Part I

1 *Historical Curiosity*

We are the only creatures on the planet, as far as we know, who can imagine what the world was like before we were born. The picture that each of us forms in our minds when asked to think about what it would have been like to live hundreds or thousands of years ago is distinctive. Even when considering the same object in a museum, or visiting the same ruins of an ancient city, no two people imagine the same thing. And if we are honest, lots of what we picture is pure speculation.

As it turns out, speculating about the past is something we humans have been doing for a long time. The world's earliest examples of art preserved on cave walls provide a vivid image of a landscape full of strange animals, many now extinct. It is a safe bet that if our ancestors were capable of creating and comprehending art—a process estimated to have begun about fifty thousand years ago—then origin stories, myths, and legends describing the past were already being passed down from generation to generation.[1]

In popular fictions, archaeologists take risks and track down relics from the past. Indiana Jones, Lara Croft: these are adventure stories. But modern archeologists are not out to raid tombs or hunt for treasure. We are engaged in the science of reconstructing

humanity's past. So as a fiction genre analogue, adventure stories are, at best, a bad fit. Archaeologists are more like the people who create and devour stories about time travel: we are intensely curious about history. We are interested in artifacts not for their own sake, but because they can help us understand the societies that produced them.

Humanity has made massive technological leaps that have given us the evidence necessary to separate fact from fiction about what the world was like in the past. Written records, maps, and calendars, the earliest examples of which go back five thousand years, have captured certain times and places in incredible detail. Within the past two centuries, the technology to faithfully preserve images and sounds lets us experience the past through historic photographs, recordings, and films. And since the 1950s, the discovery of radiocarbon dating has allowed archaeology to take fragmented physical evidence from around the world—artifacts and architecture—and piece it together into an increasingly coherent picture of our shared history.

There has also been a leap forward in the pursuit of the distant past thanks to a host of technologies that fall under the larger category of geospatial technologies. The term *geospatial* refers to the relative location of things on the planet. Devices and applications that use locational data include technology with which we are well acquainted. Need a ride somewhere? The GPS inside your phone uses your location to connect you with rideshare drivers and a digital map plots the route to your destination. Want a preview of the place you are going? You have a lot of options—digital maps, satellite and street view images, and 3-D models of buildings and the landscape around them. This blending of the real world and the digital world will only continue as augmented and virtual reality become more common.

Tech companies like Google make a lot of money from geospatial technologies. But the origins of many of them are far outside Silicon Valley. GPS, for example, has a fascinating history. Developed during the Cold War, the Global Positioning System was for many years a closely guarded military secret. Even more bizarre, GPS works only thanks to advances in theoretical physics that predated the first satellite by fifty years. To be able to triangulate your location using the swarm of satellites above us requires precise synchronization of your device and the satellites. On Earth, synchronization is trivial since we have atomic clocks everywhere keeping perfect time with one another. But on GPS satellites, time moves differently. In orbit, weaker gravity and the crafts' incredible speed mean every GPS satellite experiences a day that is thirty-eight microseconds (one millionth of a second) shorter than ours. Not spectacular time travel, but enough to put your Earth-bound device and the satellites out of sync without accounting for Einstein's theories of special and general relativity.

Archaeologists have a track record of being early adopters of geospatial technologies to improve how we study, interpret, and represent evidence of the ancient world—and the lives of the people who lived in it (McCoy and Ladefoged 2009). Some have used lasers mounted on aircraft to reveal ruins of cities below the jungle canopy. Others have come together to create digital atlases and indices to document hundreds of thousands of places where archaeology has been found. (In this book I use the term *archaeology* to refer to "the scientific study of material remains (such as tools, pottery, jewelry, stone walls, and monuments) of past human life and activities," as well as to the "remains of the culture of a people" (merriam-webster.com).) Still others have applied 3-D scanning—using images from drones and ground-based laser

scanning—as a powerful tool not only for preserving sites, but also for giving virtual tourists a look inside the world's most incredible monuments.

