

pact after the mid-eighteenth century and definitely after the 1920s, but cannot explain all or even most of the pre-twentieth-century decline. He thus explores demographic and epidemiologic causes, reviewing in detail existing scholarly explanations that tie declining mortality to changing living standards, particularly improvements in nutrition. While he finds these explanation plausible, he posits that more significant probable causes for the post-seventeenth-century decline were simultaneous declines in the incidence and virulence of a number of infectious childhood diseases—most notably smallpox—that, if contracted by a pregnant woman, greatly increase the risk of fetal death.

Woods ends his book with a discussion of how legalized induced abortion in the latter half of the twentieth century has given patient status to the fetus while subjecting it to the irony of both being the beneficiary and victim of advanced medical technology. In one sense, the discussion seems divorced from what precedes it, but in another it appears the logical culmination of what is less a linear history than a wide-ranging disquisition on fetal death, its incidence and meaning, and the issues and challenges involved in studying it.

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PAUL N. EDWARDS. *A Vast Machine: Computer Models, Climate Data, and the Politics of Global Warming*. Cambridge, Mass.: MIT Press. 2010. Pp. xxvii, 518. \$32.95.

Political controversy over global climate change has increased along with the temperature in recent years, particularly in the United States. While climatologists are increasingly confident that humans are contributing to rising global temperatures through agricultural and industrial practices, conservative politicians and a small band of scientist-allies have attacked climate modeling, the data on which it is based, and the motivations of climate scientists themselves. A significant fraction of American citizens now regard climate science as a political scam, reflecting a declining faith in experts and sharply divergent views over state regulation and whether health or economic opportunities are most at risk. Historians have begun to examine the churning climate wars in political terms, analyzing the libertarian, anti-regulatory views of certain oft-quoted scientists such as S. Fred Singer and Frederick Seitz who have moved serially from controversy to controversy, including acid rain and ozone depletion.

Paul N. Edwards aims to tell a different, richer, and vital story in this book—how we came to discover, understand, and model the planet's climate system—and succeeds admirably. A historian of recent science and technology who has written previously on computing systems in the Cold War, Edwards draws on the work of historians of atmospheric sciences as well as considerable original research and oral history interviews, and provides a sweeping conceptual overview of climate science. He examines how scientists created systems of data collection beginning in the nineteenth century,

worked to refine existing temperature records, embarked on massive efforts to collect new data (including the Global Weather Experiment of the late 1970s), and built increasingly sophisticated computer models, such as the National Center for Atmospheric Research's Community Climate Model Series, to test predictions against what was becoming known about past climatic conditions. Edwards's stimulating, well-written analysis eschews extended discussions of personalities or institutions to focus instead on how knowledge was produced. His book is also a visual feast, richly illustrated with maps, charts, diagrams, and informative sidebars.

To a remarkable extent, Edwards manages to interweave several distinct books into one. A crucial theme he addresses in this largely chronological narrative is the challenge of creating usable sets of global climate data from existing meteorological observations as well as temperature measurements of the oceans. Surface temperature measurements made in the nineteenth and twentieth centuries are fraught with individual and systematic errors: observing stations established in the late nineteenth century on the outskirts of rapidly growing cities in certain cases now record hot exhaust venting from air conditioner units in newly constructed buildings, skewing long-duration temperature records; thermometers moved from sheltered areas to airports are influenced by wind. How measurements are made similarly affects their reliability as indications of precise conditions. British vessels in the first half of the twentieth century determined sea water temperature by placing thermometers in water-filled buckets (some insulated, some not) hauled up to the deck; by contrast, certain U.S. vessels recorded temperatures from sensors installed near the water intake valves of ship engines (some close to the surface, some much lower down, some close to the hot engines). As Edwards notes, a large, sudden drop in reported sea surface temperatures beginning in 1945 may not reflect any actual cooling but rather a contemporary decision to increasingly rely on compiled British vessel data using over-the-side buckets. Like historians' own interpretations of the past, prior climates are never definitively nailed down with historical temperature measurements but instead shimmer within a realm of uncertainty. Edwards uses examples such as this to make a larger political point: while conservative commentators by the late twentieth century began decrying the use of models rather than reported temperatures to assess past climates and possible future scenarios, *all* knowledge about climate change, he points out, depends on modeling. We can no more avoid models in studying climate than we can in assessing future economic activity in either national or global markets.

