

The chapter asks the broader question that this example raises: “What is the [scientific images’] relationship to the phenomena they purport to represent?” (p. 128). Kessler addresses this question by drawing together concepts from history of science, art history, and cultural studies to reflect on how digital imaging and processing has changed how scientists think about the relationship between object and image.

Kessler’s most novel and interesting argument, one that she weaves throughout the book, is that Hubble images are best understood as sublime landscapes. In her words, “Through a reprisal of Romantic tropes, the Hubble images once again invoke the sublime and they encourage the viewer to experience the cosmos visually *and* rationally, to see the universe as simultaneously beyond humanity’s grasp and within reach of our systems of knowledge. . . . [Thus] the Hubble images make claims not only about what we know of the cosmos but how we gain knowledge and insights” (p. 5). Having deftly articulated the visual similitude between landscapes and spacescapes in the first chapter, the final chapter weighs the implications of this view of the universe. Thomas Moran and Albert Bierstadt painted their landscapes of the American West while accompanying scientific expeditions of the late nineteenth century. These paintings lauded America’s steady expansion. The Hubble images similarly portray deep space as a site of exploration and conquering, albeit this is a conquest performed by the scientific mind rather than the pioneer’s body. Hubble images present the cosmos as sublime, but Kessler argues that in appealing to a familiar aesthetic they simultaneously present the universe as a knowable place.

Picturing the Cosmos is beautifully produced, instrumentally juxtaposing full-color Hubble images alongside text that offers new ways to view the photographs. This is not strictly a work of history, though the discussion of the Hubble Heritage Project is a new contribution for historians of the space sciences. Rather, it is a careful cultural reading of the production and consumption of astronomical images that will continue to have currency long after Hubble ceases operation.

LISA MESSERI

W. Patrick McCray. *The Visioneers: How a Group of Elite Scientists Pursued Space Colonies, Nanotechnologies, and a Limitless Future.* xii + 351 pp., illus., index. Princeton, N.J./Oxford: Princeton University Press, 2013. \$29.95 (cloth).

In *The Visioneers*, Patrick McCray chronicles the careers of two scientists in the late twentieth century who each laid out powerful visions of the technologized future, rallying institutional resources and extensive public engagement to their cause. McCray first focuses on Gerard O’Neill, a Princeton physicist who spent the 1970s formulating detailed technical plans for the design of human habitats in space. He then turns to O’Neill’s acolyte Eric Drexler, regularly credited (and, later, discredited) with the development of nanotechnology in the United States.

While the book adheres closely to these scientists’ professional biographies and will no doubt interest historians of physics, spaceflight, and nanotechnology, this is no hagiographic account; nor is it a tale of lost utopias. McCray’s interest is in developing a new analytical category of engineering scientist: the *visioneer*. Visioneers combine grandiose plans for the future with the technical and scientific expertise necessary to gain credibility for their ideas and the ability to navigate political circles. For example, O’Neill produced technical designs and specifications for his space colonies, but he also conducted workshops at Princeton and cultivated key ties with sponsors ranging from NASA to wealthy enthusiasts to counterculture leader Stewart Brand. Drexler, for his part, charted a course from MIT to Silicon Valley to promote his scientific vision of mechanical assembly lines at the nano-scale.

McCray does not judge whether these men were successful in seeing their visions of the future come to fruition (space colonies are, after all, still an impossibility). Instead, he shows how O’Neill’s and Drexler’s visioneering work was important for accruing professional resources and public attention, all the while skirting the line of professional credibility. In their example, we witness diverse communities of individuals coalescing across political lines: from the burgeoning institutions of Silicon Valley to the staid “Establishment” schools and government commissions in the Northeast, from swinging hippies to firm Republicans. The thick descriptions of life in California, in particular, demonstrate the continued importance of place, individuals, and institutional prestige in the development of novel technological systems and the social interconnections that fuel innovation.

