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HISTORY IN THE LANDSCAPES OF MODERN KNOWLEDGE

THE LANDSCAPE OF HISTORY: HOW HISTORIANS MAP THE PAST. By John Lewis Gaddis. Oxford: Oxford University Press, 2002. Pp. xiv, 192.

I. MAPPING THE PAST

What is history? And what is its place in the landscape of modern knowledge? In *The Landscape of History*, John Lewis Gaddis revisits these old questions with intelligence, verve, and elegance, qualities that make the book a joy to read and a joy to argue with.

Awarded the 2000–2001 George Eastman Visiting Professorship in Balliol College, Oxford, Gaddis decided to spend his time thinking seriously about "how historians think," and to do so by revisiting two of the historiographical classics of the twentieth century: Marc Bloch's *The Historian's Craft*, and E. H. Carr's *What is History?*[1] The book's central metaphor is implicit in its cover picture: Caspar David Friedrich's 1818 painting *The Wanderer above the Sea of Fog*. Friedrich's painting shows a young man looking down on a foggy landscape. Gaddis argues that historians, like Friedrich's Wanderer, try to make sense of a foggy landscape. They cannot replay the past in laboratory experiments; the best they can do is to represent the past or map it. "We can portray the past as a near or distant landscape, much as Friedrich has depicted what his wanderer sees from his lofty perch" (3). Subsequent chapters discuss what it means to map the past, and why it is important to do so. How do historians handle the different scales of time and space? How do they reconstruct the "processes" of the past from the "structures" that survive in the present? Why is it so important to our sense of identity to have well-constructed and carefully tested maps of the past? The book's central question, however, is really about the relationship between history and the sciences. Can a discipline whose highest goal is a sort of mapping really claim any affinity with the natural sciences?

Gaddis's answer is a qualified "yes," and he insists that this was also the position of Bloch and Carr. He argues that historians have stumbled, more by luck than judgment, on procedures and methodologies that have turned out to be surprisingly close to those of the sciences. Like hobbits, historians stayed in their methodological burrows while the world of knowledge shifted around them (92). Fortunately, this has turned out to be a good decision, as the wide world of science has discovered that historians were more or less right all along. Reality real-

1. E. H. Carr, *What is History?* [1961] (Harmondsworth, Eng.: Penguin, 1964) and Marc Bloch, *The Historian's Craft*, transl. Peter Putnam [1953] (Manchester, Eng.: Manchester University Press, 1992).

ly is as messy as the historians always thought it was! However, he argues, things have turned out less well for the social scientists who tried much harder than the historians to prove that their disciplines were "scientific" in a traditional and more reductionist sense of the word. As a result, Gaddis claims, the social sciences have been left stranded in mechanistic territory that the sciences have long since abandoned.

This is an argument that will appeal to many historians, but, as Gaddis is aware, most social scientists will find it caricatured, unfair, and overstated. They are probably right, but there is clearly something to what Gaddis says. While nineteenth-century scientists aspired to a complete, reductionist description of reality that might even allow for prediction once all the data were in, most historians believed that their main objects of study, human beings, were so lawless and unpredictable that history could never hope to attain such precision and predictability. So historians had to settle for messier methodologies to deal with a confusing and unpredictable reality; and they had to accept that the written word offered as much precision as their discipline could normally attain.[2] To many, these methodological and thematic differences seemed to split the entire universe of knowledge into separate realms: a natural realm of predictability and precision, and a human world of unpredictability and something like free will. It is tempting to think that this division preserved an even older epistemological schism between matter and spirit, a distinction that allowed some to hope that within the humanities there might still be preserved a realm beyond the cold certainties of science or the dark plain of Matthew Arnold's "Dover Beach," "Swept with confused alarms of struggle and flight, Where ignorant armies clash by night."