But the deepest insight Edwards provides comes from treating the production of knowledge about Earth's climate as a technological system, much as the eminent historian Thomas P. Hughes viewed electrical power networks and automobile manufacturing as immense systems involving engineers, scientists, finance, educational infrastructure, and state regulation. What

scientists strive to produce are not widgets, but reliable knowledge. The history of climate science, as Edwards notes, is simultaneously a history of standardization. Thermometers, telegraphy, time zones and time-keeping, recording practices, reporting information to centralized offices, gathering national data sets into global systems, and ever more powerful and comprehensive computer models are all essential ingredients. From the time climate studies began in the nineteenth century, the goal of researchers in this field has been to develop ways of assessing the past and future states of Earth's atmosphere. To reduce data friction (eliminating disparities between data sets), scientists use standards as lubricants. To overcome losses of raw materials (such as when the People's Republic of China between 1949 and 1956 ceased providing all weather data to the international scientific community for a quarter of the globe's land surface—the first of several Cold War information crises), scientists reinforced professional networks. In particular, they employed the World Meteorological Organization (WMO) to create World Weather Watch—to this day the largest scientific experiment ever attempted. At present this technological system includes a unique global government-science hybrid—the joint WMO-United Nations-sponsored Intergovernmental Panel on Climate Change, better known as the IPCC—to produce climate knowledge sufficient for states to use in planning and policy decisions. In recent years, IPCC researchers have found that no computer model of Earth's climate can predict the most recent warming period except when human activities are included.

By treating climate knowledge as the product of a technological system, Edwards clarifies how politics, ideology, and corporate interests have shaped and influenced the use of new insights into likely climatic futures. No other scientific finding has so challenged the energy economy of the planet—built with other, distinct technological systems—and vociferous controversy, he writes, should and ought to be expected. But the pushback from fossil energy companies, automobile manufacturers, and related interests has stymied remedial plans. These industries, adopting an approach skillfully employed by tobacco companies by the 1950s to undermine links between cigarette smoking and lung cancer, have manufactured doubt about the consensus of climatologists that climate change is real and bludgeoned climate scientists over perceived shortcomings and shaky evidence. While Edwards remains evenhanded in his analysis of recent developments, he is particularly sharp in criticizing the George W. Bush administration, noting that “even as the scientific consensus grew ever stronger, political appointees carried the manufacture of controversy to the point of criminal corruption” (p. 409).

A bibliography separate from the book's extensive notes is unfortunately absent, and Edwards's index sometimes misses major concepts and proper names. Edwards's masterful analysis, however, not only provides the best overview to date on how climate knowl-

edge was produced, but has significantly expanded our historical understanding of how technological systems work in our modern global landscape.

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#### ASIA

ANTHONY REID. *Imperial Alchemy: Nationalism and Political Identity in Southeast Asia*. New York: Cambridge University Press. 2010. Pp. xiii, 248. Cloth \$75.00, paper \$29.99.

Although the market for studies of ethno-nationalism seems saturated, Anthony Reid offers us a delightful book that students of ethnic identities, nationalism, and Asian history should not miss. Reid does not dwell on particular theories or conceptual arguments such as primordialism or constructivism, or on any specific categories of nationalism: civic, state, ethnic, anti-colonial, and so on. Nor does he see the claimed essences of particular nationalisms—religion, ethnicity, territory, or language—as discrete elements that can be untangled. Instead, Reid takes them all in and offers a few more concepts that are pertinent to the experiences of Southeast Asia. The result is a fascinating book on how those elements produced vicissitudes of nationalisms—like alchemy—as determined by historical particularities.

The role of colonialism in creating ethnic identities runs through Reid's accounts, although he traces his cases back to the pre-colonial period and follows them into the post-colonial period. Fortunately for readers, the roles of native agents are prominent. He masterfully shows how “Malay” was produced as an ethnic category in the nineteenth century, despite its multiple meanings until then that had nothing to do with ethnicity. Thanks to colonial scholars, it became an ethnic category that was widely adopted and sustained by native elites across the archipelago. However, the construction of ethnic categories was not always limited to the power of the colonial or national state. The category of “overseas Chinese” was constructed variably in ethnic terms over time and across societies. The significance of the Chinese as traders and as a major alien people all over Asia is well known. Here Reid intriguingly introduces them as the “essential outsiders,” a significant element in the alchemy of many ethnic identities and nationalisms in the region.

Readers can see many of these interrelated elements at play in Reid's treatment of Indonesia. Layers of ethnic identity make up Indonesia, itself a product of the alchemy of state nationalism to which some the ethno-nationalisms of its residents are antagonistic. For example, Acehnese nationalism in Sumatra, Reid expertly shows, has its “[deep roots] resting on a memory of state . . . as well as an exceptionally strong OSH factor based on personal memories of resistance to outsiders and suffering at their hands” (p. 136). OSH (Outrage at State Humiliation) is “a category which is characteristically Asian as a reaction to the humiliations the state