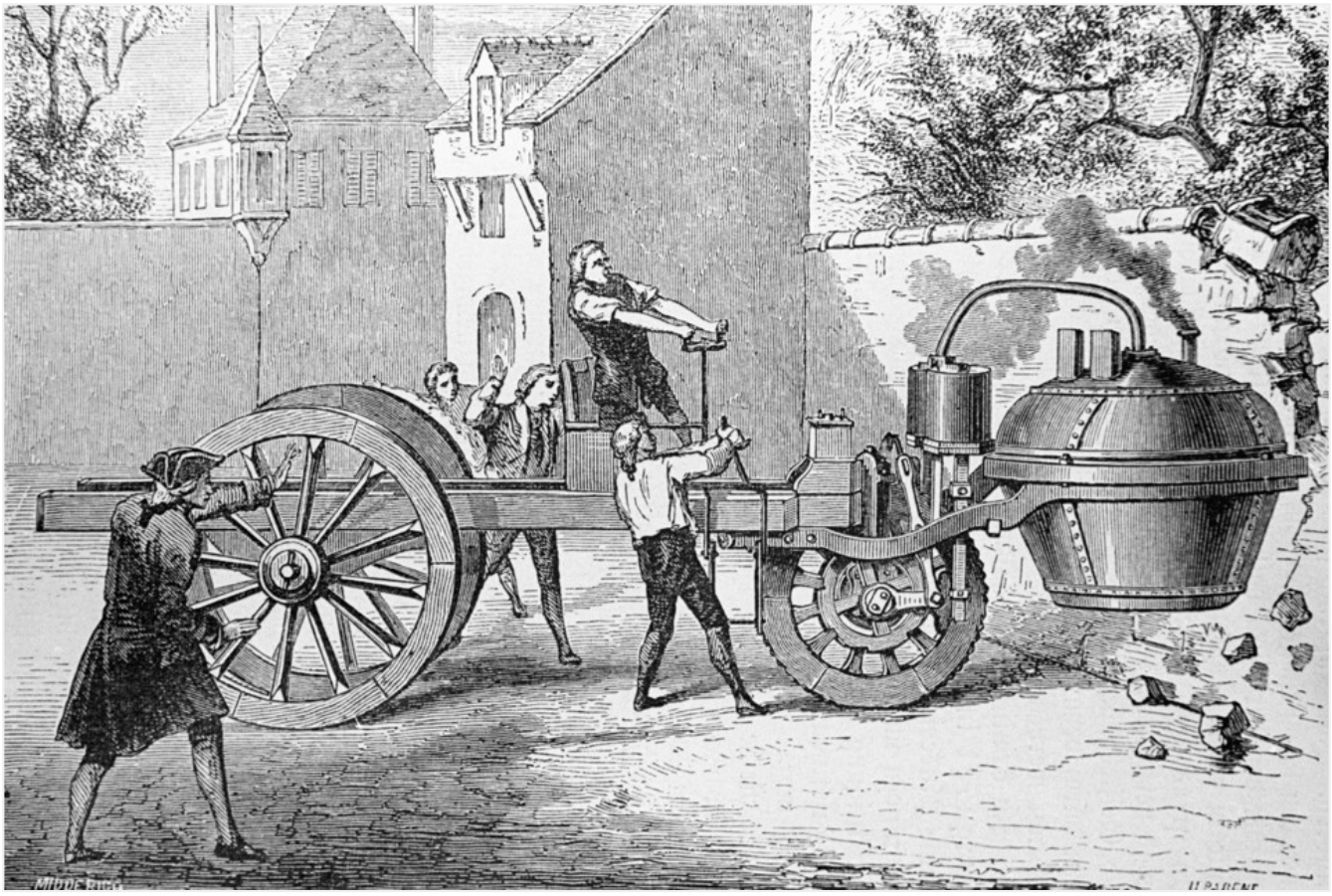
The Atlantic

Progress Isn't Natural

Humans invented it—and not that long ago.



A 1770 engraving of a steam engine crushing a wall

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JOEL MOKYR | NOV 17, 2016 | BUSINESS

How and why did the modern world and its unprecedented prosperity begin? Many bookshelves are full of learned tomes by historians, economists, political

philosophers and other erudite scholars with endless explanations. One way of looking at the question is by examining something basic, and arguably essential: the emergence of a belief in the usefulness of progress.

Such a belief may seem self-evident today, but most people in the more-remote past believed that history moved in some kind of cycle or followed a path that was determined by higher powers. The idea that humans should and could work consciously to make the world a better place for themselves and for generations to come is by and large one that emerged in the two centuries between Christopher Columbus and Isaac Newton. Of course, just believing that progress could be brought about is not enough—one must bring it about. The modern world began when people resolved to do so.

