Introduction

Imperialism and Technology

For over five centuries, Europeans and their overseas descendants dominated the oceans of the world and much of its land and its peoples as well. This domination has been challenged many times, as it is once again in our times. Now that imperialism has returned to the forefront of world events, it is time to revisit its history and learn its lessons.

On Imperialism

Western imperialism is but the most recent example of a phenomenon going back to ancient times and culminating in the conquests of Genghis Khan. The first phase in the expansion of Europe, often called the Old Empires, began in the early sixteenth century with the Spanish conquest of Mexico and Peru and the Portuguese domination of the Indian Ocean; by the beginning of the nineteenth century, however, Western efforts in China, Central Asia, Africa, and the Americas were running into diminishing returns. Then in the mid-nineteenth century came a renewed spurt of empire-building—the New Imperialism—that lasted until the outbreak of World War II. Since World War II we have been in a third phase, one in which the Western powers (including Russia) have tried to hold on to their colonies and dependencies and even expand their spheres of influence, but in vain.

Historians have written in great detail about Western imperialism, often under the name "expansion of Europe." The second phase, or New Imperialism, has long been the object of controversy among historians because of its extraordinary speed and scope; by one account, the land area of the world controlled by Europeans increased

from 35 percent in 1800 to 84.4 percent in 1914.[1] In trying to explain this phenomenal expansion, historians have focused on the motives of the explorers, missionaries, merchants, military men, diplomats, and political leaders involved. These motives were as diverse as the protagonists. Some wanted to spread Christianity or Western ethics, laws, and culture around the world. Others sought valuable commodities or markets for their goods or investment opportunities. Yet others saw imperial expansion as a means of achieving personal glory, national prestige, or strategic advantage. And, of course, many had several concurrent motives.[2] But in their fascination with the motivations of the imperialists, most historians took for granted that the European powers and the United States had the technical and financial means to turn their ambitions into reality. A few referred to these means as "prerequisites" or "a disequilibrium" or "a power advantage" without further investigation.[3] Others considered the issue too trivial to mention.

Yet events require not only motives and opportunities but also means. By what means did imperialists carry out their ambitions? This is the question to which I turned twenty-five years ago in a book called *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century*.[4] In it, I described the relationship between technological innovations and the European colonial conquests in Africa and Asia during the New Imperialism. Among the factors that explain this dramatic expansion, certain technological innovations—in particular steam engines, better firearms, and medical advances—played a major role. Technology is now widely recognized as a necessary, if not sufficient, explanation for the New Imperialism in Africa and Asia.

As an author, it is gratifying to realize that my book has reached a large audience and that the conclusions I drew about the role of technology in nineteenth-century European imperialism have been cited and disseminated in numerous other books. However, in drawing conclusions from the events of one time and place, there is the temptation to generalize from that specific situation to others—in short, to turn a contingent conclusion into a *law* of history. If one accepts the idea that technological innovations were essential to the European conquests of the nineteenth century, does it then fol-

low that technological factors explain other conquests at other times in the past? Does it follow that the key to successful conquests in our own times lies in possessing more powerful technologies than one's opponents? Or was the case of nineteenth-century European imperialism a fluke, an aberration? These are the questions that prompted me to write this book.

On Technology

Before I attempt to address these questions, let me propose a definition of technology. Simply put, by technology I mean all the ways in which humans use the materials and energy in the environment for their own ends, beyond what they can do with their bodies. Under the rubric of technology I would include not only artifacts and domesticated plants and animals but also the skills needed to use them and the systems in which they are embedded: playing the violin, for instance, but not singing; riding a horse, but not running; writing a letter or talking on the telephone, but not speaking to someone within earshot; using drugs, rather than prayers, to combat disease. In their creation as well as in their use, all technologies are the results of human ingenuity. The history of technology is the story of humans' increasing ability to manipulate nature, from Stone Age hand axes to nuclear bombs, from dugout canoes to supertankers, from gardening to genetic engineering.

