

Why Did Human History Unfold Differently on Different Continents for the Last 13,000 Years?

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Part 1: Around the world in 40 minutes

I've set myself the modest task today of trying to explain the broad pattern of human history, on all the continents, for the last 13,000 years. Why did history take such different evolutionary courses for peoples of different continents? This problem is now ripe for a new synthesis because of recent advances in many fields seemingly remote from history, including molecular biology, plant and animal genetics and biogeography, archaeology, and linguistics. I'll try to answer this question for you in 40 minutes, which averages out at less than 7 minutes per continent.

My theme, then, is the different courses of history for peoples of different continents. As we all know, Eurasians, especially peoples of Europe and eastern Asia, have spread around the globe, to dominate the modern world in wealth and power. Other peoples, including most Africans, survived, and have thrown off European domination but remain far behind in wealth and power. Still other peoples, including the original inhabitants of Australia, the Americas, and southern Africa, are no longer even masters of their own lands but have been decimated, subjugated, or exterminated by European colonialists. Why did history turn out that way, instead of the opposite way? Why weren't Native Americans, Africans, and Aboriginal Australians the ones who conquered or exterminated Europeans and Asians?

This question can easily be pushed back one step further. By the year A.D. 1500, the approximate year when Europe's overseas expansion was just beginning, peoples of the different continents already differed greatly in technology and political organization. Much of Eurasia and North Africa was occupied then by Iron Age states and empires, some of them on the verge of industrialization. Two Native American peoples, the Incas and Aztecs, ruled over empires with stone tools and were just starting to experiment with bronze. Parts of sub-Saharan Africa were divided among small indigenous Iron Age states or chiefdoms. But all peoples of Australia, New Guinea, and the Pacific islands, and many peoples of the Americas and sub-Saharan Africa, were still living as farmers or even still as hunter/gatherers with stone tools.

Obviously, those differences as of A.D. 1500 were the immediate cause of the modern world's inequalities. Empires with iron tools conquered or exterminated tribes with stone tools. But how did the world evolve to be the way that it was in the year A.D. 1500?

This question, too can be easily pushed back a further step, with the help of written histories and archaeological discoveries. Until the end of the last Ice Age around 11,000 B.C., all humans on all continents were still living as Stone Age hunter/gatherers. Different rates of development on different continents, from 11,000 B.C. to A.D. 1500, were what produced the inequalities of A.D. 1500. While Aboriginal Australians and many Native American peoples remained Stone Age hunter/gatherers, most Eurasian peoples, and many peoples of the Americas and sub-Saharan Africa, gradually developed agriculture, herding, metallurgy, and complex political organization. Parts of Eurasia, and one small area of the Americas, developed indigenous writing as well. But each of these new developments appeared earlier in Eurasia than elsewhere.

So, we can finally rephrase our question about the evolution of the modern world's inequalities as follows. Why did human development proceed at such different rates on different continents for the last 13,000 years? Those differing rates constitute the broadest pattern of history, the biggest unsolved problem of history, and my subject today.

To appreciate how far from obvious is the answer to this question, imagine that an alien historian from Outer Space had visited the Earth 50,000 years ago. If that visitor had been asked to predict which continent's people would develop technology most rapidly, and who would conquer whom, what do you think that the alien would have predicted? The alien might well have answered "Africa," because human history in Africa had a six-million-year head start over history on the other continents. Or, the alien might instead have predicted "Australia," the continent with perhaps the earliest evidence of anatomically and behaviorally fully modern humans, and the continent with by far the earliest evidence for human use of watercraft. The visitor would surely have written off Europe, where Homo sapiens still hadn't even arrived as of 50,000 years ago. To that visitor, the state of the world as we see it today would be incomprehensible. What were the reasons for the unexpected outcome?

By now, you may have been starting to wonder: Oh, my God! Did the Faculty Research Lecture Committee really blow it in their choice this year? Is this guy going to give us excuses for the status quo, with all its gross injustices? Are we about to hear an apology for racism?

No, I won't be talking about differences in IQ, and I won't be asserting that Europeans spread overseas because of being smarter than other peoples. Many Europeans tacitly assume so, even though they may have learned that it's no longer considered politically correct to say so in public. Technologically primitive peoples are often assumed to be biologically primitive.