Why might people in the past have been hesitant to embrace the idea of progress? The main argument against it was that it implies a disrespect of previous generations. As the historian Carl Becker noted in a classic work written in the early 1930s, "a Philosopher could not grasp the modern idea of progress … until he was willing to abandon ancestor worship, until he analyzed away his inferiority complex toward the past, and realized that his own generation was superior to any yet known." With the great voyages and the Reformation, Europeans increasingly began to doubt the great classical writings on geography, medicine, astronomy, and physics that had been the main source of wisdom in medieval times. With those doubts came a sense that their own generation knew more and was wiser than those of previous eras.

This was a departure from the beliefs of most societies in the past, which were usually given to some measure of "ancestor worship"—the belief that all wisdom had been revealed to earlier sages and that to learn anything one should peruse their writings and find the answer in their pages. In the Islamic world, wisdom

was found in the Koran and the Hadith (which consists of sayings and acts attributed to the prophet Muhammad); in the Jewish world it was the Torah, the Talmud, and the sayings of Chazal; in China, wisdom was contained in Sishu Jizhu, the four books of commentary on Confucius compiled in the 12th century. In late medieval Europe, wisdom was found in a limited number of ancient texts, above all those written by Aristotle.

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The respect for classical texts started to fade away in Europe in the 16th century and went into a meltdown in the 17th, when more and more of the ancient certainties were questioned and then found to be incorrect. If the classic authorities could be wrong about so many things, why would should they be trusted about anything? The English philosopher William Gilbert, the author of a famous book on magnetism, sounded downright impudent when he wrote in 1600 that he was not going to waste time on "quoting the ancients and the Greeks as our supporters, for neither can paltry Greek argumentation demonstrate the truth more subtly nor Greek terms more effectively."

Many of the widely believed propositions of classical science collapsed under close examination. The examples piled up. Above all, the belief that the earth was at the center of the universe, the centerpiece of ancient cosmology, withered away. But there were so many others: Aristotle had insisted that all the stars

apart from the planets were immutable and fixed, but in 1572 a young Danish astronomer named Tycho Brahe observed a supernova and realized that Aristotle had been wrong. Even more striking, Aristotle had written that the tropical areas around the equator were so torrid as to be uninhabitable—but Europeans found people living and thriving in such regions in Africa, America, and India. By 1600, much of ancient wisdom had crumbled.

Worse was to come: After 1600, Europeans developed scientific instruments that allowed them to see things the ancient writers could never have imagined. No wonder they began to feel superior: Ptolemy had no telescope, Pliny had no microscope, Archimedes had no barometer. The great classical writers may have been smart and well-educated, but European intellectuals thought of themselves as equally intelligent and better informed—and thus able to see things the ancients could not. Hence, everything must be tested with real evidence, not on the say-so of authorities who had lived 1,500 years earlier. The motto of the Royal Society, which was founded in 1660 in London, was *in nullius verba*—"on no one's word." Skepticism was the taproot of all knowledge. Even the Bible itself began to be examined critically, not least by Baruch Spinoza, who cast doubt on its divine origins and saw it as just another text.

Tradition did not give up without a fight. In the closing decades of the 17th century, an intellectual battle occurred between two groups, the ancients and the moderns. People in all seriousness debated the question of who was better, the writers and philosophers of Greek and Roman antiquity or those of their own age. This controversy was memorably mocked by the great satirist Jonathan Swift in his *Battle of the Books*, in which he described an absurd physical battle between modern writers and those of antiquity, not unlike the Monty Python skit hundreds of years later in which caricatures of Greek and German philosophers compete in a soccer match.

While the question of whether Sophocles was as good a playwright as Shakespeare is clearly a matter of taste, the questions of who was right about the speed of falling objects, the circulation of blood, the orbits of heavenly bodies, or the spontaneous generation of organisms were not, and the answers were becoming increasingly clear. By 1700, in Europe, the battle had been won decisively, and ancient writings on science and medicine were treated with condescending respect. A leading textbook in natural philosophy published in 1755 (and still taught a century later) started off by noting that "it is a matter of no small surprize to think how inconsiderable a progress the knowledge of nature had made in former ages … compared with the vast improvements it has received … of latter times." It went on, "Philosophers of former ages buried themselves in framing hypotheses … without any foundation in nature [and] so lame and defective as to not answer those very phaenomena for whose sakes they had been contrived."