As technologies change, new ones are often deemed "superior" to the old ones they replace. What we mean by a "superior" technology is one that gives its owners more power over nature—for instance, the ability to travel faster, to communicate further, to live longer, healthier lives, or to kill more efficiently—than to those who lack it. But such superiority is instrumental, that is, it allows people to do more. This is not the same as moral superiority. We must be careful not to confuse the two.

We associate technological innovations with Western civilization. Seen over the course of human history, however, the technological advantage of the West over other cultures is a recent phenomenon. Until the fifteenth century, the Chinese and the Arabs

were at the forefront of technology. Not until the mid-fifteenth century did western Europe begin to forge ahead. The innovativeness of the West came from two sources. One is a culture that encouraged the domination of nature through experimentation, scientific research, and the rewards of capitalism. The other is the competitive nature of the Western world, in which states powerful enough to challenge one another—Spain, France, Britain, Germany, Russia, and the United States—at one time or another vied for dominance over Europe. Nor were states the only competitive elements in Europe civilization. Bankers and traders competed with one another and encouraged competition among kings and states. Individuals, some of them rootless adventurers, sought glory, wealth, and honors through heroic deeds.[5]

Technologies are never evenly distributed. Their skewed distribution allows—though it does not oblige—those who possess a given technology to share it with others, to withhold it from them, or to use it against them. Thanks to the technologies they command, some people enjoy longer, healthier, more comfortable and exciting lives than others. Weapons, means of surveillance, and systems of organization can be used to coerce or intimidate. This disparity gives some people an advantage over others; in the words of philosopher Leon Kass, "What we really mean by 'Man's Power over Nature' is a power exercised by some men over other men, with a knowledge of nature as their instrument."[6] It is the disparities in knowledge of nature—and in the institutions such as universities, governments, and corporations that transform that knowledge into practical applications—that have fueled the disparities of power associated with technological change.

Although no technology forces people to use it, any new form of power over nature creates a powerful temptation to do so. There have been cases in which nations and their leaders have turned away from using a well-known technology; since 1945, for example, the nuclear powers have avoided using their atomic weapons. But all too often nations, like individuals, succumb to temptation. Once it becomes possible, for instance, to put men on the moon or to keep a body alive after its brain has died, it is tempting to do so. Likewise, it is tempting to use one's technological advantage to coerce other

people into doing one's bidding. In most societies, this disparity is evident in the police powers of the state. Between states, it is expressed in unequal economic or military might, and sometimes in war. When a powerful state uses force or the threat of force to impose its will on a weaker society, especially when the weaker society belongs to another culture, we call that imperialism.

What are the connections between technological innovations and Western imperialism? One of the connections, as historian Michael Adas has argued, is Western arrogance, a belief that technological superiority demonstrates religious, cultural, and even biological superiority over non-white peoples.[7] Another connection is the desire to conquer and control other peoples; a technological advantage is itself a motive for imperialism. The temptation to coerce is especially compelling when weaker societies fail to live up to the expectations of the powerful, for instance by practicing a different religion, treating their people in ways that offend, threatening their neighbors, or withholding valuable resources.

From the fifteenth to the eighteenth centuries, as historians Carlo Cipolla and Geoffrey Parker have shown, European technological superiority manifested itself outside Europe in the form of ships and guns.[8] During the nineteenth century, as I argued in *The Tools of Empire*, the key technologies were steamboats, steamships, rifles, quinine prophylaxis, and the telegraph, all of them products of the Industrial Revolution. The twentieth century saw a great many technological advances, the most striking being airplanes. Not surprisingly, these periods of technological creativity correspond to eras of Western expansion. The competitive nature of Western society has been the engine of both technological innovations and imperialism.

Yet our study of the relations between technology and imperialism is not complete without considering two other factors. One is the environments in which imperial expeditions took place. Nature is extremely varied, and so is its influence on historical events. Western imperialism was subject to environmental forces as much as by the encounters between peoples. In some situations, environmental factors greatly aided the conquerors; the diseases imported by Spaniards to the Americas are the most famous case. In others, such as

diseases in Africa, the environment was an obstacle to conquest. But saying that environments influence events does not mean that geography determines history, as Jared Diamond and others have asserted, but only that it poses challenges to the technical ingenuity of the protagonists.[9]

Although most technological advances originated in the West in the period we are studying, it does not follow that other cultures were passive victims. Some societies, it is true, submitted to Western conquest and domination. Others attempted to emulate the technology of the West, sometimes successfully, as in the case of Japan, but more often unsuccessfully, like early nineteenth-century Egypt. Yet others—and these are the most interesting cases—found alternative ways of resisting the Western pressure, relying on indigenous or simple technologies; we call the resulting conflicts asymmetrical. Power over nature may be permanent, but power over people is often ephemeral.