As the technology has evolved, geospatial tools have gone from being used for a fairly narrow scope of activities to being incorporated into almost everything we archaeologists do. The ancient world may be receding further and further into the past, but with the help of geospatial technology, archeologists are bringing us closer to it than we have ever been. At no point in human history have we been able to create a better, more complete, and more accessible rendering of the past. It is a geospatial revolution. It is still up to us as individuals to try to tell fact from fiction, but now we have an additional problem: How do we make sense of such a massive amount of information and use it to form a clear picture of the past?

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Fictional time travel and the science of archaeology are almost never talked about side by side, so before we go too far down the road, I want to clear up a few things about their histories.

To begin, it is important to remember that for many years, before archaeology came along, the Bible was thought of as a history book. For example, in 1650, an Irish archbishop went as far as to calculate the specific year when the Earth was created by counting the generations of families mentioned in the Bible. He estimated our planet had been created six thousand years ago, in 4004 BC. When Europeans traveled to North and South America, some accounted for the existence of Native Americans, unmentioned in the Bible, by declaring them the lost tribes of Israel. Over the years,

it became increasingly clear that such explanations could not accommodate the hard evidence that history had unfolded differently. By the nineteenth century, the young science of geology was showing that natural features like the Grand Canyon resulted from millions of years of erosion. Scientists made it clear that Earth must be many, many times older than six thousand years.

Around the same time, Christian Thomsen, tasked with displaying finds at the National Museum in Copenhagen, developed a new system for categorizing antiquities, as objects from the distant past were then called. Thomsen reasoned that stone tools found deep underground must be from a time before metallurgy. Based on the locations where other tools had been discovered, he discerned that bronze preceded iron—and thus the classifications Stone Age, Bronze Age, and Iron Age were established.[2] This nineteenth century antiquarian was not working in isolation. Other natural philosophers, as they called themselves, observed Stone Age deposits that included the bones of extinct animals. This was independent confirmation of what cave paintings, like the famous ones at Lascaux, taught us: people were around tens of thousands of years ago during the last Ice Age, at the same time as long-extinct animals.

This rudimentary way to tell time was quickly joined by something that would make room for the new science of archaeology to grow: Charles Darwin's theory of evolution by natural selection. When *On the Origin of Species* was published in 1859, it gave us a mechanism to understand how new life could form through random chance and circumstance. The giraffe did not will itself to grow a long neck: conditions over many generations favored the success of individuals born with a slightly longer neck. Humanity had not been designed, or magically brought to life from clay: like giraffes, we too have an evolutionary history.

In Darwin's day, the details of our evolution were poorly known. Over the years we would come to appreciate that humans, as we are today, are relative newcomers to the Earth. We never walked with dinosaurs, unless you count the scurrying of our distant mammalian ancestors as walking. We only became biologically distinct from the common ancestor we share with chimpanzees about seven million years ago; the first stone tools were chipped into existence two to three million years ago; and the first people with our current body form came on the scene a mere 250,000 years ago. And evidence suggests that our cognitive evolution reached the point it is today only fifty thousand years ago, when we were able to conceive, among other things, of earlier eras.

At the start of the twentieth century, universities began awarding degrees in anthropology.[3] Fueled by the knowledge that there were thousands of years of human life and culture before our own, early archaeologists endeavored to reconstruct the "culture histories" of people who lived long ago. When did these cultures come about? Where were they located? Did they die out, or slowly transform? The idea that there were cultures like the ones we know from the contemporary world that lay waiting to be discovered through careful study of the physical evidence left behind (artifacts, art, architecture, human remains) was now cutting-edge science. Early scholars went forth and created new long timelines for everywhere.

It was no coincidence that time travel stories became popular around the same time. Western society as a whole was so taken by new discoveries about the past that its historical imagination clicked into high gear, spawning a new market for speculative fiction. But even as archeologists plunged into the ancient past, time

travel stories have tended to take place in more recent eras that authors could at least partially access through written, historical records. Perhaps authors found it easier to imagine a time in the past they could read about themselves, or, to take another tactic and send characters into a future unconstrained by historical reality.

