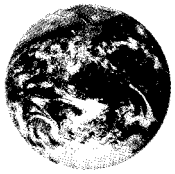
The Haskins Lectureship on Science Policy



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

JARED M. DIAMOND, Ph.D.
Professor of Physiology
UCLA School of Medicine

Introduction by

JAMES A. THOMSON
President and Chief Executive Officer
of
RAND

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Dr. Haskins and the late Mrs. Haskins were dedicated to improving the nation's understanding of the relationship between scientific progress and sound public policy.

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JIM THOMSON

[Our speaker] has chosen a narrow subject. The title: "Why did human history unfold differently on different continents for the last 13,000 years?" [audience laughter]

We are honored to be hearing from one of the biggest and most captivating thinkers around. To give you a sense of his breadth . . . the list of fields he has mastered includes physiology, evolutionary biology, history, ornithology, and goes on from there. Last year, he received the National Medal of Science. Jared Diamond has also won more topflight science writing awards than any other contemporary writer, especially for his book *Guns, Germs, and Steel: The Fates of Human Societies.* Our colleague Lynn Karoly suggested this book to me. I read it and, as a result, when we were talking about possible Haskins lecturers, Dr. Diamond's name came immediately to mind.

A native of Boston, Dr. Diamond earned a B.A. at Harvard, [then] traveled to England to take a Ph.D. at Cambridge. He moved to UCLA in 1966 to become professor of physiology at the medical school and has remained here ever since. It's a great honor and pleasure to introduce to you Dr. Jared Diamond.

JARED DIAMOND

It is a great honor and pleasure for me to be with you this evening, especially because I get to discuss the most interesting and important and difficult question about history; namely, why history unfolded differently on different continents.

Just to introduce this subject in a personal way: As I look out at you this evening, it looks to me as if the great majority of you here are of Old-World origin—Eurasian or African origin. And yet if we could

have been at this spot 500 years ago, everybody at this spot 500 years ago would have been of Native American origin. So why did history unfold *that* way? Why didn't it unfold the reverse way? Why was it not the case that Native Americans were the ones to sail across the Atlantic to Europe and conquer and exterminate and infect Europeans? And why is it not the case that the last original Europeans are now living on reservations somewhere up in the Pyrenees? It didn't happen *that* way. Why not? [audience laughter]

It's a simple question, but it proves complicated. The answer to this question depends on recent advances in fields seemingly remote from human history—recent advances in genetics, linguistics, archaeology, molecular biology, animal behavior, and plant biochemistry—and that's why this question has escaped solution by historians themselves.

The contents of my book *Guns, Germs, and Steel* are well summed up by the British subtitle—which my American editor refused because it seemed too flip to him. But I think the British subtitle does accurately catch what my book is about. That British subtitle is *A Short History of Everybody for the Last 13,000 Years.* Now, you can easily calculate: The text of my book is 420 pages long. And we've got five continents, 13,000 years, 130 centuries. So 5 times 130 divided into 420—that means on the average, one page of my book covers the history of one continent for 150 years. And right away you can tell that I had to omit some details about history [audience laughter] to get it all into 420 pages. And this evening I promise you to get it all into about 35 minutes, and therefore I am going to omit *more* details, but nevertheless I hope in these 35 minutes to hit the high points of what happened everywhere since the last Ice Ages and why it happened.

A convenient starting point is to go back 13,000 years and to look at the state of the world then. At that time, at the end of the Ice Ages, everybody everywhere in the world was living as a hunter-gatherer, gaining sustenance by gathering wild plants and small animals and hunting large animals rather than by growing crops and livestock. Hunter-gatherer societies are mostly mobile, shifting base every few days or every few weeks to follow seasonal movements in the food supply. Hunter-gatherers live at low population densities, typically one person per square mile down to one person per 100 square miles. And those low population densities of hunter-gatherers result from two things.

First of all, nomadism and shifting camp means that hunter-gatherer women are constrained to spacing out their children at intervals of four years. A hunter-gatherer woman can carry one baby on her back when she shifts camp, but she can't carry two babies on her back, and therefore hunter-gatherer women in various ways spaced out their children at four-year intervals. When a child is four years old, then that child can keep up with the adults. But a woman cannot afford to have another child until the previous child is four years old and can keep up with the group. So hunter-gatherer women then space out their children at four years—that's *one* of the reasons for the low population densities of hunter-gatherers.

And the *other* reason is that most of the wild plants and animals out there simply are not edible to us humans. The density of edible plants and animals in wild habitats is really very low; there is *not* much food there. So there we have two reasons for the low population densities of hunter-gatherers.