But many attempts, especially in the U.S., to document innate IQ differences among different peoples have been unsuccessful. My own impression, from my 32 years of field work in New Guinea, is that New Guineans recently out of the Stone Age appear on the average considerably more intelligent than Europeans -- partly for the obvious reason that natural selection related to intelligence operates much more ruthlessly in traditional New Guinea societies than in politically organized Europe, so that New Guineans probably have an average genetic advantage. In addition, most European and American children today suffer from the crippling developmental disadvantage of spending much of their time being passively entertained by radio, TV, and movies, while traditional New Guinea children spend all of their waking time talking or otherwise actively engaged with other children and adults.

We therefore have to turn the usual racist assumption on its head. Instead of asking how industrial peoples came to be smarter, we have to ask: why is it that modern Stone Age peoples, despite probably being genetically smarter and certainly being developmentally advantaged, nevertheless ended up technologically outstripped and conquered by Eurasians?

In case you still feel uncomfortable about exploring this subject, just reflect on the underlying reason why so many people accept racist explanations of history's broad pattern: we don't have a convincing alternative explanation. Until we do, people will continue to gravitate by default to racist theories. That leaves us with a huge moral gap, which constitutes the strongest reason for tackling this uncomfortable subject.

Part 2: Why did a few hundred Spaniards overthrow the Aztecs and Incas?

Let's proceed continent-by-continent. As our first continental comparison, let's consider the collision of the Old World and the New World that began with Christopher Columbus's voyage in A.D. 1492, because the proximate factors involved in that outcome are well understood. I'll now give you a summary and interpretation of the histories of North America, South America, Europe, and Asia from my perspective as a biogeographer and evolutionary biologist. Here we go:

Most of us are familiar with the stories of how a few hundred Spaniards under Cortés and Pizarro overthrew the Aztec and Inca Empires. The populations of each of those empires numbered tens of millions. We're also familiar with the gruesome details of how other Europeans conquered other parts of the New World. The result is that Europeans came to settle and dominate most of the New World, while the Native American population declined drastically from its level as of A.D. 1492. Why did it happen that way? Why didn't it instead happen that the Emperor Montezuma or Atahualpa led the Aztecs or Incas to conquer Europe?

The **proximate reasons** are obvious. Invading Europeans had steel swords, guns, and horses, while Native Americans had only stone and wooden weapons and no animals that could be ridden. Those military

advantages repeatedly enabled troops of a few dozen mounted Spaniards to defeat Indian armies numbering in the thousands.

Nevertheless, steel swords, guns, and horses weren't the only proximate factors behind the European conquest of the New World. Infectious diseases introduced with Europeans, like smallpox and measles, spread from one Indian tribe to another, far in advance of Europeans themselves, and killed an estimated 95% of the New World's Indian population. Those diseases were endemic in Europe, and Europeans had had time to develop both genetic and immune resistance to them, but Indians initially had no such resistance. That role played by infectious diseases in the European conquest of the New World was duplicated in many other parts of the world, including Aboriginal Australia, southern Africa, and many Pacific islands.

Finally, there is still another set of proximate factors to consider. How is it that Pizarro and Cortés reached the New World at all, before Aztec and Inca conquistadores could reach Europe? That outcome depended partly on technology in the form of ocean-going ships. Europeans had such ships, while the Aztecs and Incas did not. Also, those European ships were backed by the centralized political organization that enabled Spain and other European countries to build and staff the ships. Equally crucial was the role of European writing in permitting the quick spread of accurate detailed information, including maps, sailing directions, and accounts by earlier explorers back to Europe, to motivate later explorers. Writing may also be relevant to what seems to us today the incredible naiveté that permitted the Inca Emperor Atahualpa to walk into Pizarro's trap, and that permitted the Aztec Emperor Montezuma to mistake Cortés for a returning god. Since the Incas had no writing and the Aztecs had only a short tradition of writing, they didn't inherit knowledge of thousands of years of written history. That may have left them less able to anticipate a wide range of human behavior and dirty tricks, while writing made Pizarro and Cortés better able to do so.