Happily for those appalled by the vision of a mechanistic universe, science itself has abandoned its once mechanistic and reductionist view of reality. It has done so in two main steps.[3] Early in the twentieth century, physicists discovered that reality itself is fuzzy and accident-prone at very deep levels. If, as quantum physics has shown, the movements of individual subatomic particles are not predictable, then, it seems, contingency and perhaps something akin to "free will" may be built into the very weave of the universe. Since then, contingency has popped up in many different sciences. In the nineteenth century, the French mathematician Jules Henri Poincaré had already shown that vanishingly small differences in the micro world can cascade into huge differences in the macro world. If the initial differences are too small to be measured, even in theory, this means that much of the macro world must be completely unpredictable. Even

2. In a book that Gaddis uses, John Ziman argues that "the use of mathematical languages is a desirable, but not essential, characteristic of a branch of science. Natural language may be imperfectly consensible [i.e. more open to misunderstanding], but is infinitely richer in vocabulary than algebra." This makes natural language a more appropriate medium of communication in history, where grasp of complexity may be more important than mathematical precision. After all: "The first priority of science is that *meaningful* messages should pass between scientists, not that these messages should be censored to misleading triviality in the name of logical precision." *Reliable Knowledge: An Exploration of the Grounds for Belief in Science* (Cambridge, Eng.: Cambridge University Press, 1978), 14.

3. In his account of these changes, Gaddis makes use of William McNeill, "Passing Strange: The Convergence of Evolutionary Science with Scientific History," *History and Theory* 40 (February 2001), 1-15.

more spectacularly, Poincaré showed that, even in the perfectly logical world of mathematics, there were simple problems that allowed of no unique solutions. The best-known example is the three-body problem, the problem of computing the mutual gravitational pull of three separate bodies. As Gaddis writes: "Poincaré's great insight was to show that linear and non-linear relationships could coexist: that the same system can be simple and complex at the same time" (76). Computers have made it possible to extend these insights within the new scientific subdisciplines of "chaos" and "complexity," which Gaddis describes with admirable clarity. But historians always knew they were dealing with a chaotic reality, so these changes in our understanding of the nature of science left them

> in the curious position of having come out on the cutting edge of a revolution by persisting in a thoroughly reactionary stance. Without our having had to do anything different—indeed without even realizing, for the most part, what's happened—we find ourselves, at least in metaphorical terms, practicing the new sciences of chaos, complexity, and even criticality [the study of systems far from equilibrium, and highly sensitive to initial conditions]. (88)

Science took a second step away from a mechanical view of the universe as it became more historical, a development that both Marc Bloch and E. H. Carr understood perfectly well (38). Sciences that tried to describe the past of the universe, of the earth, or of living organisms (including ourselves), could not depend on the reproducible laboratory experiments that provided the ideal model of science in less time-bound disciplines such as mechanics or physics. Instead, cosmologists, geologists, and paleontologists had to try to reconstruct past processes from surviving structures. In such fields, experiments could only be conducted in the mind, and the task of testing or refuting conclusions was much less precise. For historians this, too, was familiar—even comfortable—territory. Accurate "prediction" is more or less ruled out in the study of the past (except in the important sense that a good historical hypothesis may implicitly "predict" the sort of evidence that will turn up in the course of future research).[4] When studying an unrecoverable past, whether in paleontology, cosmology, or history, the best you can aim at is representation, or a sort of "mapping," whose accuracy can be tested only by comparing it with surviving remnants of the past. And this, Gaddis argues, is perhaps the most helpful way of describing what goes on in both the work of historians and that of scientists who work in the evolutionary sciences, from cosmology to paleontology.[5] The task of both scientists and historians is to construct useful maps of the past, which can help us achieve a sense

4. Marshall G. S. Hodgson makes a similar argument: "Increased predictability through the 'lessons' of history, and hence increased power of manipulation, may sometimes supervene through historical study; but it is surely not its true purpose. On the other hand, prediction as a *means of verification* sometimes plays an essential role in historical inquiry. This is not, of course, prediction of 'the future'—that is not the proper purpose of any scholarly or scientific discipline—but prediction of future evidence, which may come in the form of laboratory experiments, of field surveys, or (in the case of history) of newly found documents." *The Venture of Islam* (Chicago: University of Chicago Press, 1974), I, 23, footnote 14.