Hunter-gatherer societies are relatively simple in their technology. No hunter-gatherers ever developed metal tools, [they] never developed writing, and there are a couple of reasons for that. One reason is that

if you are shifting camp every few days or every couple of weeks, the last thing[s] you want to carry on your back [are] some large pots and a printing press and an iron forge and an atomic bomb. [audience laughter] So hunter-gatherers have simple, light, portable technology. The other reason for the relative simplicity of hunter-gatherer technology is that the hunter-gatherer lifestyle does not produce food surpluses that can be stored and can be used to feed people who do not go to the work of hunting and gathering but [rather] can stay home and devote all their time to figuring out how to smelt iron and build atomic bombs. So there we have two reasons for the simple technology of hunter-gatherers: the fact that it's got to be portable, and the fact that they don't have the surpluses to feed people who devote all their time to being technological specialists.

Similarly, hunter-gatherer societies are relatively egalitarian. They are not socially stratified. They are not politically centralized. Hunter-gatherer societies don't have kings. They don't even have chiefs. And the reason for that, again, is that they don't produce food surpluses. So there are not food surpluses that can be used to feed people who'd be spending all their time acting as kings, priests, generals, and all those other social parasites. [audience laughter]

So, those are the characteristics then of hunter-gatherer societies, which meant everybody, until 10,500 years ago when agriculture first began to emerge. *With* the rise of agriculture, all of the things I've just told you about hunter-gatherer societies began to change. With the development of the farming lifestyle, people at last for the first time in human history were able to settle down in permanent villages, living next to their orchards and their fields and their pastures. Societies of farmers and herders typically live at high population densities, typically 100 people per square mile up to 1,000 people per square mile. And those high densities of farmers and herders are

partly because they are sedentary, so farmer women *don't* have the problem of being unable to have babies more often than every four years. They are not going to have to *carry* the babies, and so the birth intervals of traditional farming societies typically are two years or less. That's *one* reason for the population explosion.

Now, the *other* reason for the population explosion associated with the advent of farming 10,500 years ago was that in that pasture or orchard or wheat field, essentially *all* the plants and animals there are edible to us humans. There is a much higher density of edible food in the pasture/orchard/garden than there is out in the forest or in wild habitats. So the development of farming and herding was associated with a population explosion.

The agricultural lifestyle is capable of producing food surpluses. You could harvest the wheat and store the wheat. When you kill the cows and kill the sheep, you can dry out the resulting meat. And so farming societies do produce storable food surpluses that can be used to feed people who will not devote their time to acquiring food or producing food but [who] can sit in the village all the time and figure out how to extract copper and smelt copper and produce bronze and smelt iron and eventually [devise] high technology. In addition, because farming societies don't have the problem of shifting base every few days or every couple of weeks, it's perfectly possible to have large, heavy, nonportable technology. Farmers have the specialists who can figure out how to make printing presses, and they can afford to have a one-ton printing press; they are not going to have to carry it with them.

So the development of agriculture—somewhat more than 10,000 years ago—was associated with an explosion of technology, and with a shift from stone and wooden tools to metal tools. In addition, those food surpluses that farmers accumulate are a temptation to some

charismatic farmer who is sick of getting out there and hoeing the wheat field every day. [He would] say, "Hi, folks. I'll be your boss. I'll be your chief or king. I am not going out into the wheat field but I'm gonna render you services. I am going to set up a judicial system so if there is an argument you don't go out and kill each other. We're going to have courts and adjudicate. I am going to organize your society, and we are going to use the storable food surpluses to feed me in return for these services that I render you, and to feed my tax collectors and bureaucrats to administer you, and also to feed a standing army and generals who use that standing army and generals to go smoosh the people next door and to take over their land to feed all of you, my beloved people, and your children. And incidentally, if any of you peasants decide to revolt against me, that standing army will put down your revolts."

So, the development of the agricultural lifestyle, then, was associated with sedentary living, population explosion, proliferation of complex technology, the rise of social stratification, class structure, and the development of political centralization and standing armies. And as I'm going to explain to you, the development of agriculture was also associated with the rise of crowd epidemic diseases.

So we've now got lots of reasons why throughout history the farmers have been able to kill/exterminate/conquer/drive out the hunter-gatherers in all areas of the world suitable for farming. Namely, the farmers are much more numerous. There are 1,000 to 10,000 times more farmers per square mile than there are hunter-gatherers. The farmers have much more advanced technology, including more advanced military technology. The farmers have permanent standing armies, and the armies have generals and political centralization. So it's no surprise that the farmers have been able to crush the hunter-gatherers. We have seen that in the last 500 years described in

excruciating detail as European farmers spread around the world and conquered or exterminated hunter-gatherers on other continents. Thus, the European conquest of Aboriginal Australia and of the hunter-gatherers in western North America and of the Khoisan hunter-gatherers of Southern Africa and of the Siberian hunter-gatherers. But those displacements or exterminations of hunter-gatherers by farmers actually began *long* before the European expansion of the last 500 years.