Part 3: How domestication of animals proved easiest for Europeans

So far, we've identified a series of proximate factors behind European colonization of the New World: namely, ships, political organization, and writing that brought Europeans to the New World; European germs that killed most Indians before they could reach the battlefield; and guns, steel swords, and horses that gave Europeans a big advantage on the battlefield. Now, let's try to push the chain of causation back further. Why did these proximate advantages go to the Old World rather than to the New World? Theoretically, Native Americans might have been the ones to develop steel swords and guns first, to develop ocean-going ships and empires and writing first, to be mounted on domestic animals more terrifying than horses, and to bear germs worse than smallpox.

The part of that question that's easiest to answer concerns the reasons why Eurasia evolved the nastiest germs. It's striking that Native Americans evolved no devastating epidemic diseases to give to Europeans, in return for the many devastating epidemic diseases that Indians received from the Old World. There are two straightforward reasons for this gross imbalance. First, most of our familiar epidemic diseases can sustain themselves only in large dense human populations concentrated into villages and cities, which arose much earlier in the Old World than in the New World. Second, recent studies of microbes, by molecular biologists, have shown that most human epidemic diseases evolved from similar epidemic diseases of the domestic animals with which we came into close contact. For example, measles evolved from a disease of our dogs, influenza from a disease of pigs, smallpox from a disease of cows, and falciparum malaria from a disease of birds such as chickens. The Americas had very few native domesticated animal species from which humans could acquire such diseases.

Let's now push the chain of reasoning back one step further. Why were there far more species of domesticated animals in Eurasia than in the Americas? The Americas harbor over a thousand native wild mammal species and several thousand wild bird species, so you might initially suppose that the Americas offered plenty of starting material for domestication.

In fact, only a tiny fraction of wild mammal and bird species has been successfully domesticated, because domestication requires that a wild animal fulfill many prerequisites: the animal has to have a diet that humans can supply; a rapid growth rate; a willingness to breed in captivity; a tractable disposition; a social structure involving submissive behavior towards dominant animals and humans; and lack of a tendency to panic when fenced in. Thousands of years ago, humans domesticated every possible large wild mammal species fulfilling all those criteria and worth domesticating, with the result that there have been no

valuable additions of domestic animals in recent times, despite the efforts of modern science.

Eurasia ended up with the most domesticated animal species in part because it's the world's largest land mass and offered the most wild species to begin with. That pre-existing difference was magnified 13,000 years ago at the end of the last Ice Age, when more than 80% of the large mammal species of North and South America became extinct, perhaps exterminated by the first arriving Indians. As a result, Native Americans inherited far fewer species of big wild mammals than did Eurasians, leaving them only with the llama and alpaca as a domesticate. Differences between the Old and New Worlds in domesticated plants, especially in large-seeded cereals, are qualitatively similar to these differences in domesticated mammals, though the difference is not so extreme.

Another reason for the higher local diversity of domesticated plants and animals in Eurasia than in the Americas is that Eurasia's main axis is east/west, whereas the main axis of the Americas is north/south. Eurasia's east/west axis meant that species domesticated in one part of Eurasia could easily spread thousands of miles at the same latitude, encountering the same day-length and climate to which they were already adapted. As a result, chickens and citrus fruit domesticated in Southeast Asia quickly spread westwards to Europe; horses domesticated in the Ukraine quickly spread eastwards to China; and the sheep, goats, cattle, wheat, and barley of the Fertile Crescent quickly spread both west and east.

In contrast, the north/south axis of the Americas meant that species domesticated in one area couldn't spread far without encountering day-lengths and climates to which they were not adapted. As a result, the turkey never spread from its site of domestication in Mexico to the Andes; llamas and alpacas never spread from the Andes to Mexico, so that the Indian civilizations of Central and North America remained entirely without pack animals; and it took thousands of years for the corn that evolved in Mexico's climate to become modified into a corn adapted to the short growing season and seasonally changing day-length of North America.