5. The metaphor of science as a sort of mapping is explored in Ziman, *Reliable Knoweldge*, chapter 4, "World Maps and Pictures."

of identity by seeing our place within the larger landscape of knowledge (5-8).[6] Gaddis adds that these maps can have considerable psychic power because they can expand our sense of ourselves by helping us see ourselves as part of larger entities, from nation-states to the cosmos as a whole.[7] This is why scientific and historical maps of reality can be both inspiring and dangerous. In science, the maps of Social Darwinism sustained new visions of progress and divisive views of ethnic and racial identities. In historiography, the power of maps is clearest of all in the great national histories of the nineteenth and twentieth centuries, which provided such inspiring maps of nationhood that millions were willing to live and die for them. William McNeill has captured this mythic aspect of historiography in a famous essay on "Mythistory."[8]

As scientists began to understand the unpredictability of reality and to see their own work as closer to mapping than to rigorous prediction, the gulf between history and the sciences narrowed. Have the two realms touched? Gaddis is not so sure and his book ends by drawing new boundaries. History is unique, he argues, because it deals with "molecules that think," with "self-reflective, feedback-generating, information-exchanging entities, by which I mean *people*" (112). Human behavior is more complicated and less predictable than that of animals "because the capacity for self-reflection opens the prospect of responding to similar circumstances in very dissimilar ways" (113). Further, historians are entangled in their subject matter in a way that is not true of scientists so, unlike scientists, they cannot avoid moral judgments. In other words, history remains fundamentally different from the evolutionary sciences. Despite everything said elsewhere in the book, Gaddis implies that there is still an ocean between history and the sciences rather than just some choppy waters. The issue is profoundly important because, if Gaddis is right, we are back with the uncomfortable conclusion that reality itself must somehow be carved into different epistemological domains, each with its own, unique rules.

If we reject that view, preferring, like E. O. Wilson, to accept the core belief of modern science that "the world is orderly," then we are bound to conclude that there must be a bridge between history and the sciences, even if we have not yet found it.[9] In *Consilience: The Unity of Knowledge*, Wilson argued forcefully that the major challenge of modern scholarship is to find that bridge: "The greatest enterprise of the mind has always been and always will be the attempted linkage of the sciences and humanities."[10] Wilson bemoaned "the ongoing fragmentation

6. E. H. Carr also understood this similarity between history and the sciences, though he used a slightly different metaphor: "The world of the historian, like the world of the scientist, is not a photographic copy of the real world, but rather a working model which enables him more or less effectively to understand it and to master it." *What is History?*, 103-104.

7. Ziman describes well how maps can "enlarge" our sense of self: "Through the mental faculties of consciousness and rationality, by means of memory and imaginative forethought, we humans live beyond the present moment, and carry within us personal segments of time, from the past, into the future. By interpersonal communication, by interaction with socially-stored knowledge, we may each enormously extend these segments, from the distant cosmological or historical past to the potential triumphs or disasters in the shape of things to come." *Reliable Knowledge*, 32.

8. William H. McNeill, "Mythistory, or Truth, Myth, History, and Historians," *American Historical Review* 91 (February 1986), 1-10.

9. E. O. Wilson, *Consilience: The Unity of Knowledge* (London: Abacus, 1998), 3.

10. *Ibid*., 6.

of knowledge and resulting chaos in philosophy," and insisted that these are not "reflections of the real world but artifacts of scholarship."[11] He added that the intellectual payoff to any successful merger should be enormous, as a new dialogue is opened between the "Two Cultures." C. P. Snow, whose 1959 Rede Lecture popularized the notion of the "Two Cultures," was both a scientist and a writer, and he was painfully aware of the intellectual loss caused by this fundamental division in modern scholarship. But he was also, like Wilson, optimistic that it could be bridged, and confident that bridging the cultural gap would transform modern knowledge. "The clashing point of two subjects, two disciplines, two cultures—of two galaxies, so far as that goes—ought to produce creative chances. In the history of mental activity that has been where some of the breakthroughs came. The chances are there now. But they are there, as it were, in a vacuum, because those in the two cultures can't talk to each other."[12]

