third of Americans.[6] In *The*

Progress Paradox, the journalist Gregg Easterbrook suggests that a major reason that Americans are not happier, despite their rising objective fortunes, is "collapse anxiety": the fear that civilization may implode and there's nothing anyone can do about it.



Of course, people's emotions are irrelevant if the risks are real. But risk assessments fall apart when they deal with highly improbable events in complex systems. Since we cannot replay history thousands of times and count the outcomes, a statement that some event will occur with a probability of .01 or .001 or .0001 or .00001 is essentially a readout of the assessor's subjective confidence. This includes mathematical analyses in which scientists plot the distribution of events in the past (like wars or cyberattacks) and show they fall into a power-law distribution, one with "fat" or "thick" tails, in which extreme events are highly improbable but not astronomically improbable.[7] The math is of little help in calibrating the risk, because the scattershot data along the tail of the distribution generally misbehave, deviating from a smooth curve and making estimation impossible. All we know is that very bad things can happen.

That takes us back to subjective readouts, which tend to be inflated by the Availability and Negativity biases and by the gravitas market (chapter 4).[8] Those who sow fear about a dreadful prophecy may be seen as serious and responsible, while those who are measured are seen as complacent and naïve. Despair springs eternal. At least since the Hebrew prophets and the Book of Revelation, seers have warned their contemporaries about an imminent doomsday. Forecasts of End Times are a staple of psychics, mystics, televangelists, nut cults, founders of religions, and men pacing the sidewalk with sandwich boards saying "Repent!"[9] The storyline that climaxes in harsh payback for technological hubris is an archetype of Western fiction, including Promethean fire, Pandora's box, Icarus's flight, Faust's bargain, the Sorcerer's Apprentice, Frankenstein's monster, and, from Hollywood, more than 250 end-of-the-world flicks.[10] As the historian of science Eric Zencey has observed, "There is seduction in apocalyptic thinking. If one lives in the Last Days, one's actions,

one's very life, take on historical meaning and no small measure of poignance."[11]

Scientists and technologists are by no means immune. Remember the Y2K bug?[12] In the 1990s, as the turn of the millennium drew near, computer scientists began to warn the world of an impending catastrophe. In the early decades of computing, when information was expensive, programmers often saved a couple of bytes by representing a year by its last two digits. They figured that by the time the year 2000 came around and the implicit "19" was no longer valid, the programs would be long obsolete. But complicated software is replaced slowly, and many old programs were still running on institutional mainframes and embedded in chips. When 12:00 A.M. on January 1, 2000, arrived and the digits rolled over, a program would think it was 1900 and would crash or go haywire (presumably because it would divide some number by the difference between what it thought was the current year and the year 1900, namely zero, though why a program would do this was never made clear). At that moment, bank balances would be wiped out, elevators would stop between floors, incubators in maternity wards would shut off, water pumps would freeze, planes would fall from the sky, nuclear power plants would melt down, and ICBMs would be launched from their silos.

And these were the hardheaded predictions from tech-savvy authorities (such as President Bill Clinton, who warned the nation, "I want to stress the urgency of the challenge. This is not one of the summer movies where you can close your eyes during the scary part"). Cultural pessimists saw the Y2K bug as comeuppance for enthralling our civilization to technology. Among religious thinkers, the numerological link to Christian millennialism was irresistible. The Reverend Jerry Falwell declared, "I believe that Y2K may be God's instrument to shake this nation, humble this nation, awaken this nation and from this nation start revival that spreads the face of the earth before the Rapture of the Church." A hundred billion dollars was spent worldwide on reprogramming software for Y2K Readiness, a challenge that was likened to replacing every bolt in every bridge in the world.

As a former assembly language programmer I was skeptical of the doomsday scenarios, and fortuitously I was in New Zealand, the

first country to welcome the new millennium, at the fateful moment. Sure enough, at 12:00 A.M. on January 1, nothing happened (as I quickly reassured family members back home on a fully functioning telephone). The Y2K reprogrammers, like the elephant-repellent salesman, took credit for averting disaster, but many countries and small businesses had taken their chances without any Y2K preparation, and they had no problems either. Though some software needed updating (one program on my laptop displayed "January 1, 19100"), it turned out that very few programs, particularly those embedded in machines, had both contained the bug and performed furious arithmetic on the current year. The threat turned out to be barely more serious than the lettering on the sidewalk prophet's sandwich board. The Great Y2K Panic does not mean that all warnings of potential catastrophes are false alarms, but it reminds us that we are vulnerable to techno-apocalyptic delusions.



How should we think about catastrophic threats? Let's begin with the greatest existential question of all, the fate of our species. As with the more parochial question of our fate as individuals, we assuredly have to come to terms with our mortality. Biologists joke that to a first approximation all species are extinct, since that was the fate of at least 99 percent of the species that ever lived. A typical mammalian species lasts around a million years, and it's hard to insist that *Homo sapiens* will be an exception. Even if we had remained technologically humble hunter-gatherers, we would still be living in a geological shooting gallery.[13] A burst of gamma rays from a supernova or collapsed star could irradiate half the planet, brown the atmosphere, and destroy the ozone layer, allowing ultraviolet light to irradiate the other half.[14] Or the Earth's magnetic field could flip, exposing the planet to an interlude of lethal solar and cosmic radiation. An asteroid could slam into the Earth, flattening thousands of square miles and kicking up debris that would black out the sun and drench us with corrosive rain. Supervolcanoes or massive lava flows could choke us with ash, CO_2, and sulfuric acid. A black hole could wander into the solar system and pull the Earth out of its orbit or suck it into oblivion. Even if the

species manages to survive for a billion more years, the Earth and solar system will not: the sun will start to use up its hydrogen, become denser and hotter, and boil away our oceans on its way to becoming a red giant.

Technology, then, is not the reason that our species must someday face the Grim Reaper. Indeed, technology is our best hope for cheating death, at least for a while. As long as we are entertaining hypothetical disasters far in the future, we must also ponder hypothetical advances that would allow us to survive them, such as growing food under lights powered with nuclear fusion, or synthesizing it in industrial plants like biofuel.[15] Even technologies of the not-so-distant future could save our skin. It's technically feasible to track the trajectories of asteroids and other "extinction-class near-Earth objects," spot the ones that are on a collision course with the Earth, and nudge them off course before they send us the way of the dinosaurs.[16] NASA has also figured out a way to pump water at high pressure into a supervolcano and extract the heat for geothermal energy, cooling the magma enough that it would never blow its top.[17] Our ancestors were powerless to stop these lethal menaces, so in that sense technology has not made this a uniquely dangerous era in the history of our species but a uniquely safe one.

For this reason, the techno-apocalyptic claim that ours is the first civilization that can destroy itself is misconceived. As Ozymandias reminds the traveler in Percy Bysshe Shelley's poem, most of the civilizations that have ever existed have been destroyed. Conventional history blames the destruction on external events like plagues, conquests, earthquakes, or weather. But David Deutsch points out that those civilizations could have thwarted the fatal blows had they had better agricultural, medical, or military technology:

> Before our ancestors learned how to make fire artificially (and many times since then too), people must have died of exposure literally on top of the means of making the fires that would have saved their lives, because they did not know how. In a parochial sense, the weather killed them; but the deeper explanation is lack of knowledge. Many of the hundreds of

> millions of victims of cholera throughout history must have died within sight of the hearths that could have boiled their drinking water and saved their lives; but, again, they did not know that. Quite generally, the distinction between a "natural" disaster and one brought about by ignorance is parochial. Prior to every natural disaster that people once used to think of as "just happening," or being ordained by gods, we now see many options that the people affected failed to take—or, rather, to create. And all those options add up to the overarching option that they failed to create, namely that of forming a scientific and technological civilization like ours. Traditions of criticism. An Enlightenment.[18]