Eurasia's domesticated plants and animals were important for several other reasons besides letting Europeans develop nasty germs. Domesticated plants and animals yield far more calories per acre than do wild habitats, in which most species are inedible to humans. As a result, population densities of farmers and herders are typically ten to a hundred times greater than those of hunter/gatherers. That fact alone explains why farmers and herders everywhere in the world have been able to push hunter/gatherers out of land suitable for farming and herding. Domestic animals revolutionized land transport. They also revolutionized agriculture, by letting one farmer plough and manure much more land than the farmer could till or manure by the farmer's own efforts. Also, hunter/gatherer societies tend to be egalitarian and to have no political organization beyond the level of the band or tribe, whereas the food surpluses and storage made possible by agriculture permitted the development of stratified, politically centralized societies with governing elites. Those food surpluses also accelerated the development of technology, by supporting craftspeople who didn't raise their own food and who could instead devote themselves to developing metallurgy, writing, swords, and guns.

Thus, we began by identifying a series of proximate explanations -- guns, germs, and so on -- for the conquest of the Americas by Europeans. Those proximate factors seem to me ultimately traceable in large part to the Old World's greater number of domesticated plants, much greater number of domesticated animals, and east/west axis. The chain of causation is most direct in explaining the Old World's advantages of horses and nasty germs. But domesticated plants and animals also led more indirectly to Eurasia's advantage in guns, swords, ocean-going ships, political organization, and writing, all of which were products of the large, dense, sedentary, stratified societies made possible by agriculture.

Part 4: Where Africa fits into the scheme

Let's next examine whether this scheme, derived from the collision of Europeans with Native Americans, helps us understand the broadest pattern of African history, which I'll summarize in five minutes. I'll concentrate on the history of sub-Saharan Africa, because it was much more isolated from Eurasia by distance and climate than was North Africa, whose history is closely linked to Eurasia's history. Here we go again.

Just as we asked why Cortés invaded Mexico before Montezuma could invade Europe, we can similarly ask why European countries colonized sub-Saharan Africa before sub-Saharan countries could colonize Europe. The proximate factors were the same familiar ones of guns, steel, ocean-going ships, political organization, and writing. But again, we can ask why guns and ships and so on ended up being developed in Europe rather than in sub-Saharan Africa. To the student of human evolution, that question is particularly puzzling, because humans have been evolving for millions of years longer in Africa than in Europe, and even anatomically modern *Homo sapiens* may have reached Europe from Africa only within the last 50,000 years. If time were a critical factor in the development of human societies, Africa should have enjoyed an enormous head start and advantage over Europe.

Again, that outcome largely reflects biogeographic differences in the availability of domesticable wild animal and plant species. Taking first domestic animals, it's striking that the sole animal domesticated within sub-Saharan Africa was a bird, the Guinea fowl. All of Africa's mammalian domesticates -- cattle, sheep, goats, horses, even dogs -- entered sub-Saharan Africa from the north, from Eurasia. At first that sounds astonishing, since we now think of Africa as the continent par excellence of big wild mammals. In fact, none of those famous big wild mammal species of Africa proved domesticable. They were all disqualified by one or another problem such as: unsuitable social organization; intractable behavior; slow growth rate; and so on. Just think what the course of world history might have been like if Africa's rhinoceroses and hippopotamuses had lent themselves to domestication! If that had been possible, African cavalry mounted on rhinos or hippos would have made mincemeat of European cavalry mounted on horses. But it couldn't happen.

Instead, as I mentioned, the livestock adopted in Africa were Eurasian species that came in from the north. Africa's long axis, like that of the Americas, is north/south rather than east/west. Those Eurasian domestic mammals spread southwards very slowly in Africa, because they had to adapt to different climate zones and different animal diseases.

The difficulties posed by a north/south axis to the spread of domesticated species are even more striking for African crops than they are for livestock. Remember that the food staples of ancient Egypt were Fertile Crescent and Mediterranean crops like wheat and barley, which require winter rains and seasonal variation in day length for their germination. Those crops couldn't spread south in Africa beyond Ethiopia, beyond which the rains come in the summer and there's little or no seasonal variation in day length. Instead, the development of agriculture in the sub-Sahara had to await the domestication of native African plant species like sorghum and millet, adapted to Central Africa's summer rains and relatively constant day length.