Given then that farming bestowed such enormous power on farmers . . . why is it *not* the case that everywhere in the world *some* hunter-gatherers went out and domesticated crops and animals and gained all these advantages and became farmers conquering their neighbors? In fact, it's especially striking if you look at the areas that are most productive for agriculture in the modern world. Not a single one of these breadbaskets in the modern world witnessed the independent origins of agriculture 10,000 years ago. For example, in the United States, here we are in California. California and the Great Plains have *the* most productive agriculture in the United States, and yet there were *no* independent origins of agriculture in California and the Great Plains. All the Native American populations of California were hunter-gatherers, and farming was brought into California from the outside. Why, since California and the Great Plains today are such great places for farming? Or Europe, with *the* most intensive productive agriculture in the world? Java, one of the most densely *populated* farming societies of the world? Japan? The Indian subcontinent, where today one *billion* people nourish themselves by farming? The Mediterranean zone of South Africa, which is *the* most productive agricultural area of Southern Africa? The Pampas of Argentina? The wheat belt of southwestern Australia? All of these centers of agriculture in the modern world—not a single one of them saw the independent origins of agriculture. Instead, agriculture came

into *all* these heartlands of modern agriculture that I've just mentioned from the outside.

The reason for this paradox is that, as agriculture arose, the agricultural lifestyle had to compete with the hunter-gatherer lifestyle. But the first farmers required not just one crop but an entire package of productive crops and animals in order to be able to settle down and outcompete the local hunter-gatherers. It turns out, though, that only a tiny fraction of the wild plants and animals out there can be usefully domesticated. And there are very few parts of the world where there were enough wild plants and animals *lending* themselves to domestication to make it possible for hunter-gatherers to settle down, become farmers, and outcompete the other hunter-gatherers. It's now clear there were not more than nine parts of the world—and maybe as few as five parts—where agriculture arose independently.

These very local origins of agriculture, and the fact that so *few* wild plants and animals were capable of being domesticated, are clearest for mammals. Now, there are something like 4,000 species of wild mammals around the world. *Every* continent has hundreds of species of wild mammals. So . . . you might think that people on *every* continent would be able to go out and domesticate some of the wild mammals around them. Why didn't the Aboriginal Australians go out and domesticate wombats and kangaroos and become herders? Well, of those 4,000 species of wild mammals, two-thirds are rats and bats which do not lend themselves to milking and hitching up to carts. [audience laughter] But that still leaves us with 148 species of terrestrial mammals weighing more than 100 pounds, animals that are either omnivores or herbivores, and would look like good candidates for domestication. And *every* continent, even Australia, has at least a *couple* of these species of large, wild mammals, herbivores or omnivores. So again, why didn't people everywhere go out and domesticate some of the big, wild mammals around them?

Here we get into animal behavior. It turns out that for a wild mammal to be "domesticable," it must possess at least six characteristics. And if it lacks any one of these six characteristics, it gets disqualified from domestication. For example, obviously we humans are not going to be able to domesticate and rear in our barnyards an animal with such a finicky diet that we humans cannot provide its food supply. As a result, we have not been able to domesticate anteaters; we can't feed them. And we have not been able to domesticate koala bears, which eat the leaves of six species of tall eucalyptus trees.

There are other problems: No farmer would have the patience to domesticate a wild mammal [that] is slow-growing and doesn't reach full size, ready for the slaughterhouse, until it is 20–25 years old. So gorillas (which would otherwise be a great meat-production animal because they'll eat all sorts of rubbish and plant food) . . . gorillas are very slow-growing and there is no farmer that will wait 20 years until his barnyard gorilla has grown big enough to be ready to send to the slaughterhouse. [audience laughter] Again, no herder is going to domesticate a mammal which, once it reaches the size suitable for slaughtering, is more likely to turn on you and slaughter you than for you to be able to slaughter it. And so grizzly bears, which would have been a fabulous meat-production animal . . . they reach full size in three to five years and they will eat all sorts of garbage, very easy to feed . . . alas, grizzly bears have one disadvantage, shared with rhinoceroses and hippopotamuses and zebras: namely, that they are very nasty animals more likely to kill you than you to kill them. So, we have never domesticated grizzly bears.

Obviously, we can't domesticate a mammal that refuses to breed in captivity. There are some animals that just won't breed in captivity (or it couldn't be done until within the last few decades with high technology in zoos). Cheetahs! The fastest of hunting animals. If you

could have a hunting cheetah, you would much rather go hunting with your pet cheetah than with your pet dog. But cheetahs could not be bred in captivity until zoos with great difficulty achieved it a couple of decades ago. Vicuñas, the little wild camel of the Andes, with the finest wool in the world—today all vicuña wool still comes from wild-caught vicuñas or wild-killed vicuñas because we have never been able to get vicuñas to breed in captivity.

It's easiest to domesticate a mammal species that has what's called a follow-the-leader social structure, where the number two individual follows the number one and the number three follows the number two. Because when a mammal has a follow-the-leader social structure, it is easy for us humans to take *over* that social structure. The animals see us as the *alpha* animal, and that is why you can see a little shepherd girl or shepherd boy leading behind her or him this line of big cows or sheep: because cows or sheep in the wild have a follow-the-leader social structure and they instinctively will follow a leader. Easy to domesticate. Many mammals do *not* have this follow-the-leader social structure. For example, the bighorn sheep of west North America seems so similar, is closely related, in the same genus as the Eurasian sheep. But the Eurasian sheep has a follow-the-leader social structure. The bighorn sheep does *not*. And that is why Native Americans and modern farmers today have never domesticated bighorn sheep. They won't follow you.

