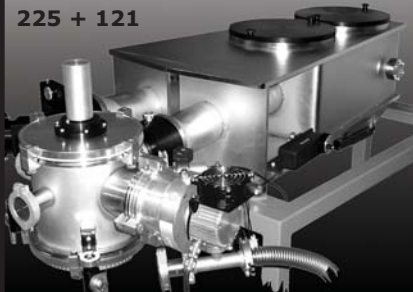


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from optics and light to sound. The treatment begins creditably, and in places the authors quite skillfully explain wave behavior without using much space. But space is the problem: Sound, hearing, and room and musical acoustics just can't be crammed with lots of figures into 90 small pages. After doing a nice job on periodic oscillations, damping, and resonance, the authors miss some opportunities in a section called "Resonators in Musical Instruments." They mention only sympathetic resonance of a sitar, the marimba, the xylophone, the vibraphone, and the sounding board of the piano. The granddaddy of all resonators for music, the Helmholtz resonator, is not mentioned, so the playing qualities of everything from an ocarina to a violin are not discussed. Nor does the text discuss Chladni plate oscillations—another huge factor in musical instruments—except for a quick mention of piano sounding boards. When the authors consider vibrations of strings and of air in tubes, they do not mention that the vibration modes are subject to resonances, that musicians drive those resonances when they play their instruments, and that such resonances play a crucial role in the formants that make human speech possible. In a short sentence, formants are attributed to "resonances of the oral cavity." In fact they are resonances of a 17-cm-long tube very much like one treated earlier in the book; the formants are controlled by changes in the tube's cross section.

The final chapter includes a few pages devoted explicitly to the physics of musical instruments, as an application of the principles presented in the book. The rushed treatment includes the shape of violin strings during play, tone holes and mouthpieces, and such wind-instrument excitation mechanisms as feedback resonance. The topic can't be covered that quickly, and indeed it was not covered accurately or insightfully. That kind of rush job is a perennial problem for survey books meant for nonmajors.

In spite of misgivings I have concerning *Physics in the Arts*, I would recommend that someone teaching a physics and art course look the book over as a possible text. Its selection of subjects—optics, color theory, photography, harmonic oscillations, and musical acoustics—is an excellent blend for such a course. Alternatives might include separate books on sound and light, selected chapters of a more comprehensive survey book, or an extensive set of reprints and reading lists.

These days, especially with the World Wide Web, one can assemble a custom set of materials and satisfy undergraduates who prefer a single reference. The question for prospective teachers will be whether *Physics in the Arts* is a suitable prepackaged version of what they would like to teach.

The Great Warming

Climate Change and the Rise and Fall of Civilizations

Brian Fagan

Bloomsbury Press, New York, 2008.

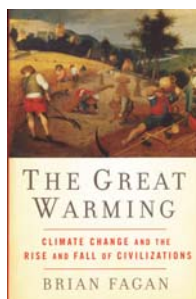
\$26.95 (282 pp.).

ISBN 978-1-59691-392-9

The Great Warming: Climate Change and the Rise and Fall of Civilizations is Brian Fagan's fourth book on climate change. Although the book focuses on the so-called Medieval Warm Period, it could have accurately been titled *The Great Drying*, for that is its recurrent theme.

A professor emeritus of anthropology at the University of California, Santa Barbara, Fagan is an accomplished archaeologist and prolific writer. He presents a world survey of the rise and mostly fall of civilizations from the 10th through 15th centuries during and after extended drought conditions that were possibly triggered by changes in the general circulation of the atmosphere. Not so long ago, English climatologist Hubert Horace Lamb (1913–97) established the field of climate change as a serious research subject and documented in great detail its social effects, primarily for Western and Northern Europe. The longer growing seasons of the 11th century and the Norse journeys are common knowledge, and Fagan uses those as the starting point for his worldwide excursion.

The author gives extended treatment to people and places beyond Europe: Angkor Wat in Cambodia, Chaco Canyon in New Mexico, Maya cities, the Mongol hordes, early Polynesian navigators, and other lost and exotic civilizations. Fagan does not tell their histories; instead, he imagines what the protagonists might have gone through and sketches their collective environmental experiences in broad strokes. The faces of the horsemen in Genghis Khan's horde are lashed by bitterly cold winds, sweating medieval peasants climb tall trees to lop off their branches, Viking sailors peer into the mist, and a merry band of natives gathers acorns in California. Such short vignettes are interwoven as the author



THE GREAT WARMING

CLIMATE CHANGE AND THE RISE AND FALL OF CIVILIZATIONS
BRIAN FAGAN

introduces some of the evidence for the stresses that climate change, especially the megadroughts, must have placed on their ways of life. In the preface, Fagan argues that subtle shifts in the environment—a degree or two rise in temperature accompanied by worldwide shifts in wind and rainfall patterns—propagated throughout societies “like ripples on a pond” and ultimately destabilized them. But ripples do not destabilize ponds and may not even annoy the frogs.

In chapter after chapter the author argues that climate change must have been important but admits that the evidence is sketchy, nonexistent, or ambiguous. That admission is actually a strength of the book. Undergraduate students could be entertained and intrigued by the archaeological stories and could be introduced to the need for further study of climate dynamics, social dynamics, and the details of the climate proxy record. I also think an interdisciplinary graduate seminar could use the book as a preliminary source before undertaking more detailed and extensive empirical work.

If *The Great Warming* has a significant weakness, it is the much too brief mention of the work of climatologist Michael Mann and his associates who, in their attempt to reconstruct the climate of the past millennium, charted the now controversial hockey-stick graph of temperature. Their graph, which has engendered both political and scientific debate, magnified current warming trends while diminishing the warming of the Middle Ages. There Fagan missed an opportunity to examine some of the uncertainties of climate science. In part 6 of its *Climate Change 2007: Synthesis Report* (available at <http://www.ipcc.ch>), the Intergovernmental Panel on Climate Change does a decent job discussing those uncertainties, and the weblog of the Center for Science and Technology Policy Research (<http://sciencepolicy.colorado.edu/prometheus>) at the University of Colorado at Boulder has covered aspects of the hockey-stick controversy. But I do not know of any book that treats those subjects comprehensively.

Like Lamb before him, Fagan peers into the climatic future and flinches at what he sees. His final chapter delivers a stern and timely warning to the world that the effects of global warming—

that is, our own great warming of today—will likely manifest in severe drought and food vulnerability, especially for civilizations living on “looted water” and thus on “borrowed time” (page 239). Adapt or perish is Fagan’s ultimate message, and that lesson is apparently being practiced by the water authority in his home city of Santa Barbara as it pursues a diversified plan of stockpiling, looting, recycling, and desalinating its own liquid gold—seawater. The well-to-do have the financial resources to build the technology that allows them to live in marginal areas; I doubt that the poorer

areas of the world can afford such adaptations.

Archaeology and the proxy record indicate that the “climatic pendulum,” a term used by Fagan (page 7), is indeed chaotic. The noted meteorologist and mathematician Edward Lorenz once reminded us that climate is what you expect; weather is what you get. Fagan might add that climate change is what you expect; social and economic collapse leading to violence and massive suffering is what you may expect to get—even with the best planning.

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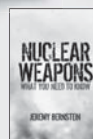
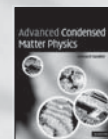
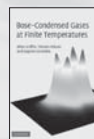
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