Ironically, those crops of Central Africa were for the same reason then unable to spread south to the Mediterranean zone of South Africa, where once again winter rains and big seasonal variations in day length prevailed. The southwards advance of native African farmers with Central African crops halted in Natal, beyond which Central African crops couldn't grow.

In short, a north/south axis, and a paucity of wild plant and animal species suitable for domestication, were decisive in African history, just as they were in Native American history. Although native Africans domesticated some plants in the Sahel and in Ethiopia and in tropical West Africa, they acquired valuable domestic animals only later, from the north. The resulting advantages of Europeans in guns, ships, political organization, and writing permitted Europeans to colonize Africa, rather than Africans to colonize Europe.

Part 5: Australia tests theories about evolution of human societies

Let's now conclude our whirlwind tour around the globe by devoting five minutes to the last continent, Australia. Here we go again, for the last time.

In modern times, Australia was the sole continent still inhabited only by hunter/gatherers. That makes Australia a critical test of any theory about continental differences in the evolution of human societies. Native Australia had no farmers or herders, no writing, no manufacture of metal tools, and no political organization beyond the level of the tribe or band. Those, of course, are the reasons why European guns and germs destroyed Aboriginal Australian society. But why had all Native Australians remained hunter/gatherers?

There are three obvious reasons. First, even to this day no native Australian animal species and only one plant species (the macadamia nut) have proved suitable for domestication. There still are no domestic kangaroos.

Second, Australia is the smallest continent, and most of it can support only small human populations because of low rainfall and productivity. Hence the total number of Australian hunter/gatherers was only about 300,000.

Finally, Australia is the most isolated continent. The sole outside contacts of Aboriginal Australians were tenuous overwater contacts with New Guineans and Indonesians.

To get an idea of the significance of that small population size and isolation for the pace of development in Australia, consider the Australian island of Tasmania, which had the most extraordinary human society in the modern world. Tasmania is just an island of modest size, but it was the most extreme outpost of the most extreme continent, and we'll see that it illuminates a big issue in the evolution of all human societies. Tasmania lies 130 miles southeast of Australia. When it was first visited by Europeans in 1642, Tasmania was occupied by 4,000 hunter/gatherers related to mainland Australians, but with the simplest technology of any recent people on Earth. Cultural features that mainland Aboriginal Australians possessed and that Tasmanians lacked included the following. Tasmanians couldn't start a fire; they lacked the boomerangs, spear throwers, and shields of mainland Australians; and they had no bone tools, no specialized stone tools, and no compound tools like an axe head mounted on a handle. Their only stone tool was a crude hand-held scraper without ground edges. With only those scrapers, Tasmanians couldn't cut down a tree or hollow out a canoe. They lacked nets, traps, ropes, and sewing, hence even in Tasmania's cold winter climate they lacked clothing other than a one-piece cape thrown over the shoulder. Though they lived mostly on the sea coast, the Tasmanians -- incredibly -- didn't catch or eat fish. How did those enormous gaps in Tasmanian material culture arise?

The answer stems from the fact that Tasmania used to be joined to the southern Australian mainland at Pleistocene times of low sea level, until that land bridge was severed by rising sea level 10,000 years ago. People walked out to Tasmania tens of thousands of years ago, when it was still part of Australia. Once that land bridge was severed, though, there was absolutely no further contact of Tasmanians with mainland Australians or with any other people on Earth until European arrival in 1642, because both Tasmanians and mainland Australians lacked watercraft capable of crossing those 130-mile straits between Tasmania and Australia. Tasmanian history is thus a study of human isolation unprecedented except in science fiction -- namely, complete isolation from other humans for 10,000 years. Tasmania had the smallest and most isolated human population in the world. If population size and isolation have any effect on accumulation of inventions, we should expect to see that effect in Tasmania.

If all those technologies that I mentioned, absent from Tasmania but present on the opposite Australian mainland, were invented by Australians within the last 10,000 years, we can surely conclude at least that Tasmania's tiny population didn't invent them independently. Astonishingly, the archaeological record demonstrates something further: Tasmanians actually abandoned some technologies that they brought with them from Australia and that persisted on the Australian mainland. For example, bone tools and the practice of fishing were both present in Tasmania at the time that the land bridge was severed, and both disappeared from Tasmania by around 1500 B.C. That represents the loss of valuable technologies: fish could have been smoked to provide a winter food supply, and bone needles could have been used to sew warm clothes. What sense can we make of these cultural losses?