Producing an engaging and lively read for amateurs and professional historians alike, McCray beautifully situates his account within the political and commercial world of the time, including the end of the Cold War, the energy crisis, the contradictory politics of the environmental movement, and the discussion of “limits.” He tells memorable stories that bring his characters—and their times—vividly to life. The chapters about O’Neill recall

the heady days of the 1970s, including Timothy Leary's public lectures and the antics of kooky New Age patrons. The chapters dedicated to Dexter pulse with the rise of Silicon Valley, complete with journalistic frenzy, government funding, and fragile institutional partnerships. A connecting chapter on the rise of *Omni*—a popular science and engineering magazine founded by the creators of *Penthouse*—is fascinating for its description of the importance of print media subscriptions in this period, as well as its titillating looks behind the scenes.

McCray's analysis is well supported by documentary evidence, including a considerable amount of primary historical work and use of uncatalogued archival materials. What he does not analyze is how and why particular individuals emerge as visioneers. For example, McCray admits in the conclusion that both of his actors are connected to powerful and prestigious institutions (Princeton, Stanford, and MIT) and that both are white, upper-middle-class men. No mere coincidence, such aspects do not play a role in McCray's analysis of his actors' visioneering successes, although they no doubt played a role in their trajectories at the time. While it is historiographically wise to resist attributing "success" or "failure" to historical actors, this analytical gap leaves open the question of what it takes to be successful at future-shaping or what these two specific cases might tell us about other examples of visioneering.

This point aside, *The Visioneers* offers an important and novel perspective to the history of science in its example of just how powerful future-making can be. Showing how the visioneer shapes not only scientific futures but also institutional contexts and social relations, McCray provides an essential step toward our historical understanding of the role of the future in the past.

JANET VERTESI

Edwin A. Martini. *Agent Orange: History, Science, and the Politics of Uncertainty.* xvi + 302 pp., illus., map, index. Amherst/Boston: University of Massachusetts Press, 2012.

Agent Orange was not designed as a chemical weapon to use against people directly, but its legacy is as complex and in many cases as devastating as the use of mustard gas. Edwin Martini has done an outstanding job of unraveling the multilayered history of this now-infamous herbicide. Manufactured for use during the Vietnam War, Agent Orange and other herbicides were seen as a technological solution

to several military problems, including removing the forests in order to deny enemy forces cover and eliminating food sources so the NLF (more commonly known as the Viet Cong) could not live off the land. The consequences of engaging in what David Zierler called "ecocide" are still being endured by the Vietnamese and the thousands of other people exposed to Agent Orange.

After an introduction that sets out the historiographic and theoretical framework for the book, *Agent Orange* is divided into five chapters. The first two, "Only You Can Prevent Forests" and "Hearts, Minds, and Herbicides," cover the use of AO in Vietnam, looking at its strategic and tactical applications. While AO did exactly what its developers said it would do, the consequence of often indiscriminate spraying was a military, political, and ecological disaster. South Vietnamese farmers had their crops destroyed, the denuded forests did not stop the movement of NLF forces, and civilian and military personnel exposed to the dioxin-based herbicide suffered short- and long-term health damage.

The concluding three chapters look at the ideology of herbicides, the difficulty of getting rid of the toxic stockpiles, and the ecological and health problems associated with AO. The dioxin family of herbicides proved to be notoriously difficult to clean up from a scientific and technical perspective, but the real problem, as Martini documents, was the politics of herbicides. Herbicides were developed to give users the ability to control nature, but the unexpected consequences called into question not just their practical value but the entire worldview of those promoting the technological mastery of nature. What followed was a complex social interplay that saw concerns about health issues and the growing ecological movement facing off against government and business interests. For example, at the same time the U.S. government was trying (and largely failing) to find a place to incinerate AO safely, it was being used in New Zealand as part of the "grasslands revolution" that turned millions of acres into grazing land and transformed the agricultural sector. Even among those who might have common cause because they were exposed to AO, the complexity is profound, as those affected include Vietnamese and New Zealand farmers, soldiers from America, Korea, and Canada, municipal workers tending roadways, chemical workers, and a host of bystanders exposed accidentally or under the uninformed belief that AO was safe.

Agent Orange will find a wide audience. There is something here for historians of chem-