

gravitational waves in the direct sense with respect to which Challoner defends the efficiency of our visual sense in the introduction. Indeed, many of the images in this volume are not seen at all but exist only as the (imagined) result of the instruments and assumptions used to construct them. The claim that a picture is worth a thousand words thus runs on a collision course with the fact, acknowledged by Challoner in passing, that none of the book's spectacular images convey any knowledge without the accompanying words that explain what we are looking at. The hidden message of Challoner's book is therefore quite in contrast with the celebration of our visual sense set out in the introduction. Our visual sense may be dominant, but we cannot simply trust what we see. The infographics of one of the early innovators of the visual representation of statistical data, William Playfair (1759–1823; not present in this volume), were not incidentally considered to deceive rather than inform as to the state of the British economy. Challoner nowhere addresses the ambiguities of the images and their construction and what they convey. He shows no trace of hesitation in taking the authority of science as given and its rendering in visual form as unproblematically showing “knowledge.” And that is unfortunate. For decades visualization has been a well-discussed topic in the history and philosophy of science and technology, but the fruits of this literature do not seem to have reached Challoner. I found this surprising for someone with a background at the Education Unit of the London Science Museum and a missed opportunity for a book that, as the author rightly emphasizes, presents such stunning images.

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Martin Brückner; Sandy Isenstadt; Sarah Wasserman (Editors). *Modelwork: The Material Culture of Making and Knowing*. 312 pp., illus., index. Minneapolis/London: University of Minnesota Press, 2021. \$30 (paper); ISBN 9781517910907. Cloth available.

Because models are so pervasive, “crossing professions and academic disciplines and permeating everyday life” (p. vii), we should write about them. But how? While attempts are made in *Modelwork: The Material Culture of Making and Knowing* to define models, particularly in Chapter 1, all other chapters address the more pertinent question: What do they *do*? This simple question is not easy to answer because models do many different things in different fields, as testified by the book's coverage of a wide variety of fields: natural philosophy (Ch. 3), drawing instruction books (Ch. 4), music software (Ch. 5), patents (Ch. 6), body measurements (Ch. 7), virtual reality (Ch. 8), midwifery (Ch. 9), shoemaking (Ch. 10), and digital humanities (Ch. 11). Despite this wide range of doings, the materiality of the model matters to all of them. The model's materiality, “its physical presence, its sensible materials, the volume it occupies” (p. ix), affects how we can work with it. According to the editors, a model is “a mediating process, a mechanism for doing something” (p. x), a process they call “modelwork.”

This approach, with its particular focus on materiality and seeing models as mediators, is clearly based on Mary S. Morgan and Margaret Morrison's *Models as Mediators* (Cambridge, 1999), which first addressed both aspects. However, the scope of the fields those authors covered was limited to physics and economics. *Modelwork* nicely shows that models are not only the critical instruments of modern science but have also become the essential tools with which we shape the world around us. While *Models as Mediators* is recognized as one of the relevant sources for *Modelwork*, I would like to make one critical remark about the latter volume. In the introductory chapter, along with the incorrect publication date, the reference to *Models as Mediators* gives the wrong name for the second editor: instead of Morrison, Steve Woolgar is credited. In Chapter 1, Morrison is referred to as a “distinguished economist” (p. 6); she was actually a distinguished philosopher of science. And in the same chapter her name is replaced again in a reference to *Models as Mediators*, this time by that of Charles Baden-Fuller. This careless referencing harms the otherwise excellent quality of *Modelwork*.

To discuss the work that models do, the volume is divided into four sections: “Knowing,” “Sensing,” “Making,” and “Doing.” While “Knowing” discusses the more traditional aspect of models—namely, their epistemological role—the other sections explore more interesting new avenues. The second part, “Sensing,” considers the phenomenological dimensions of modeling: models “may not only delimit the scope of observation but can to some degree determine what is *observable*” (p. xiv). For example, Christopher J. Lukasik, in his chapter on the “instructed eye,” shows how drawing instruction books teach “not only how and what to draw but also how to see”; they “model vision” (p. 70). And Martin Scherzinger, in his chapter on “modeling musical perception,” shows that models determine not only seeing but also hearing: modeling hearing is also “a mode of constructing hearing” (p. 107).

Part III discusses the making of models primarily in terms of how immaterial ideas are materialized or embodied. A literal embodiment is presented by Catherine Newman Howe in Chapter 7, where the “ideally measured body” was turned into a sculpture representing the “typical American.”

The insights of the first three sections are more explicitly addressed in the last part, which focuses on “Doing.” As a separate body, the model has a life of its own, following its own internal logic, which may be quite different from the “cultural or structural logic of whatever phenomenon it is modeling” (p. xv). In fact, models can do their work because they are not analogues or transcriptions. This is nicely demonstrated by Lisa Gitelman in her chapter on shoe lasts. Shoe lasts are not models of the foot; rather, they “present stable volumetric forms that roughly correspond to the shapes and sizes of feet so that shoe parts can be patterned and assembled on them” (p. 214). The model works as “a kind of structuring figuration,” “as a normative outcome proper to a disciplinary regime” (p. 222). Other examples of this disciplinary role have already been mentioned in the section of the book on “Sensing”: the “instructed eye” and the “construction of hearing.” And similarly, in her chapter on “modeling interpretation,” Johanna Drucker emphasizes that the model’s conceptual work of “form-giving” is not necessarily “representational.” In fact, AI programs—not only for text interpretation, but also for language translation—started to function better when the designers stopped trying to copy human intelligence.

This collection of material culture studies on modeling shifts the focus from “about finding meaning” to “about making it” (p. 255). While most studies on models and modeling focus on science and engineering, this volume testifies to the central role that modeling plays in the humanities. This will help us to understand better that although models are human made, they have also shaped how we view ourselves.

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Antiquity

Wengcheong Lam. *Connectivity, Imperialism, and the Han Iron Industry.* xviii + 304 pp., illus., maps, tables, notes, index. (Routledge Studies in Chinese Archaeology.) London/New York: Routledge, 2023. \$136 (cloth); ISBN 9781032194479. E-book available.

China’s long history offers a wealth of insights into imperialism in action and into the role of technology in pursuing—or undermining—the goals of imperial governance. Bringing the perspective of an anthropological archaeologist to bear on the formation of China’s first unified empire, Wengcheong Lam’s innovative analysis of iron production and state building in early China provides an illuminating contribution to