The only interpretation that makes sense to me goes as follows. First, technology has to be invented or adopted. Human societies vary in lots of independent factors affecting their openness to innovation. Hence the higher the human population and the more societies there are on an island or continent, the greater the chance of any given invention being conceived and adopted somewhere on the island.

Second, for all human societies except those of totally isolated Tasmania, most technological innovations diffuse in from the outside, instead of being invented locally, so one expects the evolution of technology to proceed most rapidly in societies most closely connected with outside societies.

Finally, technology not only has to be adopted; it also has to be maintained. All human societies go through fads in which they temporarily either adopt practices of little use or else abandon practices of considerable use. Whenever such senseless taboos arise in an area with many competing human societies, only some societies will adopt the taboo at a given time. Other societies will retain the useful practice, and will either outcompete the societies that lost it, or else will be there as a model for the societies with the taboos to repent their error and re-acquire the practice. If Tasmanians had remained in contact with mainland Australians, they could have rediscovered the value and techniques of fishing and making bone tools. But that couldn't happen in the complete isolation of Tasmania, where cultural losses became irreversible.

In short, the message of the differences between Tasmanian and mainland Australian societies seems to be the following. All other things being equal, the rate of human invention is faster, and the rate of cultural loss is slower, in areas occupied by many competing societies with many individuals and in contact with societies elsewhere. If this interpretation is correct, then it's likely to be of much broader significance. It probably provides part of the explanation for native Australians, on the world's smallest and most isolated continent, remaining Stone Age hunter/gatherers, while people of other continents were adopting agriculture and metal. It's also likely to contribute to the differences that I already discussed between the farmers of sub-Saharan Africa, the farmers of the much larger Americas, and the farmers of the still larger Eurasia.

Part 6: Environmental differences outweigh biological differences

Naturally, there are many important factors in world history that I haven't had time to discuss in 40 minutes. For example, I've said little or nothing about the distribution of domesticable plants; about the precise way in which complex political institutions and the development of writing depend on agriculture and herding; about the reasons for the differences within Eurasia between China, India, the Near East, and Europe; and about the effects of individuals, and of environment-unrelated cultural differences, on history. But it's now time to summarize the overall meaning of this whirlwind tour through human history, with its unequally distributed guns and germs.

The broadest pattern of history -- namely, the differences between human societies on different continents -- seems to me to be attributable to differences among continental environments, and not to biological differences among peoples themselves. In particular, the availability of wild plant and animal species suitable for domestication, and the ease with which those species could spread without encountering unsuitable climates, contributed decisively to the varying rates of rise of agriculture and herding; which in turn contributed decisively to the rise of human population numbers, population densities, and food surpluses; which in turn contributed decisively to the development of epidemic infectious diseases, writing, technology, and political organization. In addition, the histories of Tasmania and Australia warn us that the differing areas and isolations of the continents, by determining the number of competing societies, may have been another important factor in human development.

As a biologist practicing laboratory experimental science, I'm aware that some scientists may be inclined to dismiss these interpretations as unprovable speculation, because they're not founded on replicated laboratory experiments. The same objection can be raised against any of the historical sciences, including astronomy, evolutionary biology, geology, and paleontology. The objection can of course be raised against the entire field of history, and most of the other social sciences. That's the reason why we're uncomfortable about considering history as a science. It's classified as a social science, which is considered not quite scientific.

But remember that the word "science" isn't derived from the Latin word for "replicated laboratory experiment," but instead from the Latin word for "knowledge." In science, we seek knowledge by whatever methodologies are available and appropriate. There are many fields that no one hesitates to consider sciences even though replicated laboratory experiments in those fields would be immoral, illegal, or impossible. We can't manipulate some stars while maintaining other stars as controls; we can't start and stop ice ages; and we can't experiment with designing and evolving dinosaurs. Nevertheless, we can still gain considerable insight into these historical fields by other means.