

The Climate Connection: Climate Change and Modern Human Evolution

Renée Hetherington and Robert G.B. Reid

New York: Cambridge University Press, 2010, 440 pp. (paperback), \$44.00.

ISBN-13: 9780521147231.

Reviewed by ISABELLE WINDER

Department of Archaeology, University of York, York YO1 7EP, UNITED KINGDOM; icw503@york.ac.uk

The Climate Connection is one of the latest contributions to the growing literature exploring the use of mathematical models of paleoclimates and environments in explaining human evolution, dispersal and behavioral adaptability. Unlike many, however, it does not simply compare climate history with the fossil and archaeological records and attempt to explain the latter by appeal to the former. Instead, it operates under the banner of *emergence theory*, which it uses specifically to argue for links between major climatic instabilities and rapid, saltatory change in human (and hominin) biology and culture. The authors, in fact, reject Darwinian gradualism from the opening; even in the introductory sections on evolutionary history, gradualism is introduced with a single sentence and the rest of the section (pages 9–11) argues for emergence. These ideas are then further elaborated in an appendix, titled “evolutionary theory,” which briefly discusses the nature of the fossil record before considering various models—including Lamarckism and neo-Lamarckism as well as Darwinism, the modern synthesis, and punctuated equilibria—in turn, to provide further arguments about the importance of emergence.

Overall, the text is organized into three main parts: “Early human history,” “Climate during the last glacial cycle,” and “The interaction between climate and humans,” followed by three substantial appendices (49 pages in total) describing evolutionary theory, developmental evolution, and human adaptability. The parts deal with their subject matter in depth and with remarkably little overlap; although there is some discussion of the timing of major changes in the human lineage in sections on proxy climate evidence in Part Two, for instance, the authors resist the temptation to engage much with the topic, thus minimizing the amount of repetition in Part Three. The key focus of Parts Two and Three is the last 135,000 years of human history, a period sufficiently bounded and recent that it can be discussed in great detail while still retaining a focus on the ‘bigger picture’ of emergence and adaptation.

Part One begins with a chapter titled “From ape to human: the emergence of hominins,” though this title is somewhat misleading. For most paleoanthropologists, the term “hominin” refers to all species more closely related to modern humans than to their closest relatives, the chimpanzees and bonobos (Harrison 2010), but the main focus of this chapter is on the appearance of modern humans, with earlier taxa barely considered. It is split into an introductory section (2.1) discussing the philosophical debate

over continuity between ape and human, a very detailed piece on the emergence and characteristics of modern humans (2.2 and subsections) and a conclusion (2.3). The focus seems to be on whether the preference for gradualism and a unilinear (rather than branching) model of evolutionary history has constrained our understanding of the emergence of modern *Homo*. The section on modern human origins provides a little more background—beginning with the “significant” debate about whether “living humans (*Homo sapiens sapiens*) are the direct descendants of *Homo erectus*” (page 19) and discussing multiregional versus Out-of-Africa models—before considering in great detail what it is that makes us “human,” and how these traits influence the fossil record. The book seems to assume readers already know the story of human evolution and concentrates on explaining why their take on it differs from the norm. This is an effective strategy for improving readability and argument, but some readers may be disappointed by the failure to deliver the promised overview. In addition, the focus on emergence is driven home a little too hard and one is tempted to ask whether largely ignoring the merits of alternative explanations was wise. The authors’ argument would be strengthened if they were to recognize those merits and review the evidence rather than trying to impose their perspective without further consideration.

Later chapters (Three and Four) discuss behavioral evolution and dispersal, again trying to demonstrate the plausibility of punctuated change in response to rapid climatic fluctuation. Here the authors seem more relaxed and prepared to consider other arguments in more depth. One comes away from them feeling much more comfortable that Hetherington and Reid have substantiated their key point, that “human physiological and behavioural adaptability provides for immediate responses to rapid climate change” (page 79) and that some phenomena—dispersal “events”, for example—might be explained this way.

The stage is then set for a dramatic switch in the logic of the text, from demonstrating that the fossil and archaeological records support saltation theory to summarizing climatic change over the period from Marine Isotope Stage 6 through to the present day. Part Two, then, is much more about describing the ways climate works and reviewing the results of the set of simulations which provide background data. Chapter Five summarizes the climatic changes during this period, drawing upon proxy data and the authors’ simulations, made using the UVic Earth system climate model. Chapter Six expands upon this to describe the ways

those climate changes impacted upon conditions, particularly with regards to vegetation and landscape. These sections cover the last 135,000 years of climatic and human history stage by stage from earliest to most recent, with a good balance between the detailed appraisal of key events and breadth.