The Goal and Organization of This Book

The goal of this book is to analyze the role of technology in the global expansion of Western societies from the fifteenth century to the present. To explain this role, we must take into account three factors. One is the use of technology to master particular natural environments, in other words, its power over nature. The second is the technological innovations that permitted the Western powers to conquer or coerce non-Western societies. And the third is the responses of non-Western societies, technological and otherwise, to the Western pressures. In short, this book aims to be a technological, environmental, and political history of Western imperialism in the past six hundred years.

The first phase of European expansion began in the fifteenth century, at a time when Christian Europe, though dynamic and growing in population, was hemmed in on the south and east by powerful and hostile Muslim states. To escape the confinement of their continent and adjacent seas, a few adventurous Europeans turned toward the ocean. But the ocean was a dangerous environment. Chapter 1,

"The Discovery of the Oceans, to 1779," therefore recounts how Europeans mastered the Atlantic, Indian, and Pacific oceans through the technologies of shipbuilding and navigation.

Their goals were not exploration but military, commercial, and religious domination. Chapter 2, "Eastern Ocean Empires, 1497–1700," discusses the use of new naval technologies in establishing naval empires, beginning with that of the Portuguese in the Indian Ocean. On the oceans, Europeans encountered little resistance and often no other ships of any sort. In coastal waters and on narrow seas, however, they encountered barriers that were both environmental and technological. There, they faced stiff opposition and sometimes suffered serious reverses at the hands of the Ottomans, the Chinese, and the Gulf Arab states.

At the same time the Portuguese were attempting to dominate the Indian Ocean and its approaches, Spaniards were undertaking the conquest of a land empire in the Americas. This story has received a great deal of scholarly attention, of course, so chapter 3, "Horses, Diseases, and the Conquest of the Americas, 1492–1849," concentrates on the roles that technologies new to the Western Hemisphere, especially horses and steel weapons, played in the conquest. It also highlights the importance of the diseases that Spaniards introduced into the New World. But it contrasts this story of triumph with another, less well-known one, namely the resistance of certain Indian tribes and the resulting inability of the Europeans to extend their conquests into the grasslands of South and North America.

Chapter 4, "The Limits of the Old Imperialism: Africa and Asia to 1859," takes the story to the Eastern Hemisphere where it considers two anomalies. One was the Portuguese failure to emulate in Africa the victories of the Spaniards in the Americas; the other is the equally surprising conquest of India by the British. In both cases, the role of technology is analyzed and found wanting. Instead, the better explanation for the African experience is the disease environment, and for India, it is tactics and organization rather than weapons. By the early nineteenth century, however, the European advantage based on weapons, tactics, and organization had reached its limits, as shown by the British defeat in Afghanistan, the very costly

French conquest of Algeria, and the many failed attempts at penetrating sub-Saharan Africa.

Just when Europeans seemed to have reached the limit of their ability to conquer other peoples, they acquired new means of advancing where their predecessors had been stymied. In the early nineteenth century, we enter the second phase, an era marked by the technological innovations of the Industrial Revolution and the advances in science since the Enlightenment. Western industrialization had two kinds of impacts on the rest of the world: the demand for its products and the means of conquest and colonization. On the demand side, Western industrialization stimulated a ravenous appetite for raw materials and exotic stimulants. At the same time, industrialization provided Western nations with the means to expand their spheres of influence and impose their will on non-Western peoples for the purpose of obtaining these necessities and achieving the other goals of the empire-builders. The next three chapters examine the three technical and scientific breakthroughs that had the most impact on the New Imperialism of the nineteenth century: steamboats, medical technologies, and firearms. They will cover much of the ground covered in *The Tools of Empire* but in more detail and extend the scope of its argument to the Americas.