Then finally, a mammal [that] when you fence it in is likely to panic and dash itself to death against the fence or leap over the fence—you can't herd/keep that animal. As a result, gazelles—which used to be the main wild food mammal of the Middle East in the area where the first farming and the first herding arose—were never domesticated [by those first herders] because when you fence a gazelle, it freaks out and either leaps over the fence or bashes itself to death against the fence. So there are reasons that disqualified 134 out of the world's 148 big

mammals from being domesticated. That left only 14 species of big, wild mammals that could be domesticated, and of those 14 it turned out that 13 were Eurasian species . . . . The 13 wild mammals domesticated in Eurasia were the cow, sheep, goat, pig, horse, reindeer, donkey, Arabian camel, Asian camel, yak, water buffalo, gaur, and banteng . . . . That left only one big mammal native to the New World that was domesticated. Can any of you think of the one big wild mammal that was domesticated in the New World? Llama! People have been reading my book, that's right! [audience laughter] The llama, alias alpaca. The only big mammal domesticated in the New World; all of the others were disqualified. And no big mammal was ever domesticated in Australia or in Africa south of the Sahara. Incidentally, that fact proved very important in medicine and epidemiology because as you look at the crowd infectious epidemic diseases of humans which have been the major killers of humans in the last 10,000 years—diseases like smallpox and measles and flu and pertussis and typhoid and tuberculosis—those diseases evolved in dense societies of farmers. But where did we get those diseases? Molecular biological studies of the last few decades have shown that these specialized diseases of humans evolved from specialized diseases of our domestic animals and jumped the species barrier within the last 10,000 years. So, for example, measles and tuberculosis evolved within the last 10,000 years from rinderpest and TB of cattle, and flu and pertussis evolved from corresponding diseases of pigs. That's why Europeans carried all these nasty germs that wiped out Native Americans. Because Eurasians in Eurasia had evolved these specialized infectious diseases of humans. The New World lacked herds of large domestic mammals, except for the llama, and so the New World never evolved these crowd epidemic diseases. That's the story for mammals.

For plants, surprisingly, it's also the case that in each part of the world there were only very few plant species that could [be] and were domesticated. That's even more surprising . . . because around the world there are 200,000 species of wild higher plants. And every continent has at least tens of thousands, many tens of thousands (even Australia has tens of thousands) of wild plant species. So again why didn't Aboriginal Australians just go out and domesticate some of the plants around them? Again, it turns out that the vast majority of wild plants, for one reason or another, cannot be domesticated. And those that can be domesticated are very unevenly distributed around the world. For example: the large-seeded, wild cereals that include wheats and barley and corn and rice. These cereals are today the most valuable crops in the world, and around the world there are 56 species of wild, large-seeded cereals—the potential ancestors of the world's most valuable crops. But those 56 species were very unevenly distributed. Thirty-two of them were confined to the Mediterranean zone of Western Eurasia, and that included emmer wheat, einkorn wheat, the hybrid ancestor of bread, wheat, and barley. And of these 56 species of large-seeded, wild cereals, there were only one or two each in California and Chile and Australia. So, of course, native Californians and native Chileans and native Australians never became farmers. There were just not the wild cereals out there for them to domesticate, but there were lots of them in Western Eurasia.

As a result of these advantages of Western Eurasia in wild plants and animals suitable for domestication, the earliest farming and herding arose in that part of Western Eurasia that's known as the Fertile Crescent: that crescent-shaped band of land that runs through what's now Iran, Iraq, Syria, Southeastern Turkey, down into Lebanon, Jordan, Palestine. That's the area where there grew the wild ancestors, the wild wheats and wild barley and wild peas and wild lentils and wild chickpeas and wild flax. That's the area where also lived wild

sheep and wild goats and wild pigs and wild cattle and, nearby, wild horses. So beginning around 8500 B.C., hunter-gatherers of the Fertile Crescent began to domesticate, unconsciously, wheats and barley and sheep and goats and pigs and cattle and, eventually, nearby horses. And, within a short time, they'd assembled a complete package of plants and animals that provided their protein, their carbohydrate, their fat, their vegetable fiber, their animal fiber, their milk, their traction, and their hides. Within a short time thereafter or maybe around the same time, independently, hunter-gatherers in China domesticated wild plants and animals around them. Domesticated wild millets and wild rice and chickens and water buffalo and, again, independently, pigs. And then later, hunter-gatherers domesticated wild plants independently in up to seven other areas of the world: the highlands of New Guinea; three parts of Africa (tropical West Africa, the Sahel zone, Ethiopia); [and] three parts of the New World (Mexico, the Andes and possibly Amazon, and Southeastern United States). But those nine areas are the only candidates, the independent origins of domestication. And from those nine areas, agriculture herding spread around the rest of the world. In particular, there were no independent origins of agriculture and herding anywhere in Australia, in California, in Southern Africa, et cetera, et cetera.