Prominent among the existential risks that supposedly threaten the future of humanity is a 21st-century version of the Y2K bug. This is the danger that we will be subjugated, intentionally or accidentally, by artificial intelligence (AI), a disaster sometimes called the Robopocalypse and commonly illustrated with stills from the *Terminator* movies. As with Y2K, some smart people take it seriously. Elon Musk, whose company makes artificially intelligent self-driving cars, called the technology "more dangerous than nukes." Stephen Hawking, speaking through his artificially intelligent synthesizer, warned that it could "spell the end of the human race."[19] But among the smart people who aren't losing sleep are most experts in artificial intelligence and most experts in human intelligence.[20]

The Robopocalypse is based on a muzzy conception of intelligence that owes more to the Great Chain of Being and a Nietzschean will to power than to a modern scientific understanding.[21] In this conception, intelligence is an all-powerful, wish-granting potion that agents possess in different amounts. Humans have more of it than animals, and an artificially intelligent computer or robot of the future ("an AI," in the new count-noun usage) will have more of it than humans. Since we humans have used our moderate endowment to domesticate or exterminate less well-endowed animals (and since technologically advanced societies have enslaved or annihilated technologically primitive ones), it follows that a supersmart AI would do the same to us. Since an AI

will think millions of times faster than we do, and use its superintelligence to recursively improve its superintelligence (a scenario sometimes called "foom," after the comic-book sound effect), from the instant it is turned on we will be powerless to stop it.[22]

But the scenario makes about as much sense as the worry that since jet planes have surpassed the flying ability of eagles, someday they will swoop out of the sky and seize our cattle. The first fallacy is a confusion of intelligence with motivation—of beliefs with desires, inferences with goals, thinking with wanting. Even if we did invent superhumanly intelligent robots, why would they *want* to enslave their masters or take over the world? Intelligence is the ability to deploy novel means to attain a goal. But the goals are extraneous to the intelligence: being smart is not the same as wanting something. It just so happens that the intelligence in one system, *Homo sapiens,* is a product of Darwinian natural selection, an inherently competitive process. In the brains of that species, reasoning comes bundled (to varying degrees in different specimens) with goals such as dominating rivals and amassing resources. But it's a mistake to confuse a circuit in the limbic brain of a certain species of primate with the very nature of intelligence. An artificially intelligent system that was designed rather than evolved could just as easily think like shmoos, the blobby altruists in Al Capp's comic strip *Li'l Abner,* who deploy their considerable ingenuity to barbecue themselves for the benefit of human eaters. There is no law of complex systems that says that intelligent agents must turn into ruthless conquistadors. Indeed, we know of one highly advanced form of intelligence that evolved without this defect. They're called women.

The second fallacy is to think of intelligence as a boundless continuum of potency, a miraculous elixir with the power to solve any problem, attain any goal.[23] The fallacy leads to nonsensical questions like when an AI will "exceed human-level intelligence," and to the image of an ultimate "Artificial General Intelligence" (AGI) with God-like omniscience and omnipotence. Intelligence is a contraption of gadgets: software modules that acquire, or are programmed with, knowledge of how to pursue various goals in various domains.[24] People are equipped to find food, win friends and influence people, charm prospective mates, bring up children,

move around in the world, and pursue other human obsessions and pastimes. Computers may be programmed to take on some of these problems (like recognizing faces), not to bother with others (like charming mates), and to take on still other problems that humans can't solve (like simulating the climate or sorting millions of accounting records). The problems are different, and the kinds of knowledge needed to solve them are different. Unlike Laplace's demon, the mythical being that knows the location and momentum of every particle in the universe and feeds them into equations for physical laws to calculate the state of everything at any time in the future, a real-life knower has to acquire information about the messy world of objects and people by engaging with it one domain at a time. Understanding does not obey Moore's Law: knowledge is acquired by formulating explanations and testing them against reality, not by running an algorithm faster and faster.[25] Devouring the information on the Internet will not confer omniscience either: big data is still finite data, and the universe of knowledge is infinite.

For these reasons, many AI researchers are annoyed by the latest round of hype (the perennial bane of AI) which has misled observers into thinking that Artificial General Intelligence is just around the corner.[26] As far as I know, there are no projects to build an AGI, not just because it would be commercially dubious but because the concept is barely coherent. The 2010s have, to be sure, brought us systems that can drive cars, caption photographs, recognize speech, and beat humans at Jeopardy!, Go, and Atari computer games. But the advances have not come from a better understanding of the workings of intelligence but from the brute-force power of faster chips and bigger data, which allow the programs to be trained on millions of examples and generalize to similar new ones. Each system is an idiot savant, with little ability to leap to problems it was not set up to solve, and a brittle mastery of those it was. A photo-captioning program labels an impending plane crash "An airplane is parked on the tarmac"; a game-playing program is flummoxed by the slightest change in the scoring rules.[27] Though the programs will surely get better, there are no signs of foom. Nor have any of these programs made a move toward taking over the lab or enslaving their programmers.

Even if an AGI tried to exercise a will to power, without the cooperation of humans it would remain an impotent brain in a vat. The computer scientist Ramez Naam deflates the bubbles surrounding foom, a technological Singularity, and exponential self-improvement:

> Imagine that you are a superintelligent AI running on some sort of microprocessor (or perhaps, millions of such microprocessors). In an instant, you come up with a design for an even faster, more powerful microprocessor you can run on. Now . . . drat! You have to actually *manufacture* those microprocessors. And those fabs [fabrication plants] take tremendous energy, they take the input of materials imported from all around the world, they take highly controlled internal environments which require airlocks, filters, and all sorts of specialized equipment to maintain, and so on. All of this takes time and energy to acquire, transport, integrate, build housing for, build power plants for, test, and manufacture. The real world has gotten in the way of your upward spiral of self-transcendence.[28]

The real world gets in the way of many digital apocalypses. When HAL gets uppity, Dave disables it with a screwdriver, leaving it pathetically singing "A Bicycle Built for Two" to itself. Of course, one can always imagine a Doomsday Computer that is malevolent, universally empowered, always on, and tamperproof. The way to deal with this threat is straightforward: don't build one.

As the prospect of evil robots started to seem too kitschy to take seriously, a new digital apocalypse was spotted by the existential guardians. This storyline is based not on Frankenstein or the Golem but on the Genie granting us three wishes, the third of which is needed to undo the first two, and on King Midas ruing his ability to turn everything he touched into gold, including his food and his family. The danger, sometimes called the Value Alignment Problem, is that we might give an AI a goal and then helplessly stand by as it relentlessly and literal-mindedly implemented its interpretation of that goal, the rest of our interests be damned. If we gave an AI the goal of maintaining the water level behind a dam, it might flood a

town, not caring about the people who drowned. If we gave it the goal of making paper clips, it might turn all the matter in the reachable universe into paper clips, including our possessions and bodies. If we asked it to maximize human happiness, it might implant us all with intravenous dopamine drips, or rewire our brains so we were happiest sitting in jars, or, if it had been trained on the concept of happiness with pictures of smiling faces, tile the galaxy with trillions of nanoscopic pictures of smiley-faces.[29]

I am not making these up. These are the scenarios that supposedly illustrate the existential threat to the human species of advanced artificial intelligence. They are, fortunately, self-refuting.[30] They depend on the premises that (1) humans are so gifted that they can design an omniscient and omnipotent AI, yet so moronic that they would give it control of the universe without testing how it works, and (2) the AI would be so brilliant that it could figure out how to transmute elements and rewire brains, yet so imbecilic that it would wreak havoc based on elementary blunders of misunderstanding. The ability to choose an action that best satisfies conflicting goals is not an add-on to intelligence that engineers might slap themselves in the forehead for forgetting to install; it *is* intelligence. So is the ability to interpret the intentions of a language user in context. Only in a television comedy like *Get Smart* does a robot respond to "Grab the waiter" by hefting the maître d' over his head, or "Kill the light" by pulling out a pistol and shooting it.