II. A BRIDGE BETWEEN THE TWO CULTURES?

In the rest of this essay, I will argue that we may already know where the bridge between the two cultures lies, even if it has not yet carried much traffic. We certainly know where the bridge *ought* to be. It must be at the point where we clarify what it means to be human. On both sides of the cultural divide, it is approached by essentially the same question: what is it that makes our own species, *Homo sapiens*, different from other species? From the biological side, this may appear to be a question about bones, bodies, and brains. From the side of the humanities, it is more likely to be approached as a question about identity. What does it really mean to be human?

This is a question that world history is well placed to explore effectively. Gaddis argues, as would many other historians today, that history is about identity. It can help us achieve a mature sense of identity by showing us our place within the larger landscape of modern knowledge (8). But what is the identity that is being defined here? Gaddis paraphrases Geoffrey Elton's claim that "historical consciousness helps to establish human identity" (147). Yet in practice, few historians really try to map humans as humans. Instead, they map them as members of particular communities, defined by nationality, gender, class, or time. Indeed, the time scales on which historians normally operate make it almost impossible to see humanity as a whole, for to do this you need to map the history of all human beings, not just of particular groups. This is where world history, with its quest for a unified history of humanity as a whole, can play an important role. But in order to clarify what is meant by a "human identity," historians will also have to engage seriously with scientific ideas about what it is that distinguishes humans from other animals. If, despite all the difficulties, we can clarify the position of our own species within the modern landscapes of knowledge, we should have a better understanding of history and its relationship to the sciences.

11. *Ibid*.

12. C. P. Snow, "The Two Cultures and the Scientific Revolution," in C. P. Snow, *Public Affairs* [1959] (London and Basingstoke: Macmillan, 1971), 23.

I found the last two chapters of Gaddis's book the least satisfying, in part because he drops the argument just at this point. He argues that the self-awareness of humans makes them much more complex than the entities studied in the sciences. True enough. But is this a difference of kind or degree? Can we perhaps find a precise and rigorous way of specifying the type of complexity that distinguishes humans from other species?

One of the most familiar approaches to this problem, an approach with antecedents in the nineteenth century, has been the attempt to incorporate human history within an expanded version of Darwinian theory.[13] Scholars in the humanities, and particularly within anthropology, have been wary of such theories, because of the intellectually and morally damaging impact of Social Darwinism.[14] Indeed, the intellectual and moral failures of Social Darwinism may explain why so many scholars in the humanities have shied away from the task of specifying what it is that distinguishes humans as humans. Nevertheless, the problem is too fundamental to have been avoided entirely. Sociobiology, pioneered by E. O. Wilson, is one of the most influential recent attempts to confront it head on by clarifying the relationship of humans to other animals, and of human history to biology. Wilson summarizes his own ideas as follows:

> Culture is created by the communal mind, and each mind in turn is the product of the genetically structured human brain. Genes and culture are therefore inseparably linked. But the linkage is flexible, to a degree still mostly unmeasured. The linkage is tortuous: Genes prescribe epigenetic rules, which are the neural pathways and regularities in cognitive development by which the individual mind assembles itself. The mind grows from birth to death by absorbing parts of the existing culture available to it, with selections guided through epigenetic rules inherited by the individual brain.[15]

In sociobiology, genes hold culture on a leash, but the leash is short enough to suggest that natural selection may eventually help explain many important aspects of cultural change. Robert Boyd and Peter Richerson have constructed a theory of social evolution that tethers culture less closely to genes. They argue that cultural inheritance is clearly distinct from genetic inheritance, and accounts for much of the distinctiveness of human social evolution. Nevertheless, it may be possible to explain the evolution of culture in terms that are at least analogous