While both time travel fiction and archaeology exhibit a concern for other eras, time travel stories have other functions as well—entertainment and social commentary chief among them.[4] The other times that travelers encounter serve as mirrors of the present day. In 1889, for example, Mark Twain sent the fictional Hank Morgan back to medieval England in *A Connecticut Yankee in King Arthur's Court*. The book came out when the myth of the antebellum South as a land of Arthurian nobility and romance had gained national traction. Twain set out to ridicule that myth. Hank Morgan uses his knowledge of science and technology to create miracles that earn the esteem of King Arthur's court, but he does not content himself with a position of power. Instead, he fights for equity for an oppressed underclass. Americans, Twain suggests, needed to do the same.

The contemporaneous novels *Looking Backwards,* by Edward Bellamy (1887), and *The Time Machine,* by H. G. Wells (1895), comment upon present-day conditions by sending time travelers to the future.[5] Both backward and forward time travel continue as literary conventions in the perennial BBC television favorite *Doctor Who,* about an alien Time Lord whose machine, the Tardis, can go anywhere in space and time. In practice, the Tardis often goes to familiar historic eras and the far distant future.[6] I am a big fan of the show but I do worry that this aspect of time travel fiction

unintentionally dampens our historical curiosity about the era before writing; something that archaeologists have been trying to stoke in the broader public since the early days of archaeology.

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Earlier generations of professional archaeologists had far fewer tools at their disposal—an unenviable position, but one that makes their accomplishments all the more impressive. Take, for example, V. Gordon Childe. In the 1920s, Childe, a young, bespectacled, Oxford-educated Australian, started to study Stone Age Europe. He read reports of excavations, examined first-hand the bits and pieces from the past collected in museums, and conducted his own investigations. He was especially interested in the transition from what had come to be known as the Old Stone Age, or Paleolithic, to the New Stone Age, or Neolithic.[7]

Childe was fascinated by the Neolithic because it marked the start of agriculture, the creation of villages, and eventually, the birth of new societies.[8] He described these changes with intense, time-space charts showing the shift in regions from one style of artifacts to another. Population movements were illustrated in maps by arrows darting out of modern day Turkey into Eastern, and then Western, Europe. Ultimately, the evidence suggested that the "origins of civilization"—as this fundamental cultural change was then known—had been catalyzed by migrants from the Middle East (see figure 1). Childe published his research in a book he called *The Aryans: A Study of Indo-European Origins* in 1926. That same year Adolf Hitler wrote *Mein Kampf,* and forever coopted the term *Aryan* to refer to racial purity. Childe was no Nazi. He came to the term by drawing on historical linguistics, not nationalism, and far

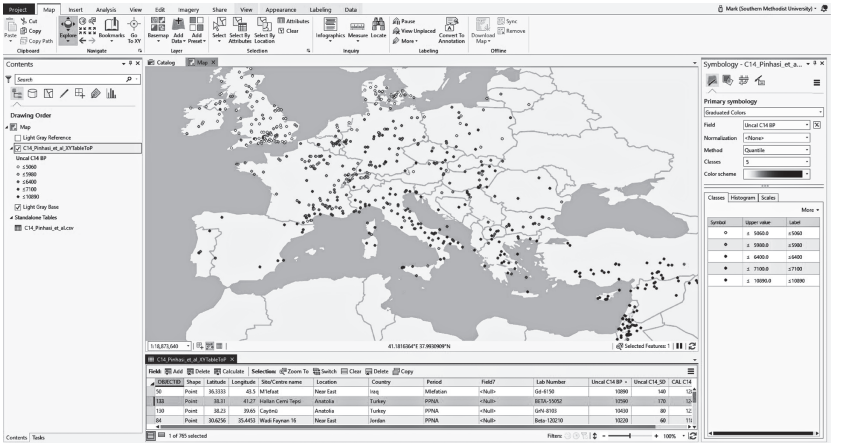

FIGURE 1. The spread of farming from the Middle East to Europe (about five thousand to ten thousand years ago). Dots represent the earliest signs of farming in each location. Earlier radiocarbon dates are dark, later dates are light. Data source: Pinhasi, Fort, and Ammerman (2005). Data displayed in ArcGIS Pro 2.2.3.

from advocating racial purity, the point of his culture history was to show the Asiatic roots of many of the defining characteristics of Europe before writing.