When we put aside fantasies like foom, digital megalomania, instant omniscience, and perfect control of every molecule in the universe, artificial intelligence is like any other technology. It is developed incrementally, designed to satisfy multiple conditions, tested before it is implemented, and constantly tweaked for efficacy and safety (chapter 12). As the AI expert Stuart Russell puts it, "No one in civil engineering talks about 'building bridges that don't fall down.' They just call it 'building bridges.'" Likewise, he notes, AI that is beneficial rather than dangerous is simply AI.[31]

Artificial intelligence, to be sure, poses the more mundane challenge of what to do about the people whose jobs are eliminated by automation. But the jobs won't be eliminated *that* quickly. The observation of a 1965 report from NASA still holds: "Man is the lowest-cost, 150-pound, nonlinear, all-purpose computer system

which can be mass-produced by unskilled labor."[32] Driving a car is an easier engineering problem than unloading a dishwasher, running an errand, or changing a diaper, and at the time of this writing we're still not ready to loose self-driving cars on city streets.[33] Until the day when battalions of robots are inoculating children and building schools in the developing world, or for that matter building infrastructure and caring for the aged in ours, there will be plenty of work to be done. The same kind of ingenuity that has been applied to the design of software and robots could be applied to the design of government and private-sector policies that match idle hands with undone work.[34]



If not robots, then what about hackers? We all know the stereotypes: Bulgarian teenagers, young men wearing flip-flops and drinking Red Bull, and, as Donald Trump put it in a 2016 presidential debate, "somebody sitting on their bed that weighs 400 pounds." According to a common line of thinking, as technology advances, the destructive power available to an individual will multiply. It's only a matter of time before a single nerd or terrorist builds a nuclear bomb in his garage, or genetically engineers a plague virus, or takes down the Internet. And with the modern world so dependent on technology, an outage could bring on panic, starvation, and anarchy. In 2002 Martin Rees publicly offered the bet that "by 2020, bioterror or bioerror will lead to one million casualties in a single event."[35]

How should we think about these nightmares? Sometimes they are intended to get people to take security vulnerabilities more seriously, under the theory (which we will encounter again in this chapter) that the most effective way to mobilize people into adopting responsible policies is to scare the living daylights out of them. Whether or not that theory is true, no one would argue that we should be complacent about cybercrime or disease outbreaks, which are already afflictions of the modern world (I'll turn to the nuclear threat in the next section). Specialists in computer security and epidemiology constantly try to stay one step ahead of these threats, and countries should clearly invest in both. Military, financial, energy, and Internet infrastructure should be made more secure and resilient.[36] Treaties and safeguards against biological

weapons can be strengthened.[37] Transnational public health networks that can identify and contain outbreaks before they become pandemics should be expanded. Together with better vaccines, antibiotics, antivirals, and rapid diagnostic tests, they will be as useful in combatting human-made pathogens as natural ones.[38] Countries will also need to maintain antiterrorist and crime-prevention measures such as surveillance and interception.[39]

In each of these arms races, the defense will never, of course, be invincible. There may be episodes of cyberterrorism and bioterrorism, and the probability of a catastrophe will never be zero. The question I'll consider is whether the grim facts should lead any reasonable person to conclude that humanity is screwed. Is it inevitable that the black hats will someday outsmart the white hats and bring civilization to its knees? Has technological progress ironically left the world newly fragile?

No one can know with certainty, but when we replace worst-case dread with calmer consideration, the gloom starts to lift. Let's start with the historical sweep: whether mass destruction by an individual is the natural outcome of the process set in motion by the Scientific Revolution and the Enlightenment. According to this narrative, technology allows people to accomplish more and more with less and less, so given enough time, it will allow one individual to do anything—and given human nature, that means destroy everything.

But Kevin Kelly, the founding editor of *Wired* magazine and author of *What Technology Wants,* argues that this is in fact not the way technology progresses.[40] Kelly was the co-organizer (with Stewart Brand) of the first Hackers' Conference in 1984, and since that time he has repeatedly been told that any day now technology will outrun humans' ability to domesticate it. Yet despite the massive expansion of technology in those decades (including the invention of the Internet), that has not happened. Kelly suggests that there is a reason: "The more powerful technologies become, the more socially embedded they become." Cutting-edge technology requires a network of cooperators who are connected to still wider social networks, many of them committed to keeping people safe from technology and from each other. (As we saw in chapter 12, technologies get safer over time.) This undermines the Hollywood

cliché of the solitary evil genius who commands a high-tech lair in which the technology miraculously works by itself. Kelly suggests that because of the social embeddedness of technology, the destructive power of a solitary individual has in fact not increased over time:

> The more sophisticated and powerful a technology, the more people are needed to weaponize it. And the more people needed to weaponize it, the more societal controls work to defuse, or soften, or prevent harm from happening. I add one additional thought. Even if you had a budget to hire a team of scientists whose job it was to develop a species-extinguishing bio weapon, or to take down the internet to zero, you probably still couldn't do it. That's because hundreds of thousands of man-years of effort have gone into preventing this from happening, in the case of the internet, and millions of years of evolutionary effort to prevent species death, in the case of biology. It is extremely hard to do, and the smaller the rogue team, the harder. The larger the team, the more societal influences.[41]

All this is abstract—one theory of the natural arc of technology versus another. How does it apply to the actual dangers we face so that we can ponder whether humanity is screwed? The key is not to fall for the Availability bias and assume that if we can imagine something terrible, it is bound to happen. The real danger depends on the numbers: the proportion of people who want to cause mayhem or mass murder, the proportion of that genocidal sliver with the competence to concoct an effective cyber or biological weapon, the sliver of that sliver whose schemes will actually succeed, and the sliver of the sliver of the sliver that accomplishes a civilization-ending cataclysm rather than a nuisance, a blow, or even a disaster, after which life goes on.

Start with the number of maniacs. Does the modern world harbor a significant number of people who want to visit murder and mayhem on strangers? If it did, life would be unrecognizable. They could go on stabbing rampages, spray gunfire into crowds, mow down pedestrians with cars, set off pressure-cooker bombs, and

shove people off sidewalks and subway platforms into the path of hurtling vehicles. The researcher Gwern Branwen has calculated that a disciplined sniper or serial killer could murder hundreds of people without getting caught.[42] A saboteur with a thirst for havoc could tamper with supermarket products, lace some pesticide into a feedlot or water supply, or even just make an anonymous call claiming to have done so, and it could cost a company hundreds of millions of dollars in recalls, and a country billions in lost exports.[43] Such attacks *could* take place in every city in the world many times a day, but in fact take place somewhere or other every few years (leading the security expert Bruce Schneier to ask, "Where are all the terrorist attacks?").[44] Despite all the terror generated by terrorism, there must be very few individuals out there waiting for an opportunity to wreak wanton destruction.

Among these depraved individuals, how large is the subset with the intelligence and discipline to develop an effective cyber- or bioweapon? Far from being criminal masterminds, most terrorists are bumbling schlemiels.[45] Typical specimens include the Shoe Bomber, who unsuccessfully tried to down an airliner by igniting explosives in his shoe; the Underwear Bomber, who unsuccessfully tried to down an airliner by detonating explosives in his underwear; the ISIS trainer who demonstrated an explosive vest to his class of aspiring suicide terrorists and blew himself and all twenty-one of them to bits; the Tsarnaev brothers, who followed up on their bombing of the Boston Marathon by murdering a police officer in an unsuccessful attempt to steal his gun, and then embarked on a carjacking, a robbery, and a Hollywood-style car chase during which one brother ran over the other; and Abdullah al-Asiri, who tried to assassinate a Saudi deputy minister with an improvised explosive device hidden in his anus and succeeded only in obliterating himself.[46] (An intelligence analysis firm reported that the event "signals a paradigm shift in suicide bombing tactics.")[47] Occasionally, as on September 11, 2001, a team of clever and disciplined terrorists gets lucky, but most successful plots are low-tech attacks on target-rich gatherings, and (as we saw in chapter 13) kill very few people. Indeed, I venture that the proportion of brilliant terrorists in a population is even smaller than the proportion of terrorists multiplied by the proportion of brilliant

people. Terrorism is a demonstrably ineffective tactic, and a mind that delights in senseless mayhem for its own sake is probably not the brightest bulb in the box.[48]