From those nine homelands of agriculture, farming and herding spread, in some cases by hunter-gatherers elsewhere acquiring crops and animals domesticated somewhere else. That's what happened in Southern Africa where the Khoisan people acquired sheep, goats, and cattle coming in from the north, and settled down and became . . . the so-called Hottentot herders. Usually, though, the hunter-gatherers never had the opportunity to acquire crops and livestock from the homelands of agriculture. Instead, the first farmers and herders in those homelands spread too quickly, taking advantage of their

demographic and technological military advantage, carrying their crops and livestock with them, and conquering or exterminating or driving out the hunter-gatherers.

The history of the world for the last 10,000 years has been the histories of these farming expansions. In modern times, what propelled the farmers was the technology that's so familiar to us. And so when I completed my book and was struggling to find a title for it, my wife came up with the idea *Guns, Germs, and Steel.* Guns, germs, and steel are a metaphor for features of technology and nasty germs that gave Europeans the advantage over other peoples. But even before there were steel weapons and guns, ancient farmers and ancient herders gained advantages over ancient hunter-gatherers and expanded similarly. The results have been massive population replacements over the last 10,000 years. And, the result again is that today 90 percent of the people in the world speak languages belonging to language families that 10,000 years ago were confined to two tiny parts of the world, confined to either the Fertile Crescent or to China. Ninety percent of the people in the modern world speak languages derived from the Fertile Crescent: Indo-European, Afro-Asiatic, Dravidian languages—or languages derived from China: Sino-Tibetan, Austroasiatic, Austronesian, Tai-Kadai, and Miao-Yao. And only 10 percent of the people in the modern world speak languages that were derived from everywhere else in the world other than the Fertile Crescent and China. That's because the Fertile Crescent and China were the two earliest centers of farming. The people in those areas got the jump on everybody else and spread around the world carrying their languages.

The expansions of farmers in modern times—European farmers—are clear and written down by literate observers. But there were also ancient expansions of farmers. The clearest ancient cases are cases in

which the immigrant farmers were very different from the indigenous hunter-gatherers, very different in their skeletons, genes, and languages. And so it's easy to recognize that there was a population replacement. One of the two clearest of these ancient farming expansions was the so-called Austronesian expansion. Starting around 4,000 B.C., farmers from the coast of Southern China, carrying with them millets and rice and pigs and chickens, expanded to Taiwan and into the Philippines and Indonesia and then all the way out into the Pacific to become the Polynesians all the way out to Easter Island, replacing in the process the original hunter-gatherer population of all of tropical Southeast Asia. Those original hunter-gatherers were related to modern New Guineans and Aboriginal Australians. But today the populations [of] the Malay Peninsula, Philippines, Indonesia, Polynesia all look very similar, and they all look like Southern Chinese because they are derived from Southern Chinese farmers of 6,000 years ago.

And the other clearest one of these ancient expansions [was the] so-called Bantu expansion: Starting around 3,000 B.C., farmers in tropical West Africa, speaking Bantu languages, began to expand, carrying their tropical West African crops into East Africa, where they picked up cattle, sheep, and goats and they picked up Sahel zone crops. And then beginning about 2,000 years ago, within literally one or two centuries, [these farmers] spread all the way from the equator south to Southern Africa, replacing the hunter-gatherer population of all of subequatorial Africa, people related to the modern pygmies and Khoisan people, replacing these hunter-gatherers except in those few areas unsuitable for Bantu agriculture . . . that's to say the Congo rainforests and the Mediterranean zone and desert of Southern Africa.

So those are two big ancient expansions of farmers. But there was also an ancient expansion of farmers in Europe. Farmers coming in from the Fertile Crescent, replacing the original Europeans. In that case it's

been harder to work out, because the arriving farmers from the Fertile Crescent were much more similar in their skeletons and genes than were the original Europeans that they replaced.

Why is it that some people conquered other peoples? Why did Europeans conquer people elsewhere in the world? I'm always asking people, "Why do you think Europeans expanded?" And within the last few months I've had the chance to talk to cabinet ministers and leaders of American industry and lots of university professors, and the answer that I regularly get is something like this: "Well . . . errrr . . . umm . . . ahhhh . . . I know . . . it's not nice to say this . . . aw shucks . . . um . . . I know this isn't nice and it's not politically correct, but let's face it, you asked me . . . is anybody looking? . . . Europeans just are smarter than these primitive people . . . look at those Aboriginal Australians, they look so primitive! And besides, Europeans have the Judeo-Christian tradition and the work ethic." That's to say people fall back on these racist explanations even though there's not the slightest shred of evidence for any intrinsic intellectual superiority of Europeans. And the reason that people fall back on these racist explanations is that historians have not told them what the answer is. It's obvious that people differ externally in their faces, and so we assume that they also differ internally in their brain power, although there's no evidence for that. In fact, the modern world, the European expansion, obviously resulted from the world of 1492. In A.D. 1492, the Eurasian continent was largely populated by empires with writing and with steel tools and agriculture, while much of the rest of the world was populated by hunter-gatherers with stone and wooden tools and no writing. And, of course, the empires with the steel tools and writing conquered or exterminated the hunter-gatherer tribes with the stone tools. So, how did the world get to be the way it was in 1492? It got to be that way as the result of differing rates of