The first chapter in Part Three, which summarizes the interaction between climate and humans, is laid out like Chapters Five and Six, with subdivisions for each marine isotope stage. This makes cross-correlating the information on climate, environmental conditions, and human interactions much simpler and adds to the book's utility as a reference source for paleoenvironmental and paleoclimatic evidence. Chapters Eight and Nine cover the relationship between climate change and the development of agriculture and the future of our "climate connections," with the final section considering whether modern humans or their institutions are at risk from future climate variability. The idea that specialized species or institutions (like complex civilizations) are more at risk from environmental perturbation is not new. It is an explicit feature of Holling's (1973) seminal work on resilience, for example. Hetherington and Reid's 300-page argument for the importance of saltatory changes in our evolution, however, considerably strengthen this argument. If environmental perturbations were key factors shaping our early evolution, they may be key also to our, or the world's, future. Any excessive specialization which makes our societies slow to respond may cause substantial damage. Anthropogenic contributions to climate change, which may make variability greater or more rapid, could even tip us into a new period of rapid turnover, the impacts of which cannot be anticipated.

This seems to be the take-home message of *The Climate Connection*: paleoanthropologists need to open their minds to theories of emergence, both as explanations of our lineage's and species' past and as potentially important players in future evolution. Whether this comes as a new idea will depend upon readers' preferred theories and models of human evolution and their understanding of emergence. In the millennial year, for instance, Tattersall (2000) argued that paleoanthropology had lagged behind evolutionary biology first in the acceptance of the Modern Synthesis of evolutionary theory and later in recognizing the complexity of evolution and the importance of punctuated equilibria. The persistence of discredited anagenetic, unilinear models of human evolution, perhaps proposed primarily by gradualists unable to accept the fossil records' accuracy in portraying punctuation and rapid change, was holding us back.

Foley's (2001) response to Tattersall suggests that, although Tattersall was right about anagenetic, unilinear models, this need not imply that Darwinian gradualism itself must be rejected. Adaptive radiation and rapid divergence, dispersal and adjustment to new conditions might be expected under some interpretations of modern Darwinism. Readers already familiar with this debate, and with similar sentiments expressed in alternative arenas, may therefore not find Hetherington and Reid's thesis par-

ticularly startling. They may even wonder whether these authors' interpretation of emergence and punctuationism is consistent with conventional definitions of these terms. There are a wide range of scales at which one can study hominin evolution (think of the differences between typical studies in paleoanthropology, archaeology, and history, for instance), some of which lend themselves to gradualistic models while at other scales the same models are harder to defend. One of Foley's key criticisms of Tattersall's thesis was that the equation of gradual, microevolutionary processes with unilinear models and multiple species/radiations with macroevolution was untenable. The fact remains, however, that it is easier to defend a gradualistic perspective when working on a meso-scale, co-evolutionary dynamic that appears as an evolutionary trend than it is at either the smallest scales of individual events or the largest of extinction events in the fossil record. The scale at which Hetherington and Reid have focused, however, is intermediate—emphasizing the changes between the last glacial and the present day—perhaps making the debate over evolutionary mechanisms more likely to impact their work.

The authors could easily have argued that climate was a driver of change among early hominins, but arguing that Darwinian gradualism has been effectively discredited and that climate remains a driver of change among modern *Homo sapiens* will surely be controversial. The idea that repeated glacial/interglacial cycles across the Pleistocene might be important drivers of major evolutionary and ecological change is fairly widespread, for instance, but would be harder to defend at the scale of individual marine isotope stages and substages. This is particularly so over the last ten millennia, when atmosphere, hydrosphere, and lithosphere seem to have been increasingly driven by cultural change and the actions of complex institutions. The systemic flip from Pleistocene to Anthropocene is itself an emergent phenomenon—the product of a complex interaction between processes operating on different space-time scales—and whether the same dynamics operate on both sides of the flip remains open to debate.

In summary, Hetherington and Reid's theoretical assumptions in *The Climate Connection* will surely be challenged by some. The book is a little heavy-handed in Part One, driving the message of emergence theory to the partial exclusion of adequate consideration of alternative explanations of evolutionary change. If the text were merely another contribution to the theoretical debate on catastrophism versus uniformitarianism, it would probably be dismissed as simplistic. Happily, though, its value as a work of reference—particularly with regards to the detailed and well-written descriptions of climatic, environmental, and human changes across the last 135,000 years—will ensure it retains a place on student reading lists and bookshelves. The later sections of Parts Two and Three (where the authors provide a more relaxed discussion of emergence dynamics and a detailed discussion of the evidence from modern human evolution) may well do the same for those who enjoy the philosophical debate over evolutionary mechanisms, particularly within projects on modern human origins.

REFERENCES

- Foley, R. 2001. In the shadow of the modern synthesis? Alternative perspectives on the last fifty years of paleoanthropology. *Evolutionary Anthropology: Issues, News and Reviews* 10, 5–14.
- Harrison, T. 2010. Apes among the tangled branches of human origins. *Science* 327, 532–534.
- Holling, C.S. 1973. Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics* 4, 1–23.
- Tattersall, I. 2000. Paleoanthropology: the last half-century. *Evolutionary Anthropology: Issues, News and Reviews* 9, 2–16.