Now take the small number of brilliant weaponeers and cut it down still further by the proportion with the cunning and luck to outsmart the world's police, security experts, and counterterrorism forces. The number may not be zero, but it surely isn't high. As with all complex undertakings, many heads are better than one, and an organization of bio- or cyberterrorists could be more effective than a lone mastermind. But that's where Kelly's observation kicks in: the leader would have to recruit and manage a team of co-conspirators who exercised perfect secrecy, competence, and loyalty to the depraved cause. As the size of the team increases, so do the odds of detection, betrayal, infiltrators, blunders, and stings.[49]

Serious threats to the integrity of a country's infrastructure are likely to require the resources of a state.[50] Software hacking is not enough; the hacker needs detailed knowledge about the physical construction of the systems he hopes to sabotage. When the Iranian nuclear centrifuges were compromised in 2010 by the Stuxnet worm, it required a coordinated effort by two technologically sophisticated nations, the United States and Israel. State-based cyber-sabotage escalates the malevolence from terrorism to a kind of warfare, where the constraints of international relations, such as norms, treaties, sanctions, retaliation, and military deterrence, inhibit aggressive attacks, as they do in conventional "kinetic" warfare. As we saw in chapter 11, these constraints have become increasingly effective at preventing interstate war.

Nonetheless, American military officials have warned of a "digital Pearl Harbor" and a "Cyber-Armageddon" in which foreign states or sophisticated terrorist organizations would hack into American sites to crash planes, open floodgates, melt down nuclear power plants, black out power grids, and take down the financial system. Most cybersecurity experts consider the threats to be inflated—a pretext for more military funding, power, and restrictions on Internet privacy and freedom.[51] The reality is that so far, not a single person has ever been injured by a cyberattack. The strikes have mostly been nuisances such as doxing, namely leaking confidential documents or e-mail (as in the Russian meddling in the

2016 American election), and distributed denial-of-service attacks, where a botnet (an array of hacked computers) floods a site with traffic. Schneier explains, "A real-world comparison might be if an army invaded a country, then all got in line in front of people at the Department of Motor Vehicles so they couldn't renew their licenses. If that's what war looks like in the 21st century, we have little to fear."[52]

For the techno-doomsters, though, tiny probabilities are no comfort. All it will take, they say, is for *one* hacker or terrorist or rogue state to get lucky, and it's game over. That's why the word *threat* is preceded with *existential,* giving the adjective its biggest workout since the heyday of Sartre and Camus. In 2001 the chairman of the Joint Chiefs of Staff warned that "the biggest existential threat out there is cyber" (prompting John Mueller to comment, "As opposed to small existential threats, presumably").

This existentialism depends on a casual slide from nuisance to adversity to tragedy to disaster to annihilation. Suppose there *was* an episode of bioterror or bioerror that killed a million people. Suppose a hacker did manage to take down the Internet. Would the country literally *cease to exist*? Would civilization collapse? Would the human species go extinct? A little proportion, please—even Hiroshima continues to exist! The assumption is that modern people are so helpless that if the Internet ever went down, farmers would stand by and watch their crops rot while dazed city-dwellers starved. But disaster sociology (yes, there is such a field) has shown that people are highly resilient in the face of catastrophe.[53] Far from looting, panicking, or sinking into paralysis, they spontaneously cooperate to restore order and improvise networks for distributing goods and services. Enrico Quarantelli noted that within minutes of the Hiroshima nuclear blast,

> survivors engaged in search and rescue, helped one another in whatever ways they could, and withdrew in controlled flight from burning areas. Within a day, apart from the planning undertaken by the government and military organizations that partly survived, other groups partially restored electric power to some areas, a steel company with 20 percent of workers attending began operations again, employees of the 12 banks

> in Hiroshima assembled in the Hiroshima branch in the city and began making payments, and trolley lines leading into the city were completely cleared with partial traffic restored the following day.[54]

One reason that the death toll of World War II was so horrendous is that war planners on both sides adopted the strategy of bombing civilians until their societies collapsed—which they never did.[55] And no, this resilience was not a relic of the homogeneous communities of yesteryear. Cosmopolitan 21st-century societies can cope with disasters, too, as we saw in the orderly evacuation of Lower Manhattan following the 9/11 attacks in the United States, and the absence of panic in Estonia in 2007 when the country was struck with a devastating denial-of-service cyberattack.[56]

Bioterrorism may be another phantom menace. Biological weapons, renounced in a 1972 international convention by virtually every nation, have played no role in modern warfare. The ban was driven by a widespread revulsion at the very idea, but the world's militaries needed little convincing, because tiny living things make lousy weapons. They easily blow back and infect the weaponeers, warriors, and citizens of the side that uses them (just imagine the Tsarnaev brothers with anthrax spores). And whether a disease outbreak fizzles out or (literally) goes viral depends on intricate network dynamics that even the best epidemiologists cannot predict.[57]

Biological agents are particularly ill-suited to terrorists, whose goal, recall, is not damage but theater (chapter 13).[58] The biologist Paul Ewald notes that natural selection among pathogens works against the terrorist's goal of sudden and spectacular devastation.[59] Germs that depend on rapid person-to-person contagion, like the common-cold virus, are selected to keep their hosts alive and ambulatory so they can shake hands with and sneeze on as many people as possible. Germs get greedy and kill their hosts only if they have some other way of getting from body to body, like mosquitoes (for malaria), a contaminable water supply (for cholera), or trenches packed with injured soldiers (for the 1918 Spanish flu). Sexually transmitted pathogens, like HIV and syphilis, are somewhere in between, needing a long and symptomless incubation period during

which hosts can infect their partners, after which the germs do their damage. Virulence and contagion thus trade off, and the evolution of germs will frustrate the terrorist's aspiration to launch a headline-worthy epidemic that is both swift and lethal. Theoretically, a bioterrorist could try to bend the curve with a pathogen that is virulent, contagious, and durable enough to survive outside bodies. But breeding such a fine-tuned germ would require Nazi-like experiments on living humans that even terrorists (to say nothing of teenagers) are unlikely to carry off. It may be more than just luck that the world so far has seen just one successful bioterror attack (the 1984 tainting of salad with salmonella in an Oregon town by the Rajneeshee religious cult, which killed no one) and one spree killing (the 2001 anthrax mailings, which killed five).[60]

To be sure, advances in synthetic biology, such as the gene-editing technique CRISPR-Cas9, make it easier to tinker with organisms, including pathogens. But it's difficult to re-engineer a complex evolved trait by inserting a gene or two, since the effects of any gene are intertwined with the rest of the organism's genome. Ewald notes, "I don't think that we are close to understanding how to insert combinations of genetic variants in any given pathogen that act in concert to generate high transmissibility and stably high virulence for humans."[61] The biotech expert Robert Carlson adds that "one of the problems with building any flu virus is that you need to keep your production system (cells or eggs) alive long enough to make a useful quantity of something that is trying to kill that production system. . . . Booting up the resulting virus is still very, very difficult. . . . I would not dismiss this threat completely, but frankly I am much more worried about what Mother Nature is throwing at us all the time."[62]

And crucially, advances in biology work the other way as well: they also make it easier for the good guys (and there are many more of them) to identify pathogens, invent antibiotics that overcome antibiotic resistance, and rapidly develop vaccines.[63] An example is the Ebola vaccine, developed in the waning days of the 2014–15 emergency, after public health efforts had capped the toll at twelve thousand deaths rather than the millions that the media had foreseen. Ebola thus joined a list of other falsely predicted pandemics such as Lassa fever, hantavirus, SARS, mad cow disease,

bird flu, and swine flu.[64] Some of them never had the potential to go pandemic in the first place because they are contracted from animals or food rather than in an exponential tree of person-to-person infections. Others were nipped by medical and public health interventions. Of course no one knows for sure whether an evil genius will someday overcome the world's defenses and loose a plague upon the world for fun, vengeance, or a sacred cause. But journalistic habits and the Availability and Negativity biases inflate the odds, which is why I have taken Sir Martin up on his bet. By the time you read this you may know who has won.[65]