Childe argued that a process he called the Neolithic Revolution, which included the domestication of plants and animals, had caused a ripple effect across the world. In another well-known, but poorly titled, book, *Man Makes Himself,* he suggested that not just evolution, but also free will leads us to shape our own destiny (Childe 1936). The title may have neglected women and children, but the overall idea is a good one. His work, along with that of his peers, meant that by the 1930s, scholars were writing about prehistory in the same way that historians had long been writing about the recent past.[9]

It is remarkable to me that just as archaeology was making headway in showing the public how we could make sense of the

ways our long-term history has shaped the present, the first novel that couples time travel and archaeology—L. Sprague de Camp's (1939) *Lest Darkness Fall*—falls disappointingly into the stereotype of archaeologist as self-interested adventurer. Its protagonist, the fictional American archaeologist Martin Padway, goes back to Rome in the sixth century AD, and through his knowledge of the past, steers history to avoid the start of the Dark Ages. That may sound like the kind of enlightened move made by Twain's hero in *Connecticut Yankee,* but Padway (who's really more of an expert on ancient history than archaeology anyway), sets Rome on a path to colonize the New World ahead of other European nations. He seeks personal power for himself and imperial glory for Rome.

After World War II, the technical advances that were born of the Cold War had completely unforeseen results for the field of archaeology. The biggest one was the discovery by Willard Libby that all living things incorporate into themselves a small amount of a naturally occurring isotope of carbon and that by measuring this isotope we could work out how long ago something died. Libby, a chemist who had helped in the American effort to build the first atomic bomb, showed that carbon-14, unlike most carbon, was unstable and decayed away, but at an extremely slow rate. A bone from an animal or the wood from a tree that died today has 100 percent of its radiocarbon (the term for radioactive carbon) but 5,730 years in the future it will only have half that amount. In another 5,730 years, half of the remaining amount will have disappeared, leaving just 25 percent of the original quantity. With the basics of this natural process worked out, it becomes possible, if you have bone or burned wood, to figure out when the animal or plant died based on how much radiocarbon is left. Of course, the carbon isotope would eventual decay entirely away, but that takes

more than fifty thousand years, a point when other radiometric methods can be used to work out how old something is.

Carbon dating unshackled archaeologists. Before radiocarbon, working out how old a deposit or ruin was depended a great deal on luck. If you happened to find pottery made in a style that you recognized from a local sequence, you might be able to work out its age relative to other places. Fail to find that critical evidence and you were stuck. Radiocarbon gave us a tool to create chronologies using almost any biological material that we might find.

By the 1960s, radiocarbon dating was applied globally, and archaeologists started to ask questions that involved more than writing culture histories. What motivated the new generation of archaeologists was something of a return to the intellectual space created by Darwin's theory a century beforehand. What was our place in the natural world? How did the distinctive things humans can do help us survive and thrive? Much closer ties to the natural and earth sciences led to even more challenging questions: Were we responsible for the extinctions of animals in the Ice Age? This is also when aerial photographs started to become standard in large-scale field surveys aimed at working out how people used different ecosystems.