13. An issue of *History and Theory* is devoted entirely to the problem of the convergence of the evolutionary sciences and history. *History and Theory*, *Theme Issue* 38 (December 1999), *The Return of Science: Evolutionary Ideas and History*, ed. David Gary Shaw and Philip Pomper. See also Robert L. Carneiro, *Evolutionism in Cultural Anthropology: A Critical History* (Boulder, Colo.: Westview, 2003) and Tim Ingold, *Evolution and Social Life* (Cambridge, Eng.: Cambridge University Press, 1986). It is important to distinguish between evolutionary theories in general (theories that posit an evolutionary trend in human history as a whole), and theories that specifically try to apply the mechanisms of natural selection to human history. According to Carneiro, the first rigorous attempt to construct a theory of this second kind can be found in Albert G. Keller, *Societal Evolution* (New York: Macmillan, 1915) (*Evolutionism in Cultural Anthropology*, 94); Carneiro offers a brief survey of several different theories of this kind on pages 173-179.

14. For a critical survey of the general turn away from evolutionary theories in anthropology, led by Franz Boas, see the account in Carneiro, *Evolutionism in Cultural Anthropology*, chapter 5: "Anti-Evolutionism in the Ascendancy."

15. Wilson, *Consilience*, 139. There is a very good short summary of the main arguments of sociobiology in Stephen K. Sanderson, *Social Transformations: A General Theory of Historical Development* (Lanham, Md.: Rowman & Littlefield, 1999), 404-405.

to those of natural selection, by focusing on how and why individuals choose to adopt or modify particular cultural changes. They argue that their "dual inheritance models will clarify the logical relationships between cultural transmission and other Darwinian processes and stimulate social scientists to make the empirical observations that may eventually allow us to make reliable general statements about the evolution of human behavior."[16]

This reviewer is not qualified to pass final judgment on these sophisticated attempts to unite cultural and genetic evolution. What is clear is that no theory of this kind has yet generated results persuasive enough to convince a majority of modern biologists, and they have been largely ignored by historians. This suggests that the underlying strategy of trying to subsume human history within Darwinian evolutionary theory may be misguided. Natural selection can explain much about the most stable features of our species; what it cannot do is explain convincingly what makes us so changeable—and so different. As Stephen Sanderson has put it, "The differences between social and biological evolution are great enough to require that social evolution be studied as a process in its own right, and not merely along the lines of an analogy with biological evolution."[17] In a sense, this too is something historians have always known in their bones. But to link the two cultures we will also need to specify more precisely what it is that distinguishes biological and cultural change.

Rather than seeing cultural change as an outgrowth of biological change, it may be more helpful to think of it as an "emergent" property of natural selection. The notion of "emergent" properties has acquired some prominence in recent decades, particularly through the study of complexity and chaos.[18] Reductionist explanations characteristically try to explain complex phenomena in terms of their component parts. The notion of "emergence" begins with the insight that complex systems may have properties that cannot be predicted from knowledge of their component parts. Thus, we cannot predict the qualities of water just from knowledge of the properties of hydrogen and oxygen. Nor can the distinctive characteristics of living organisms be predicted from knowledge of their chemistry alone; if they could, biology would be reducible to chemistry. Of course, biology must be (and, as far as we know, it *is*) consistent with the laws of chemistry. Yet entirely new properties appear once complex chemicals cross the threshold that transforms them into living organisms; unlike rocks, they can change and adapt to their environments. To explain these new properties, new principles are necessary, and the success of Darwinian theory arises from its abil-

16. Robert Boyd and Peter J. Richerson, *Culture and the Evolutionary Process* (Chicago: University of Chicago Press, 1984), 2. For a critique of the "individualism" of their approach, and its failure to appreciate the adaptive significance of cultural traits, see Carneiro, *Evolutionism in Cultural Anthropology*, 174-176.