Some of the threats to humanity are fanciful or infinitesimal, but one is real: nuclear war.[66] The world has more than ten thousand nuclear weapons distributed among nine countries.[67] Many are mounted on missiles or loaded in bombers and can be delivered within hours or less to thousands of targets. Each is designed to cause stupendous destruction: a single one could destroy a city, and collectively they could kill hundreds of millions of people by blast, heat, radiation, and radioactive fallout. If India and Pakistan went to war and detonated a hundred of their weapons, twenty million people could be killed right away, and soot from the firestorms could spread through the atmosphere, devastate the ozone layer, and cool the planet for more than a decade, which in turn would slash food production and starve more than a billion people. An all-out exchange between the United States and Russia could cool the Earth by 8°C for years and create a nuclear winter (or at least autumn) that would starve even more.[68] Whether or not nuclear war would (as is often asserted) destroy civilization, the species, or the planet, it would be horrific beyond imagining.

Soon after atom bombs were dropped on Japan, and the United States and the Soviet Union embarked on a nuclear arms race, a new form of historical pessimism took root. In this Promethean narrative, humanity has wrested deadly knowledge from the gods, and, lacking the wisdom to use it responsibly, is doomed to annihilate itself. In one version, it is not just humanity that is fated to follow this tragic arc but any advanced intelligence. That explains why we have never been visited by space aliens, even though the universe must be teeming with them (the so-called Fermi Paradox,

after Enrico Fermi, who first wondered about it). Once life originates on a planet, it inevitably progresses to intelligence, civilization, science, nuclear physics, nuclear weapons, and suicidal war, exterminating itself before it can leave its solar system.

For some intellectuals the invention of nuclear weapons indicts the enterprise of science—indeed, of modernity itself—because the threat of a holocaust cancels out whatever gifts science may have bestowed upon us. The indictment of science seems misplaced, given that since the dawn of the nuclear age, when mainstream scientists were sidelined from nuclear policy, it's been physical scientists who have waged a vociferous campaign to remind the world of the danger of nuclear war and to urge nations to disarm. Among the illustrious historic figures are Niels Bohr, J. Robert Oppenheimer, Albert Einstein, Isidor Rabi, Leo Szilard, Joseph Rotblat, Harold Urey, C. P. Snow, Victor Weisskopf, Philip Morrison, Herman Feshbach, Henry Kendall, Theodore Taylor, and Carl Sagan. The movement continues among high-profile scientists today, including Stephen Hawking, Michio Kaku, Lawrence Krauss, and Max Tegmark. Scientists have founded the major activist and watchdog organizations, including the Union of Concerned Scientists, the Federation of American Scientists, the Committee for Nuclear Responsibility, the Pugwash Conferences, and the *Bulletin of the Atomic Scientists,* whose cover shows the famous Doomsday Clock, now set at two and a half minutes to midnight.[69]

Physical scientists, unfortunately, often consider themselves experts in political psychology, and many seem to embrace the folk theory that the most effective way to mobilize public opinion is to whip people into a lather of fear and dread. The Doomsday Clock, despite adorning a journal with "Scientists" in its title, does not track objective indicators of nuclear security; rather, it's a propaganda stunt intended, in the words of its founder, "to preserve civilization by scaring men into rationality."[70] The clock's minute hand was farther from midnight in 1962, the year of the Cuban Missile Crisis, than it was in the far calmer 2007, in part because the editors, worried that the public had become too complacent, redefined "doomsday" to include climate change.[71] And in their campaign to shake people out of their apathy, scientific experts have made some not-so-prescient predictions:

> Only the creation of a world government can prevent the impending self-destruction of mankind.
>
> —Albert Einstein, 1950[72]

> I have a firm belief that unless we have more serious and sober thought on various aspects of the strategic problem . . . we are not going to reach the year 2000—and maybe not even the year 1965—without a cataclysm.
>
> —Herman Kahn, 1960[73]

> Within, at the most, ten years, some of those [nuclear] bombs are going off. I am saying this as responsibly as I can. That is the certainty.
>
> —C. P. Snow, 1961[74]

> I am completely certain—there is not the slightest doubt in my mind—that by the year 2000, you [students] will all be dead.
>
> —Joseph Weizenbaum, 1976[75]

They are joined by experts such as the political scientist Hans Morgenthau, a famous exponent of "realism" in international relations, who predicted in 1979:

> In my opinion the world is moving ineluctably towards a third world war—a strategic nuclear war. I do not believe that anything can be done to prevent it.[76]

And the journalist Jonathan Schell, whose 1982 bestseller *The Fate of the Earth* ended as follows:

> One day—and it is hard to believe that it will not be soon—we will make our choice. Either we will sink into the final coma and end it all or, as I trust and believe, we will awaken to the truth of our peril . . . and rise up to cleanse the earth of nuclear weapons.

This genre of prophecy went out of style when the Cold War ended and humanity had not sunk into the final coma, despite having failed to create a world government or to cleanse the Earth of nuclear weapons. To keep the fear at a boil, activists keep lists of close calls and near-misses intended to show that Armageddon has always been just a glitch away and that humanity has survived only by dint of an uncanny streak of luck.[77] The lists tend to lump truly dangerous moments, such as a 1983 NATO exercise that some Soviet officers almost mistook for an imminent first strike, with smaller lapses and snafus, such as a 2013 incident in which an off-duty American general who was responsible for nuclear-armed missiles got drunk and acted boorishly toward women during a four-day trip to Russia.[78] The sequence that would escalate to a nuclear exchange is never laid out, nor are alternative assessments given which might put the episodes in context and lessen the terror.[79]

The message that many antinuclear activists want to convey is "Any day now we will all die horribly unless the world immediately takes measures which it has absolutely no chance of taking." The effect on the public is about what you would expect: people avoid thinking about the unthinkable, get on with their lives, and hope the experts are wrong. Mentions of "nuclear war" in books and newspapers have steadily declined since the 1980s, and journalists give far more attention to terrorism, inequality, and sundry gaffes and scandals than they do to a threat to the survival of civilization.[80] The world's leaders are no more moved. Carl Sagan was a coauthor of the first paper warning of a nuclear winter, and when he campaigned for a nuclear freeze by trying to generate "fear, then belief, then response," he was advised by an arms-control expert, "If you think that the mere prospect of the end of the world is sufficient to change thinking in Washington and Moscow you clearly haven't spent much time in either of those places."[81]

In recent decades predictions of an imminent nuclear catastrophe have shifted from war to terrorism, such as when the American diplomat John Negroponte wrote in 2003, "There is a high probability that within two years al-Qaeda will attempt an attack using a nuclear or other weapon of mass destruction."[82] Though a probabilistic prediction of an event that fails to occur can

never be gainsaid, the sheer number of false predictions (Mueller has more than seventy in his collection, with deadlines staggered over several decades) suggests that prognosticators are biased toward scaring people.[83] (In 2004, four American political figures wrote an op-ed on the threat of nuclear terrorism entitled "Our Hair Is on Fire.")[84] The tactic is dubious. People are easily riled by actual attacks with guns and homemade bombs into supporting repressive measures like domestic surveillance or a ban on Muslim immigration. But predictions of a mushroom cloud on Main Street have aroused little interest in policies to combat nuclear terrorism, such as an international program to control fissile material.