The 1960s also saw a return to the idea that our ancestors were responsible for their own destiny. Archaeology set its sights on economics, politics, and why different kinds of societies formed. Borrowing from geography, we began looking at how the distribution of artifacts could reveal how people made and distributed all kinds of goods. To do this, it became increasingly important to know where in the natural world people got their raw materials—for example, for making stone tools or fine goods—as these could be read as clues about how the larger economic system worked and

changed over time. At this time, large monuments, which had always been of interest to archaeologists, were understood as more than ruins. They represented how much labor a leader could amass for construction, a proxy measure for hierarchy that, ideally speaking, could be applied to lots of different places. Modern archaeology built on the work of Childe and his peers, but the old methods were no longer adequate. Instead of piecing together evidence from the past in isolation, archaeologists connected with other sciences and stayed on top of the latest technical advances that might unlock some hidden aspect of the past.

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Satirists like Twain approach the past with a specific aim, but archaeologists are supposed to remain unbiased, taking care not to let their views cloud their reckoning. We have not always succeeded. Take, for example, the hard-to-shake stereotype of "man the hunter." Just think about how many times you have seen artists' reconstructions of ancient scenes of heroic men wielding spears. The problem with the "man the hunter" image is not that men did not hunt: the problem is other activities defined men's lives, and women and children's lives mattered too.

Time travel fiction on television today is a great example of expanding the stories we tell about the past.[10] As shows have begun to include a more diverse cast of travelers we see new narrative depth centered on dueling impulses: to preserve the past or to correct it.[11] The character Rufus Carlin, played by Malcolm Barrett, on the show *Timeless,* for example, shines a spotlight on the fact that America's past, no matter the era, is dangerous for an African American like him. By giving characters like Carlin the power to

travel backwards in time, the stories must deal with the inherent contradiction: Why should any time traveler work to preserve a past that was unjust toward people who look like them?[12]

These new narratives speak to important facets of telling nonfiction stories. For the same reason that the identity of the time traveler matters, we need archaeology written from diverse perspectives. In the United States, my generation of archaeologists is the first to have started out our careers at sex parity, an equal male to female ratio (Zedar 1994); but parity in participation in key aspects of the discipline, like publication in peer-reviewed scientific journals, remains woefully unbalanced (Bardolph 2014). This is true not just for women but for so many others who have in effect been barred from full and equal participation in archaeology because of their identity. One result is that many fewer stories are being told than should be.

And just as there are many stories to tell, there is much more archaeology to tell them about than you might think. In 1972 the United Nations began identifying places as World Heritage sites, affording them international recognition that, it was hoped, would give sites some degree of protection that might supplement the laws and regulations of individual nations.[13] Today there are 878 sites with World Heritage status. A few hundred more sites are well known enough that they have their own Wikipedia pages. But these numbers are misleading about the prevalence of archaeological sites: archaeologists have found millions upon millions of them. And those are just the sites we know about. So, while they are precious, sites are not rare, and in many respects we struggle with having too many to care for given the resources we have to investigate and protect them.

Some archaeologists have suggested that, if you think about it, we already time travel. Bodil Petersson and Cornelius Holtorf, of

Linnaeus University, write that time travel is best understood as "an experience and social practice," and might be as common as when historical reenactors recreate a bygone era (Petersson and Holtorf 2016; Holtorf 2016). Eugene Ch'ng, a professor of cultural computing at the University of Nottingham in Ningbo, China, follows a similar line of reasoning when he proposes that an immersive experience in virtual reality designed to mimic the past is "virtual time travel" (Ch'ng 2009). Any time we imagine the past, psychologists say, we are engaging in "chronesthesia," drawing on what we know to take journeys in our minds (Tulving 2002).[14] Even if you find this a bit too abstract, there is an important kernel of truth in this view of time travel: all archaeology requires, to varying degrees, imagining the past from the perspective of the present.

Archaeologists must balance our impulse to create a detailed picture of the past—like the kind required to create a virtual time travel experience—and our job as scientists, concerned with cause and effect, and the fundamental forces that drive changes in history. Over the past fifty years, we have been able to write the first detailed global history of our species founded on good empirical evidence thanks in large part to the technological advance of radiocarbon dating. Over the next fifty years, we will be writing the second draft thanks to geospatial technologies; but before we can, we need to talk more about the difference between "finding things" and "finding things out."