17. Sanderson, *Social Transformations*, 7. Since writing this, Sanderson has come to believe that it may be possible to combine theories of cultural evolution with sociobiology in order to explain, at least, the "biological constraints on social evolution"; *Social Transformation*, 404. It may be true that sociobiology, in some form, can explain many transcultural and transhistorical regularities in human behavior, but it is hard to see how a theory anchored in our genetic heritage can possibly explain in any but the most general terms the astonishing creativity and open-endedness of human culture.

18. One of many good introductions to the notion of "emergence" is Ricard Solé and Brian Goodwin, *Signs of Life: How Complexity Pervades Biology* (New York: Basic Books, 2000).

ity to make sense of these "emergent" properties. Chemistry can explain plenty about living organisms; but we need Darwinian theory to explain why living organisms are so different from rocks. Perhaps the relationship of the human sciences to the biological sciences is analogous. Study of human societies must be consistent with the rules of biology—but the rules of natural selection may be incapable of explaining what is *different* about human beings and human history. If this is so, then we need to focus on the "emergent" properties that distinguish us from all other animals, including our closest relatives, the chimpanzees.

Oddly, historians may once again have been closer to the mark than those who have opted for a more reductionist view of the relationship between cultural and biological change. E. H. Carr, in a brief aside on "progress in history" in which he tried to pin down the directional nature of human history, argued that "biological inheritance" is utterly different from what he called "social acquisition."[19] Here is how Carr drew the distinction between biological and cultural change more than forty years ago:

> Evolution by inheritance has to be measured in millennia or in millions of years; no measurable biological change is known to have occurred in man since the beginning of written history. Progress by acquisition can be measured in generations. The essence of man as a rational being is that he develops his potential capacities by accumulating the experience of past generations. Modern man is said to have no larger a brain, and no greater innate capacity of thought than his ancestor 5000 years ago. But the effectiveness of his thinking has been multiplied many times by learning and incorporating in his experience the experience of the intervening generations. The transmission of acquired characteristics, which is rejected by biologists, is the very foundation of social progress. History is progress through the transmission of acquired skills from one generation to another.[20]

Few historians today would be happy with the word "progress," preferring a more neutral term like "change" or even "directional change"; and they would talk of "human beings" rather than "men." But, with these qualifications, Carr's idea gets close to the heart of the issue. Many animals can learn, and many learning animals can communicate with other members of their own species. As a result, it is common to attribute "culture" to species such as the great apes. But the ability to *share* what individual organisms learn is of limited significance in the biological world, because the limitations of animal languages mean that not enough knowledge is shared and stored to accumulate from generation to generation. Though learning can shape the career of an individual, it cannot shape the career of entire species. Almost all the learning that goes on within each individual brain is lost once the individual dies, so the knowledge it has accumulated in its lifetime can have little impact on later generations. This is a proposition that can be easily tested. Any species that could store and accumulate significant amounts of learned knowledge would eventually begin to alter its behavior as it made use of the expanding body of knowledge it had accumulated. Over time, its behavior would shift, at an accelerating pace, and in ways that would give it an adaptive edge over neighboring species. In short, such a species would have a "history," and that history would be, in Carr's sense of the word, a history of

19. Carr, *What is History?*, 113.
20. *Ibid.*, 113-114.

"progress," or accumulating knowledge. At present, we have no evidence that any species but our own can be said to have a "history" in this sense.

Humans are different. Symbolic language allows us to share information with exceptional precision and efficiency. Unlike other animals, we can also exchange abstract knowledge, knowledge about entities that are not immediately present, even about entities (from spirits to quarks) that may or may not exist. Information that can be shared can also be stored in the collective memory of an entire community, and can therefore survive the death of the individual who first put it into circulation. Over time, such knowledge, whether of neighboring communities or of successful techniques of gathering or hunting, can accumulate. So humans face the world not just with a genetic heritage honed by natural selection, but also with a cultural heritage of knowledge tried and tested by individuals, stored within human culture over many generations, and accumulating over time. That heritage multiplies by many times the reserve of experience on which each individual and each community can draw. We can also be sure that many of the ideas stored in this way will have adaptive significance, enabling humans to exploit their environment in new ways. After all, what learning of any kind does is help individual organisms find better ways of extracting food and energy from their environment, so at least some of the ideas pooled by individuals in their community's cultural traditions will be of this sort.