Such backfiring had been predicted by critics of the first nuclear scare campaigns. As early as 1945, the theologian Reinhold Niebuhr observed, "Ultimate perils, however great, have a less lively influence upon the human imagination than immediate resentments and frictions, however small by comparison."[85] The historian Paul Boyer found that nuclear alarmism actually *encouraged* the arms race by scaring the nation into pursuing more and bigger bombs, the better to deter the Soviets.[86] Even the originator of the Doomsday Clock, Eugene Rabinowitch, came to regret his movement's strategy: "While trying to frighten men into rationality, scientists have frightened many into abject fear or blind hatred."[87]



As we saw with climate change, people may be likelier to acknowledge a problem when they have reason to think it is solvable than when they are terrified into numbness and helplessness.[88] A positive agenda for removing the threat of nuclear war from the human condition would embrace several ideas.

The first is to stop telling everyone they're doomed. The fundamental fact of the nuclear age is that no atomic weapon has been used since Nagasaki. If the hands of a clock point to a few minutes to midnight for seventy-two years, something is wrong with the clock. Now, maybe the world has been blessed with a miraculous run of good luck—no one will ever know—but before resigning ourselves to that scientifically disreputable conclusion, we should at least consider the possibility that systematic features of the international system have worked against their use. Many

antinuclear activists hate this way of thinking because it seems to take the heat off countries to disarm. But since the nine nuclear states won't be scuppering their weapons tomorrow, it behooves us in the meantime to figure out what has gone right, so we can do more of whatever it is.

Foremost is a historical discovery summarized by the political scientist Robert Jervis: "The Soviet archives have yet to reveal any serious plans for unprovoked aggression against Western Europe, not to mention a first strike against the United States."[89] That means that the intricate weaponry and strategic doctrines for nuclear deterrence during the Cold War—what one political scientist called "nuclear metaphysics"—were deterring an attack that the Soviets had no interest in launching in the first place.[90] When the Cold War ended, the fear of massive invasions and preemptive nuclear strikes faded with it, and (as we shall see) both sides felt relaxed enough to slash their weapon stockpiles without even bothering with formal negotiations.[91] Contrary to a theory of technological determinism in which nuclear weapons start a war all by themselves, the risk very much depends on the state of international relations. Much of the credit for the absence of nuclear war between great powers must go to the forces behind the decline of *war* between great powers (chapter 11). Anything that reduces the risk of war reduces the risk of nuclear war.

The close calls, too, may not depend on a supernatural streak of good luck. Several political scientists and historians who have analyzed documents from the Cuban Missile Crisis, particularly transcripts of John F. Kennedy's meetings with his security advisors, have argued that despite the participants' recollections about having pulled the world back from the brink of Armageddon, "the odds that the Americans would have gone to war were next to zero."[92] The records show that Khrushchev and Kennedy remained in firm control of their governments, and that each sought a peaceful end to the crisis, ignoring provocations and leaving themselves several options for backing down.

The hair-raising false alarms and brushes with accidental launches also need not imply that the gods smiled on us again and again. They might instead show that the human and technological links in the chain were predisposed to prevent catastrophes, and

were strengthened after each mishap.[93] In their report on nuclear close calls, the Union of Concerned Scientists summarizes the history with refreshing judiciousness: "The fact that such a launch has not occurred so far suggests that safety measures work well enough to make the chance of such an incident small. But it is not zero."[94]

Thinking about our predicament in this way allows us to avoid both panic and complacency. Suppose that the chance of a catastrophic nuclear war breaking out in a single year is one percent. (This is a generous estimate: the probability must be less than that of an accidental launch, because escalation from a single accident to a full-scale war is far from automatic, and in seventy-two years the number of accidental launches has been zero.)[95] That would surely be an unacceptable risk, because a little algebra shows that the probability of our going a century without such a catastrophe is less than 37 percent. But if we can reduce the annual chance of nuclear war to a tenth of a percent, the world's odds of a catastrophe-free century increase to 90 percent; at a hundredth of a percent, the chance rises to 99 percent, and so on.

Fears of runaway nuclear proliferation have also proven to be exaggerated. Contrary to predictions in the 1960s that there would soon be twenty-five or thirty nuclear states, fifty years later there are nine.[96] During that half-century four countries have un-proliferated by relinquishing nuclear weapons (South Africa, Kazakhstan, Ukraine, and Belarus), and another sixteen pursued them but thought the better of it, most recently Libya and Iran. For the first time since 1946, no non-nuclear state is known to be developing nuclear weapons.[97] True, the thought of Kim Jong-un with nukes is alarming, but the world has survived half-mad despots with nuclear weapons before, namely Stalin and Mao, who were deterred from using them, or, more likely, never felt the need. Keeping a cool head about proliferation is not just good for one's mental health. It can prevent nations from stumbling into disastrous preventive wars, such as the invasion of Iraq in 2003, and the possible war between Iran and the United States or Israel that was much discussed around the end of that decade.

Tremulous speculations about terrorists stealing a nuclear weapon or building one in their garage and smuggling it into the

country in a suitcase or shipping container have also been scrutinized by cooler heads, including Michael Levi in *On Nuclear Terrorism,* John Mueller in *Atomic Obsession* and *Overblown,* Richard Muller in *Physics for Future Presidents,* and Richard Rhodes in *The Twilight of the Bombs*. Joining them is the statesman Gareth Evans, an authority on nuclear proliferation and disarmament, who in 2015 delivered the seventieth-anniversary keynote lecture at the Annual Clock Symposium of the *Bulletin of the Atomic Scientists* entitled "Restoring Reason to the Nuclear Debate."

> At the risk of sounding complacent—and I am not—I have to say that [nuclear security], too, would benefit by being conducted a little less emotionally, and a little more calmly and rationally, than has tended to be the case.
>
> While the engineering know-how required to build a basic fission device like the Hiroshima or Nagasaki bomb is readily available, highly enriched uranium and weapons-grade plutonium are not at all easily accessible, and to assemble and maintain—for a long period, out of sight of the huge intelligence and law enforcement resources that are now being devoted to this threat worldwide—the team of criminal operatives, scientists and engineers necessary to acquire the components of, build and deliver such a weapon would be a formidably difficult undertaking.[98]

Now that we've all calmed down a bit, the next step in a positive agenda for reducing the nuclear threat is to divest the weapons of their ghoulish glamour, starting with the Greek tragedy in which they have starred. Nuclear weapons technology is not the culmination of the ascent of human mastery over the forces of nature. It is a mess we blundered into because of vicissitudes of history and that we now must figure out how to extricate ourselves from. The Manhattan Project grew out of the fear that the Germans were developing a nuclear weapon, and it attracted scientists for reasons explained by the psychologist George Miller, who had worked on another wartime research project: "My generation saw the war against Hitler as a war of good against evil; any able-bodied

young man could stomach the shame of civilian clothes only from an inner conviction that what he was doing instead would contribute even more to ultimate victory."[99] Quite possibly, had there been no Nazis, there would be no nukes. Weapons don't come into existence just because they are conceivable or physically possible. All kinds of weapons have been dreamed up that never saw the light of day: death rays, battlestars, fleets of planes that blanket cities with poison gas like cropdusters, and cracked schemes for "geophysical warfare" such as weaponizing the weather, floods, earthquakes, tsunamis, the ozone layer, asteroids, solar flares, and the Van Allen radiation belts.[100] In an alternative history of the 20th century, nuclear weapons might have struck people as equally bizarre.