developments on different continents since 11,000 B.C., and those different rates of development did not arise from racist causes that had anything to do with people. They instead were because of effects of the environment, especially because of differences in the distribution of "domesticable" plant and animal species, and the different orientations and areas and distances of the continents.

If you want experimental proof . . . sometimes people [ask] me: "Well, prove it. If you could show that 10,000 years ago, if we interchanged the populations of Europe and Aboriginal Australia, and brought Aborigines to Europe, then show me that Aborigines would've expanded around the world and conquered the world." Well, we can't do that experiment. But, history performed similar experiments. About 1,000 years ago, history performed some natural experiments in which Northern Germanic people got sprinkled around various places by history. Some Northern Germanic people stayed home in Scandinavia, and some spread out to England, and some spread out to Iceland and Greenland. And you come back 600 years later and see what happened to all these Northern Germanic people. It turns out that those who arrived in England are writing the plays of Shakespeare and are on the verge of an industrial revolution, [while] those Northern Germanic people who emigrated to Greenland carrying their Northern Germanic technology and writing . . . came into contact with stone-tool-using, nonliterate Inuit hunter-gatherers. And after 500 years who was extinct? It was the Northern Europeans, leaving Greenland to the Inuit hunter-gatherers. There's a natural experiment, one of many natural experiments demonstrating that Europeans have no intrinsic superiority. What advantages they have are all derived from the environment.

Well I promised you that I would summarize everything in 35 minutes, and that naturally meant that that leaves many important

factors in world history that I didn't have time to explain to you, but that I do discuss in my book. For example, I've told you very little about the distribution of "domesticable" plant species, to which I devote three whole chapters of my book. I haven't explained to you the precise way in which the development of writing and technology and government and organized religion depended on agriculture and herding, and I've been able to wrap all that up in *three* chapters of my book. And I haven't explained to you the fascinating reasons for the differences within Eurasia between the histories of China, India, the Near East, and Europe, which is possible to summarize in *nine* pages of the book. And I haven't discussed with you the effects of individuals—great men like Alexander the Great—and the effects of cultural differences unrelated to the environment on history. That takes only *two* pages to explain to my satisfaction. But it's now time to summarize the overall meaning of this whirlwind tour through human history with its unequally distributed guns, germs, and steel.

When about 15 years ago—after having devoted my career to being an academic, writing papers to be read by 33 other academics—I instead wanted in addition to communicate the excitement and importance of science to a wide public, I encountered an occupational hazard of the scientist, the academic who would like to communicate to a broad public. And that occupational hazard is to be confronted with the journalist who says to me something like the following: "Mr. Diamond, I realize that you've devoted the last five years of your life to reading these thousands of books and papers, and condensing them into 420 pages to summarize everything about everybody. But Mr. Diamond, please realize that my television viewers and my newspaper readers and my radio listeners are *busy* people. Mr. Diamond, please won't you summarize *everything* about *everybody* in one sentence?" [audience laughter] And so I've learned how to do it. My one sentence is something like the following: That 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 at all to biological differences among peoples themselves. And once you've got the journalist to listen to one sentence, you can usually slip in one more sentence with several clauses. "In particular, Ms. Journalist, 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 varying rates of rise of human population numbers, population densities, and food surpluses; which in turn contributed decisively to the varying rates of rise of epidemic infectious diseases, writing, technology, and political organization."

Now, as a biologist hired by UCLA to practice laboratory experimental science, I know that many laboratory scientists may be inclined to dismiss these historical interpretations as unprovable speculation because they are not founded on what is considered the hallmark of science; namely, replicated, controlled laboratory experiments performed by little men wearing white lab coats. The same objection can be raised, of course, against any of the *historical* sciences, including astronomy, evolutionary biology, geology, and paleontology. And the objection, of course, can be raised against the whole field of history and most of the other social sciences. That's the reason why we're uncomfortable about considering history as a science. History is classified as a *social* science, which is considered "not quite scientific."