It was a turning point when intellectuals started to conceive of knowledge as cumulative. In the past this had been questionable: Much ancient knowledge, after all, had been lost when manuscripts were destroyed. But after 1500, the printing press and the proliferation of libraries made such losses increasingly unlikely. The moderns could know what the ancients did, but they continuously added to the stock of useful knowledge. The young Blaise Pascal, for instance, saw the world of knowledge as a single infinitely-lived individual, "incessantly learning." A generation later, his compatriot Bernard de Fontenelle (now largely forgotten, but a central figure in the intellectual world of his day) asserted that in his age a truth hitherto unknown—*justesse*, he called it—ruled. He predicted that in the future this truth would go much further, and that one day the members of his generation would themselves be ancients and it would be fair and reasonable for posterity to outdo them.

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The increasing disrespect for ancient learning was paired with a conviction that human progress over the long haul was a desirable and feasible objective. But, needless to say, different authors meant different things when they thought about progress. Some thought about moral improvement, others about less tyrannical and more benevolent rulers. It became increasingly clear, however, that economic progress, in terms of increased material prosperity, was a central part of the story, in addition to matters such as religious tolerance, equality before the law, and other human rights.

By the 18th century, the idea of economic progress had taken firm root. Adam Smith felt in 1776 that "the annual produce of the land and labour of England … is certainly much greater than it was a little more than a century ago at the restoration of Charles II [in 1660] … and [it] was certainly much greater at the restoration than we can suppose it to have been a hundred years before." Sure, others doubted the power of innovation to propel the economy forward, worrying that the forces responsible for progress would be too weak and might be undone by rapid population growth. But as it turned out, even the greatest optimists underestimated the power of technology's progress in taming electricity, making cheap steel, flooding the world with abundant high-quality food, and doubling humans' life expectancy while cutting the hours people spent

working by at least half—to name but a very few of modernity's achievements.

As the 18th century unfolded, it became something close to a consensus that science and technology were the engines of economic progress. In 1780 Benjamin Franklin wrote to a friend, the English chemist Joseph Priestley, that "the rapid progress true Science now makes, occasions my regretting sometimes that I was born so soon. It is impossible to imagine the Height to which may be carried, in a thousand years, the Power of Man over Matter. … O, that Moral Science were in as fair a way of Improvement." Priestley himself thought that in the history of knowledge "we see the human understanding [at] its greatest advantage … increasing its own powers by acquiring to itself the powers of nature … whereby the security and happiness of mankind are daily improved." French Enlightenment thinkers such as Turgot felt the same way.

Interestingly, by the time of Adam Smith and Benjamin Franklin, the number of major inventions enabled by better science was still small, and most material progress was still little more than a promissory note. On the eve of the Industrial Revolution, in 1759, Samuel Johnson wrote, "When the Philosophers of the last age were first congregated into the Royal Society, great expectations were raised of the sudden progress of useful arts … The [gout] and [stone] were still painful, the ground that was not ploughed brought no harvest." He added, "The truth is, that little had been done compared with what fame had been suffered to promise."

And yet, the optimism that bubbled up in the 17th century turned out to be irrepressible and began to ring increasingly true two generations after Dr. Johnson. The Whig historian Thomas Babington Macaulay noted in 1830 that he saw that "the wealth of nations [is] increasing and all the arts of life approaching nearer and nearer perfection in spite of the grossest corruption on the part of

rulers." He predicted further progress thanks to "machines constructed on principles yet undiscovered [that] will be in every house."

Macaulay was quite right. 18th-century Europe (or better put, Britain) faced a number of difficult technological problems that were seen widely as requiring an urgent solution. Among those were how to measure longitude at sea, how to spin yarn from fibers without using human fingers, how to pump water out of flood-prone coal mines, how to prevent smallpox (the most dreaded disease of the time), and how to refine pig iron cheaply and quickly. By 1800 these problems had all been solved by people who were ingenious, informed, and inventive, and the list could be made much longer: Macaulay could write by gaslight, wear underwear bleached with a chlorine-based powder, and, within a year of completing that essay, travel by train. Of less economic significance but of inestimable psychological impact was the defeat of gravity through hot-air ballooning in 1783.

The belief in progress has always had opponents, many of whom stress the costs of technological advances. In the 17th century, the Jesuit order fought tirelessly against such godless innovations as Copernican astronomy and infinitesimal mathematics. During the Industrial Revolution, many writers, following the lead of Thomas Malthus, were convinced that unrestrained population growth would undo the fruits of economic growth, a belief that still had adherents in the late 1960s, such as Paul Ehrlich. Nowadays, unsubstantiated fears of monstrosities created by genetic engineering (including, God forbid, smarter people, drought-resistant crops, and mosquitoes that don't transmit malaria) threaten to slow down research and development in crucial areas, including coping with climate change.

Progress, as was realized early on, inevitably entails risks and costs. But the

alternative, then as now, is always worse.

ABOUT THE AUTHOR

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