I will use the phrase "collective learning" to refer to the sharing and accumulation of learned knowledge, in preference to E. H. Carr's less precise phrase "social acquisition." "Collective learning," like natural selection, can be regarded as an adaptive mechanism, a way of enabling species to change how they relate to one another and their environment. Just as the notion of natural selection helps us understand change in the biological realm, the notion of collective learning may be the key to understanding change in the cultural realm. But these similarities are masked by the many differences in the way these mechanisms work, and the different research strategies they require. Collective learning functions, not through the inheritance of genes (a process that is now quite well understood), but through more complex and less well-defined mechanisms. Pinning down the rules of cultural change is extremely difficult, partly because culture (unlike genes), does not come in discrete packages; it is amorphous, diffuse, and lacks clearly definable borders.[21] But one thing is immediately clear: cultural information can be exchanged more easily than genetic information, and, unlike genes, it can accumulate. However many ancestors we may have, each of us inherits only one set of genes; but, as cultural beings, we inherit the insights of many thousands of earlier generations. And, as human numbers have increased, the pool of shared knowledge has expanded, and the mechanisms for preserving knowledge have become more and more sophisticated. This is why collective learning can outpace and eventually override natural selection, and why the significance of cultural change is bound to increase over time. Though perfectly consistent with the principles of natural selection, the notion of collec-

21. This may be why "meme" theory, for all its suggestiveness, has failed to provide a convincing evolutionary model of cultural change. The best account is in Susan Blackmore, *The Meme Machine* (Oxford: Oxford University Press, 1999).

tive learning can therefore explain changes that cannot be explained by natural selection alone. Natural selection may help us explain the appearance of our species, and many of our more stable characteristics as a species, but it cannot explain the astonishing transformations in the behavior of our species over several hundred thousand years. Yet it is this capacity to transform our behaviors that distinguishes us most clearly from all other animal species, and therefore defines us as humans.

From the vantage point of the twenty-first century we can see that even if such processes gave humans only a slight adaptive advantage over other species for much of their early history, the cumulative nature of collective learning ensured that eventually, the ecological advantage of humans would matter more and more. One of the best measures of that advantage is the astonishing fact that humans may now be controlling between 25% and 40% of the energy derived from photosynthesis and distributed through land-based food chains.[22] We can also measure the consequences of collective learning in the fact that the resources hogged by our species are denied to other species, which has led to one of the most spectacular extinction episodes in the history of the last 600 million years.[23] Collective learning is not just a new adaptive mechanism; it is also significantly more powerful and more rapid in its effects than the more familiar adaptive mechanism of natural selection. After all, on the time scales of paleontology or geology, the 200,000 years or so it has taken humans to achieve modern levels of dominance over other species are a mere blink of an eye.

If these arguments are on the right track, they suggest that collective learning is the strategic explanatory factor we need to distinguish rigorously between human history and biology—between human beings and all other animals. Biology and evolutionary theory (and chemistry for that matter) have much to tell us about the similarities between humans and other animals. But to explain what makes us different, we need the notion of "collective learning." This is the distinctive feature not just of human history, but of human culture in general.

The notion of "collective learning" is extremely simple but, as with natural selection, its detailed implications will surely turn out to be extremely complex. Indeed, the traditional impatience of historians towards such general notions rests, at least in part, on their awareness of the complexity and unpredictability of the phenomena they deal with. Nevertheless, like natural selection, the notion of collective learning may be capable of generating fruitful and testable hypotheses about long-term change in human history. Some general principles of collective learning are immediately obvious. First, it is clear that collective learning is cumulative, so it ought to generate a history that has a clear direction and an accelerating pace. The accuracy of these retrospective predictions can best be appreciated when discussing the growth in human populations and control over energy in the course of 200,000 years or more. Human populations certainly

22. I. G. Simmons, *Changing the Face of the Earth: Culture, Environment, History*, 2nd ed. (Oxford: Blackwell, 1996), 361, adapted from J. M. Diamond, "Human Use of World Resources," *Nature* 328 (1987), 479-480.