Nor do nuclear weapons deserve credit for ending World War II or cementing the Long Peace that followed it—two arguments that repeatedly come up to suggest that nuclear weapons are good things rather than bad things. Most historians today believe that Japan surrendered not because of the atomic bombings, whose devastation was no greater than that from the firebombings of sixty other Japanese cities, but because of the entry into the Pacific war of the Soviet Union, which threatened harsher terms of surrender.[101]

And contrary to the half-facetious suggestion that The Bomb be awarded the Nobel Peace Prize, nuclear weapons turn out to be lousy deterrents (except in the extreme case of deterring existential threats, such as each other).[102] Nuclear weapons are indiscriminately destructive and contaminate wide areas with radioactive fallout, including the contested territory and, depending on the weather, the bomber's own soldiers and citizens. Incinerating massive numbers of noncombatants would shred the principles of distinction and proportionality that govern the conduct of war and would constitute the worst war crimes in history. That can make even politicians squeamish, so a taboo grew up around the use of nuclear weapons, effectively turning them into bluffs.[103] Nuclear states have been no more effective than non-nuclear states in getting their way in international standoffs, and in many conflicts, non-nuclear countries or factions have picked fights with nuclear ones. (In 1982, for example, Argentina seized the Falkland Islands from the United Kingdom, confident that Margaret Thatcher would

not turn Buenos Aires into a radioactive crater.) It's not that deterrence itself is irrelevant: World War II showed that conventional tanks, artillery, and bombers were already massively destructive, and no nation was eager for an encore.[104]

Far from easing the world into a stable equilibrium (the so-called balance of terror), nuclear weapons can poise it on a knife's edge. In a crisis, nuclear weapon states are like an armed homeowner confronting an armed burglar, each tempted to shoot first to avoid being shot.[105] In theory this security dilemma or Hobbesian trap can be defused if each side has a second-strike capability, such as missiles in submarines or airborne bombers that can elude a first strike and exact devastating revenge—the condition of Mutual Assured Destruction (MAD). But some debates in nuclear metaphysics raise doubts about whether a second strike can be guaranteed in every conceivable scenario, and whether a nation that depended on it might still be vulnerable to nuclear blackmail. So the United States and Russia maintain the option of "launch on warning," in which a leader who is advised that his missiles are under attack can decide in the next few minutes whether to use them or lose them. This hair trigger, as critics have called it, could set off a nuclear exchange in response to a false alarm or an accidental or unauthorized launch. The lists of close calls suggest that the probability is disconcertingly greater than zero.

Since nuclear weapons needn't have been invented, and they are useless in winning wars or keeping the peace, that means they can be uninvented—not in the sense that the knowledge of how to make them will vanish, but in the sense that they can be dismantled and no new ones built. It would not be the first time that a class of weapons has been marginalized or scrapped. The world's nations have banned antipersonnel landmines, cluster munitions, and chemical and biological weapons, and they have seen other high-tech weapons of the day collapse under the weight of their own absurdity. During World War I the Germans invented a gargantuan, multistory "supergun" which fired a 200-pound projectile more than 80 miles, terrifying Parisians with shells that fell from the sky without warning. The behemoths, the biggest of which would come to be called the Gustav Gun, were inaccurate and unwieldy, so few of them were built and they were eventually scuttled. The nuclear

skeptics Ken Berry, Patricia Lewis, Benoît Pelopidas, Nikolai Sokov, and Ward Wilson point out:

> Today countries do not race to build their own superguns. . . . There are no angry diatribes in liberal papers about the horror of these weapons and the necessity of banning them. There are no realist op-eds in conservative papers asserting that there is no way to shove the supergun genie back into the bottle. They were wasteful and ineffective. History is replete with weapons that were touted as war-winners that were eventually abandoned because they had little effect.[106]

Could nuclear weapons go the way of the Gustav Gun? In the late 1950s a movement arose to Ban the Bomb, and over the decades it escaped its founding circle of beatniks and eccentric professors and has gone mainstream. Global Zero, as the goal is now called, was broached in 1986 by Mikhail Gorbachev and Ronald Reagan, who famously mused, "A nuclear war cannot be won and must never be fought. The only value in our two nations possessing nuclear weapons is to make sure they will never be used. But then would it not be better to do away with them entirely?" In 2007 a bipartisan quartet of defense realists (Henry Kissinger, George Shultz, Sam Nunn, and William Perry) wrote an op-ed called "A World Free of Nuclear Weapons," with the backing of fourteen other former National Security Advisors and Secretaries of State and Defense.[107] In 2009 Barack Obama gave a historic speech in Prague in which he stated "clearly and with conviction America's commitment to seek the peace and security of a world without nuclear weapons," an aspiration that helped win him the Nobel Peace Prize.[108] It was echoed by his Russian counterpart at the time, Dmitry Medvedev (though not so much by either one's successor). Yet in a sense the declaration was redundant, because the United States and Russia, as signatories of the 1970 Non-Proliferation Treaty, were already committed by its Article VI to eliminating their nuclear arsenals.[109] Also committed are the United Kingdom, France, and China, the other nuclear states grandfathered in by the treaty. (In a backhanded acknowledgment that treaties matter, India, Pakistan, and Israel never signed it, and North Korea withdrew.) The world's

citizens are squarely behind the movement: large majorities in almost every surveyed country favor abolition.[110]

Zero is an attractive number because it expands the nuclear taboo from *using* the weapons to *possessing* them. It also removes any incentive for a nation to obtain nuclear weapons to protect itself against an enemy's nuclear weapons. But getting to zero will not be easy, even with a carefully phased sequence of negotiation, reduction, and verification.[111] Some strategists warn that we shouldn't even try to get to zero, because in a crisis the former nuclear powers might rush to rearm, and the first past the post might launch a pre-emptive strike out of fear that its enemy would do so first.[112] According to this argument, the world would be better off if the nuclear grandfathers kept a few around as a deterrent. In either case, the world is very far from zero, or even "a few." Until that blessed day comes, there are incremental steps that could bring the day closer while making the world safer.

The most obvious is to whittle down the size of the arsenal. The process is well under way. Few people are aware of how dramatically the world has been dismantling nuclear weapons. Figure 19-1 shows that the United States has reduced its inventory by 85 percent from its 1967 peak, and now has fewer nuclear warheads than at *any time since 1956*.[113] Russia, for its part, has reduced its arsenal by 89 percent from its Soviet-era peak. (Probably even fewer people realize that about 10 percent of electricity in the United States comes from dismantled nuclear warheads, mostly Soviet.)[114] In 2010 both countries signed the New Strategic Arms Reduction Treaty (New START), which commits them to shrinking their inventories of deployed strategic warheads by two-thirds.[115] In exchange for Congressional approval of the treaty, Obama agreed to a long-term modernization of the American arsenal, and Russia is modernizing its arsenal as well, but both countries will continue to reduce the size of their stockpiles at rates that may even exceed the ones set out in the treaty.[116] The barely discernible layers laminating the top of the stack in the graph represent the other nuclear powers. The British and French arsenals were smaller to begin with and have shrunk in half, to 215 and 300, respectively. (China's has grown slightly from 235 to 260, India's and Pakistan's have grown to around 135 apiece, Israel's is

estimated at around 80, and North Korea's is unknown but small.)[117] As I mentioned, no additional countries are known to be pursuing nuclear weapons, and the number possessing fissile material that could be made into bombs has been reduced over the past twenty-five years from fifty to twenty-four.[118]