But let's remember the etymology of the word *science*. Our word *science* comes from a Latin word, and that Latin word does not mean "replicated, controlled laboratory experiment performed by little men wearing white lab coats." But the Latin word *scientia* from which our

science comes instead means, in Latin, *knowledge*. The essence of science is to seek knowledge by whatever methodologies are available and appropriate in that field. There are many fields that nobody hesitates to consider sciences, even though replicated laboratory experiments in those fields would be immoral or illegal or impossible. For example, epidemiologists don't figure out genetic resistance factors to smallpox by injecting 1,000 of you with smallpox virus and keeping the other 1,000 as controls. And astronomers haven't worked out the cycles of stars by turning up the lights on Betelgeuse and Aldebaran tonight and shutting off Canopus and Sirius and keeping the Pleiades as unmanipulated controls. And geologists haven't worked out what happened with the Ice Ages by melting a glacier here [audience laughter] and pouring more ice into a glacier over there. Nor have paleontologists studied dinosaur evolution by evolving some new dinosaurs Friday night and then exterminating them Monday morning. Nevertheless, all these scientists have gained considerable insight into these historical fields by other means. And so we should surely be able to understand human history, because introspection and preserved writings give us far more insight into the ways of past humans than we shall ever have into the ways of past dinosaurs. For that reason I'm optimistic that we'll eventually arrive at convincing explanations for these broadest patterns of human history.

Thank you.

[APPLAUSE]

JIM THOMSON

We have time for some questions, and since he left so much out, there must be . . . there must be a few people that want to ask questions. And what Jared and I agreed was that I'd let him field the questions and then I'd get up here when we had to stop. So I'll bring him back up.

Q: *Have we reached the end of history?*

JARED DIAMOND Have we reached the end of history? That's the subject of my next book! We're going to know the answer within the next 50 years because we're clearly now on an unsustainable trajectory. When you multiply human population and its increase times impact per capita, we are running out, and it will all get settled within the next 50 years. Within the next 50 years, either we bring our impact on the environment under control and our population stabilizes in pleasant ways of our choice, or our population stabilizes in unpleasant ways not of our choice, possibly including the end of history. So, my sons are gonna see the answer to that question.

Q: *Jared, in your book you talk about the issue of mutations, the genetic likelihood that one might come up with a genius, for example, in a particular society. I've always been puzzled by the relationship between that and the environment, if you will. The concept that in malnutrition it may be very difficult to evolve a situation which you have a large enough population with a broad enough number of healthy people so that you are going to have the probabilities of a Mozart or an Alexander*

Graham Bell or whatever. I just wondered if you would elucidate for us what your thoughts are about the notion that societies could evolve differently in terms of their intellectual capacity on the basis of the environment in which they raise their children and/or they grow and develop.

JARED DIAMOND For those of you who didn't hear, the question asked had to do with whether there *might* be differences.

It's my impression. I can think of reasons why that should be the case, I can think of genetic reasons that in traditional societies like New Guinea societies, where the commonest cause of death is violence or starvation, whether or not you survive those common causes of death depends on your intellect there's severe natural selection for intellect; whereas in farming societies, particularly in state societies, the leading cause of death traditionally has been infectious disease, so selection is for A, B, O blood groups and genetic resistance to disease. And on top of that, the developmental surrounding for modern kids, compared to the developmental surrounding for New Guinea, is just awful. Since I'm the father of 13-year-old children, it really upsets me. The constant struggle that I go through with my kids, compared [with] the situation in New Guinea where there is no passive entertainment, no Gameboys, no TV, no handheld games. It's just play, play, play, talk, talk, talk, stimulate, stimulate, stimulate. So I see . . . developmental, nongenetic reasons, and I also see genetic reasons, why the traditional tribal societies, I think, came out slightly advantaged intellectually. But despite those possible slight advantages, they did not have the population explosion and the storable food surpluses. That's a long-winded answer to, I think, one of the most controversial questions in my book.

Q: *You did not account for the fact that Europeans have gotten the upper hand over the other great Eurasian civilizations, namely Middle East and Chinese, even though they have the same origins if you look back 13,000 years. William McNeill does account for that. I notice he was one of the persons who had some very nice things to say about your book on the back cover. He accounts for it in terms of the success of Europeans in devoting science to practical problems as opposed to devoting it to the state or devoting it to religion. How does that McNeill theory of not just the rise of Eurasia but the rise of the West Europeans, in particular, track with your view?*

JARED DIAMOND It's a very interesting question. Given the fact that Eurasia had advantages, why within Eurasia was it Europe rather than, say China or the Fertile Crescent, where it all started, that did the colonizing. I can give you a flip unfair answer. The flip unfair answer would be: read my book, which gives my answer in seven pages.... But to give you a *preview* of the answer, *I* think the reasons are ultimately geographical. They have to do with the fact that the geography of China—the coastline of China, the rivers of China, the mountains of China, lack of peninsulas of China—resulted in China's being unified early (221 B.C.) and staying unified most of the time since then. The geography of Europe resulted in Europe never being unified, still can't get unified today, and the result is that in Europe there were 2,000 different experiments, 2,000 different principalities, 2,000 places that an inventor could go. Whereas in China, once the emperor said no to your idea, that was the end of the idea. And that you can trace out. That's why although China had the best fleets and ships in the world in 1400, in 1432 the emperor said no, and that was the end of China's fleets. The emperor of China said no to the Chinese industrial revolution, said no to clocks, and so I see Europe's geography resulting in Europe's disunity, letting Europe get ahead of

China. And as for the Fertile Crescent, the Fertile Crescent where it all started is a low-rainfall area that got deforested, salinized, and committed ecological suicide. So Europe—which until 1,000 A.D. was the embarrassing backwater of old-world civilization—Europe was a big peninsula of the Fertile Crescent that received all of these developments of the Fertile Crescent, and then took over once the Fertile Crescent dropped out of the running.