23. See, for example, Richard Leakey and Roger Lewin, *The Sixth Extinction: Patterns of Life and the Future of Humankind* (New York: Doubleday, 1995).

grew in the Paleolithic (on large time scales), as humans migrated throughout most of the world, but growth rates accelerated from 10,000 years ago with the appearance of agriculture, and they have accelerated once again in the modern era. The demographic trajectory of human history reflects a similar pattern of technological change, for it is new techniques, generated and spread through the mechanisms of collective learning, that have allowed our species to feed, clothe, house, and move its growing populations. Second, it seems likely that the impact of collective learning will be greater where the number and variety of the communities exchanging information is greatest. This simple proposition immediately suggests one powerful reason why the impact of collective learning should be so much more obvious in modern times than it was in the earliest stages of human history; or why the huge and interconnected societies of the Afro-Eurasian landmass appeared to have a significant technological edge over those from other regions once the world was united from the sixteenth century. Third, where technologies of information storage and exchange become more efficient, we should expect the impact of collective learning to accelerate, a principle that brings into sharp relief the significance of technological innovations such as writing, printing, and the electronic revolution.

If the notion of collective learning is heading in the right direction, it should help us define the domain of history as rigorously and as precisely as we can define the domains of biology, chemistry, or physics. If biology concerns living organisms that change primarily through the adaptive mechanism of natural selection, history concerns the one species (our own) that changes in accordance with the more rapid adaptive mechanism of collective learning. Perhaps this is as close as historians will ever get to a Kuhnian paradigm, a core map, model, or idea that will help define the domain of history, clarify its research agendas, and stimulate the formulation of new and fruitful hypotheses.[24] It is worth noting that such a research agenda could shape scholarship not just in history, but also in many other fields concerned with human society and cultural change, including anthropology and prehistory, sociology, and literary studies. Perhaps the notion of "collective learning" is the bridge we need between the two cultures of the sciences and humanities.

The main virtue of a book as lively, graceful, and provocative as *The Landscape of History* is that it may encourage more grand speculation of this kind. As

24. Kuhn lists three distinct ways in which the existence of a paradigm can clarify research agendas: by encouraging research on facts or problems that a paradigm suggests may be particularly significant or revealing; by encouraging research on facts that can be used to test predictions generated by the paradigm; or by encouraging research into problem areas that either threaten to undermine a paradigm or require its further articulation. Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 2nd ed. (Chicago: University of Chicago Press, 1970), 25-30. One way to explore the conceptual power of the notion of "collective learning" would be to see whether it can generate analogous research agendas for historians. I have explored some of these ideas in greater detail in David Christian, *"Maps of Time": An Introduction to "Big History"* (Berkeley: University of California Press, 2004); "Science in the Mirror of 'Big History'," in *The Changing Image of the Sciences*, ed. I. H. Stamhuis, T. Koetsier, C. de Pater, and A. van Helden (Lancaster, Eng.: Kluwer Academic Publishers, 2002), 143-171; and "World History in Context," *Journal of World History* 14, no. 4 (2003), 437-458.

Gaddis argues, most historians are self-conscious about the epistemological foundations of their discipline. They

> recoil from the notion that our writing should replicate, say, the design of the Pompidou Center in Paris, which proudly places its escalators, plumbing, wiring, and ductwork on the outside of the building, so that they're there for all to see. We don't question the need for such structures, only the impulse to exhibit them. Our reluctance to reveal our own, however, too often confuses our students—even, at times, ourselves—as to just what it is we do. (xi)

Historians may have got a lot right despite their methodological and epistemological self-consciousness. But, as the work of Carr, Bloch, and Gaddis himself shows, they may get even further if they venture outside of their methodological hobbit homes, and spend more time debating the foundations of their discipline with scholars in neighboring disciplines such as biology.

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