On water, the breakthrough occurred when steam power was applied to boats and ships. This allowed steam-powered gunboats to enter the shallow seas and rivers that had been closed to the sailing ships of earlier times. The development of steam navigation and its consequences for the relations between the West and the non-West are the subject of chapter 5, "Steamboat Imperialism, 1807–1898."

For four centuries, Africa had been closed to Europeans because of the diseases it harbored, especially malaria. In chapter 6, "Health, Medicine, and the New Imperialism, 1830–1914," we look at the medical advances in the nineteenth century that opened Africa to European penetration, as well as the role that disease, medicine, and public health played in other parts of the world.

The nineteenth century witnessed the most rapid expansion of Europeans and their descendants into regions previously off-limits, an expansion variously known as the Scramble for Africa, the Winning of the West, or *la Conquista del Desierto*. What made this expan-

sion not only possible but cheap, easy, and rapid was the revolution in firearms, a by-product of the Industrial Revolution and of the rivalries and wars among Europeans and Americans. This revolution and its consequences for the non-Western world are the subject of chapter 7, "Weapons and Colonial Wars, 1830–1914."

By the turn of the nineteenth century global relations entered a new phase, as non-Western peoples began to acquire weapons and to learn tactics similar to those that Europeans had successfully employed for a generation. Just as the old methods were no longer as effective as they had once been, Americans and Europeans created an entirely new technology—aviation—that promised to give them back the advantage they were losing on the ground. Chapter 8, "The Age of Air Control, 1911–1936," looks at the impact of airplanes on various imperial ventures by Italy, the United States, Great Britain, and Spain before World War II.

After World War II, despite incredible technological advances, those who possessed the most advanced technologies were no longer able to dominate those who did not. Although France, the Soviet Union, and the United States achieved dominance of the air over insurgents with weak air defenses, these insurgents defeated them on the ground, in mountains, forests, wetlands, and cities. This will be the theme of chapter 9, "The Decline of Air Control, 1946–2007."

Thus we will end with a paradox: the greater power over nature that superior technology provides does not necessarily confer power over people with less advanced technologies. Yet the pursuit of ever more advanced technologies continues unabated and, with it, the temptation to use them against other peoples.

Notes

1. D. K. Fieldhouse, *Economics and Empire* (Ithaca: Cornell University Press, 1973), p. 3.

2. Among the many scholars who have analyzed the motives of the imperialists, we might mention J. A. Hobson, Ronald Robinson and John Gallagher, Vladimir Lenin, Henri Brunschwig, Hans-Ulrich Wehler, David Landes, Hannah Arendt, Carleton J. H. Hayes, William Langer, Joseph Schumpeter, Geoffrey Barraclough, and D. K. Fieldhouse.

3. This is the case, for example, of Fieldhouse (*Economics and Empire*, pp. 460–61), who wondered, "Why did the critical period of imperialism happen to occur in these thirty years after 1880?"

4. Daniel R. Headrick, *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (New York: Oxford University Press, 1981).

5. This is how Felipe Fernández-Armesto explains the sudden expansion of Europe in the fifteenth and sixteenth centuries; see *Pathfinders: A Global History of Exploration* (New York: Norton, 2006), pp. 144–45.

6. Leon Kass, "The New Biology: What Price Relieving Man's Estate?" *Science* 174 (November 19, 1971), p. 782.

7. Michael Adas, *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance* (Ithaca: Cornell University Press, 1989).

8. Carlo Cipolla, *Guns, Sails, and Empires: Technological Innovation and the Early Phases of European Expansion, 1400–1700* (New York: Random House, 1965); Geoffrey Parker, *The Military Revolution: Military Innovation and the Rise of the West, 1500–1800*, 2nd ed. (Cambridge: Cambridge University Press, 1996).

9. For a brilliant popular example of geographical determinism, see Jared M. Diamond, *Guns, Germs, and Steel: The Fates of Human Societies* (New York: Norton, 1997).