Q: *We live in an era of a series of warm periods alternating with cold periods. Do you have any thoughts as to why this great efflorescence of agriculture and civilization didn't occur in some earlier warm period?*

JARED DIAMOND Yeah, really interesting question. We're now in an interglacial . . . . There have been 22 interglacials. So why did agriculture rise in *this* interglacial? Even more strikingly, it arose nine times independently in the course of 6,000 years. Why, bang, bang, bang, after 5 million years, does it happen all over the place? The reason, I think, that it did not happen in previous interglacials . . . has to do with human biology. Agriculture clearly required modern human biology, modern human intellects . . . . In the *previous* interglacial, the people around were Neanderthals and other humans who were just not up to modern humans. So *that's* why it didn't happen in the previous interglacials. And it's why it happened at the *end* of . . . *this* glacial. The large mammals, with improvement in human hunting skills, that were the sustenance of the hunter-gatherers—those large mammal populations gradually got depleted, exterminated. At the end of the last glacial, the habitats with wild wheat and barley and the Fertile Crescent expanded, so the farming lifestyle became more rewarding, the hunter-gatherer lifestyle less rewarding. But that is a very interesting question.

One last question? In back . . . Yes?

Q: *I found myself uncomfortable with your answer that we're within 50 years of some kind of important bifurcation. It seems like 21st-century hubris to me. Wouldn't a Jared Diamond of any time during the last 500 years (have) given basically the same answer for different reasons?*

JARED DIAMOND The Jared Diamond of 500 years ago *could* not have given the answer, and the reason is clear . . . . We are the first society today in human history that has the capability of destroying the whole earth. If you just want to put numbers on it, today we humans are utilizing something like 60 percent of the energy of sunlight that is fixed in photosynthesis. That's today. It's roughly proportional to human population numbers, and that means that if the human population should double, we're already using 60 percent of the available energy. We *can't* use double that because there isn't energy left. So there was no way that humans could bump up against the limit in the past, and that's why I say it's possible today and it never could've been possible in the past.

[APPLAUSE]

JIM THOMSON

Thanks so much, Professor Diamond. I know that when we get this videotape to Caryl Haskins he's really going to enjoy it. Thanks to all of you for coming this evening.

ABOUT THE SPEAKER

Jared M. Diamond was formally trained at Cambridge University in physiology and membrane biophysics. His interests in biodiversity and genetics fostered a parallel career in ecology and evolutionary biology that produced landmark research in which Darwinian theory was applied to the diverse fields of physiology, ecology, conservation biology, and human history. Widely recognized as a founder of conservation biology, his imaginative work has won him a continuous stream of more than 20 literary prizes and academic honors, including the 1998 Pulitzer Prize for best book in the category of general nonfiction, *Guns, Germs, and Steel.*

Dr. Diamond devotes much of his time to writing for popular science magazines, in order to convey understanding of important scientific issues to the general public. He is a contributing editor for *Discover* and produces regular pieces for the "News & Views" section of the prestigious journal, *Nature.* His most recent book, *Why Is Sex Fun? The Evolution of Human Sexuality,* has been published in 26 languages.

RAND

Corporate Headquarters
1700 Main Street
P.O. Box 2138, Santa Monica, CA
90407-2138
Telephone: 310-393-0411
FAX: 310-393-4818

1200 South Hayes Street
Arlington, VA 22202-5050
Telephone: 703-413-1100
FAX: 703-413-8111

201 North Craig Street, Suite 102
Pittsburgh, PA 15213
Telephone: 412-683-2300
FAX: 412-683-2800

342 Madison Avenue, Suite 1532
New York, NY 10173
Telephone (Council for Aid to
Education): 212-661-5800
Telephone (New York External
Affairs): 212-661-3166
FAX: 212-661-9766

RAND Europe
Newtonweg 1
2333 CP Leiden
The Netherlands
Telephone: 011-31-71-524-5151
FAX: 011-31-71-524-5191

RAND Europe Berlin GmbH
Keithstrasse 1/3
10787 Berlin
Germany
Telephone: 011-49-30-214-73-014
FAX: 011-49-30-214-73-015

Cambridge Office
36 Regent Street
Cambridge CB2 1DB
United Kingdom
Telephone: 011-44-1223-353-329
Fax: 011-44-1223-358-845

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