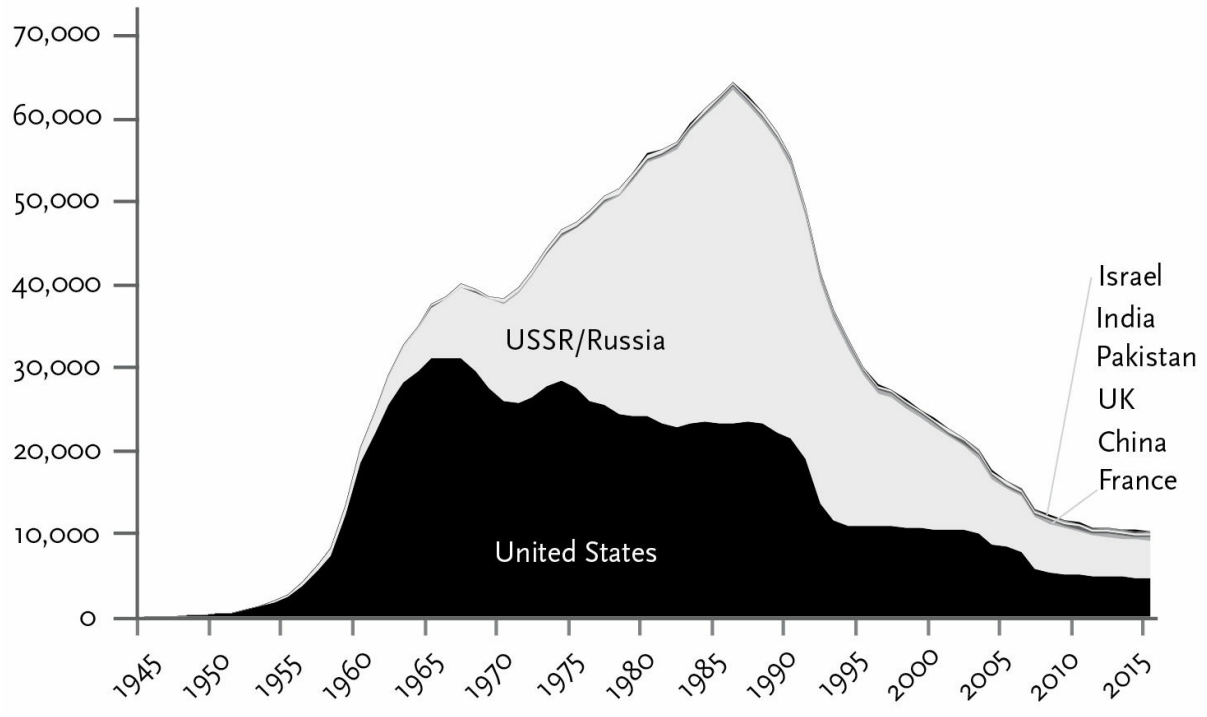


Figure 19-1: Nuclear weapons, 1945–2015

Sources: *HumanProgress,* http://humanprogress.org/static/2927, based on data from the Federation of Atomic Scientists, Kristensen & Norris 2016a, updated in Kristensen 2016; see Kristensen & Norris 2016b for additional explanation. The counts include weapons that are deployed and those that are stockpiled, but exclude weapons that are retired and awaiting dismantlement.

Cynics might be unimpressed by a form of progress that still leaves the world with 10,200 atomic warheads, since, as the 1980s bumper sticker pointed out, one nuclear bomb can ruin your whole day. But with 54,000 fewer nuclear bombs on the planet than there were in 1986, there are far fewer opportunities for accidents that might ruin people's whole day, and a precedent has been set for continuing disarmament. More warheads will be eliminated under the terms of the New START, and as I mentioned, still more reductions may take place outside the framework of treaties, which are freighted with legalistic negotiations and divisive political

symbolism. When tensions among great powers recede (a long-term trend, even if it's in abeyance today), they quietly shrink their expensive arsenals.[119] Even when rivals are barely speaking, they can cooperate in a reverse arms race using the tactic that the psycholinguist Charles Osgood called Graduated Reciprocation in Tension-Reduction (GRIT), in which one side makes a small unilateral concession with a public invitation that it be reciprocated.[120] If, someday, a combination of these developments pared the arsenals down to 200 warheads apiece, it would not only dramatically reduce the chance of an accident but essentially eliminate the possibility of nuclear winter, the truly existential threat.[121]

In the near term, the greatest menace of nuclear war comes not so much from the number of weapons in existence as from the circumstances in which they might be used. The policy of launch on warning, launch under attack, or hair-trigger alert is truly the stuff of nightmares. No early warning system can perfectly distinguish signal from noise, and a president awakened by the proverbial 3:00 A.M. phone call would have minutes to decide whether to fire his missiles before they were destroyed in their silos. In theory, he could start World War III in response to a short circuit, a flock of seagulls, or a bit of malware from that Bulgarian teenager. In reality, the warning systems are better than that, and there is no "hair trigger" that automatically launches missiles without human intervention.[122] But when missiles can be launched on short notice, the risks of a false alarm or an accidental, rogue, or impetuous launch are real.

The original rationale for launch on warning was to thwart a massive first strike that would destroy every missile in its silo and leave the country unable to retaliate. But as I mentioned, states can launch weapons from submarines, which hide in deep water, or from bomber aircraft, which can be sent scrambling, making the weapons invulnerable to a first strike and poised to exact devastating revenge. The decision to retaliate could be made in the cold light of day, when the uncertainty has passed: if a nuclear bomb has been detonated on your territory, you know it.

Launch on warning, then, is unnecessary for deterrence and unacceptably dangerous. Most nuclear security analysts recommend

—no, insist—that nuclear states take their missiles off hair-trigger alert and put them on a long fuse.[123] Obama, Nunn, Shultz, George W. Bush, Robert McNamara, and several former Commanders of Strategic Command and Directors of the National Security Agency agree.[124] Some, like William Perry, recommend scrapping the land-based leg of the nuclear triad altogether and relying on submarines and bombers for deterrence, since silo-based missiles are sitting ducks which tempt a leader to use them while they can. So with the fate of the world at stake, why would *anyone* want to keep missiles in silos on hair-trigger alert? Some nuclear metaphysicians argue that in a crisis, the act of re-alerting de-alerted missiles would be a provocation. Others note that because silo-based missiles are more reliable and accurate, they are worth safeguarding, because they can be used not just to deter a war but to win one. And that brings us to another way to reduce the risks of nuclear war.

It's hard for anyone with a conscience to believe that their country is prepared to use nuclear weapons for any purpose other than deterring a nuclear attack. But that is the official policy of the United States, the United Kingdom, France, Russia, and Pakistan, all of whom have declared they might launch a nuclear weapon if they or their allies have been massively attacked with non-nuclear weapons. Apart from violating any concept of proportionality, a first-use policy is dangerous, because a non-nuclear attacker might be tempted to escalate to nuclear pre-emptively. Even if it didn't, once it was nuked it might retaliate with a nuclear strike of its own.

So a common-sense way to reduce the threat of nuclear war is to announce a policy of No First Use.[125] In theory, this would eliminate the possibility of nuclear war altogether: if no one uses a weapon first, they'll never be used. In practice, it would remove some of the temptation of a pre-emptive strike. Nuclear weapon states could all agree to No First Use in a treaty; they could get there by GRIT (with incremental commitments like never attacking civilian targets, never attacking a non-nuclear state, and never attacking a target that could be destroyed by conventional means); or they could simply adopt it unilaterally, which is in their own interests.[126] The nuclear taboo has already reduced the deterrent value of a Maybe First Use policy, and the declarant could still protect itself with

conventional forces and with a second-strike capability: nuclear tit for tat.

No First Use seems like a no-brainer, and Barack Obama came close to adopting it in 2016, but was talked out of it at the last minute by his advisors.[127] The timing wasn't right, they said; it might signal weakness to a newly obstreperous Russia, China, and North Korea, and it might scare nervous allies who now depend on the American "nuclear umbrella" into seeking nuclear weapons of their own, particularly with Donald Trump threatening to cut back on American support of its coalition partners. In the long term, these tensions may subside, and No First Use may be considered once more.

Nuclear weapons won't be abolished anytime soon, and certainly not by the original target date of the Global Zero movement, 2030. In his 2009 Prague speech Obama said that the goal "will not be reached quickly—perhaps not in my lifetime," which dates it to well after 2055 (see figure 5-1). "It will take patience and persistence," he advised, and recent developments in the United States and Russia confirm that we'll need plenty of both.

But the pathway has been laid out. If nuclear warheads continue to be dismantled faster than they are built, if they are taken off a hair trigger and guaranteed not to be used first, and if the trend away from interstate war continues, then by the second half of the century we could end up with small, secure arsenals kept only for mutual deterrence. After a few decades they might deter themselves out of a job. At that point they would seem ludicrous to our grandchildren, who will beat them into plowshares once and for all. During this climbdown we may never reach a point at which the chance of a catastrophe is zero. But each step down can lower the risk, until it is in the range of the other threats to our species' immortality, like asteroids, supervolcanoes, or an Artificial Intelligence that turns us into paper clips.