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**Picturing Machines, 1400–1700 by
Wolfgang Lefèvre**

Steven A. Walton, *Penn State University*



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Review

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treme “seemed to disqualify from the outset” (p. 142) new impulses in late eighteenth-century science, especially biology, though within a decade these would culminate, despite him, in *Naturphilosophie* (p. 47). Lagier illuminates well the misunderstandings that resulted, for example, between Kant and Blumenbach, despite their mutual admiration.

Whereas in the first *Critique* Kant proposed to understand reason by analogy to organic forms (“epigenesis of pure reason”), in the third *Critique* he reversed himself, asserting, as Lagier notes tellingly, that “the purposive systematicity of organic form is not properly speaking even thinkable except via the limited implications of an analogy with the *intentional products of the will* (of practical reason), such that the teleological orientation of the products of nature is in principle always *the imposition by the subject himself* of a purpose onto nature, and never an objective property of objective ‘life’” (p. 190). Indeed, Kant’s ultimate considerations of teleological judgment turned away from natural history to human self-realization, from “physiological” to “pragmatic” anthropology.

Apart from mistakenly dating the “Appendix to the Transcendental Dialectic” to the second edition of the *Critique of Pure Reason*, Lagier develops a careful and persuasive historical reconstruction of Kant’s thought. On the other hand, apart from some very cautious indications of “blind spots,” he withholds judgment from a presentist perspective of the plausibility of Kant’s philosophy of science, and there are only two brief notes that point to current thinking in biological science.

JOHN H. ZAMMITO

Wolfgang Iefèvre (Editor). *Picturing Machines, 1400–1700*. vi + 347 pp., table, bibl., indexes. Cambridge, Mass.: MIT Press, 2004. \$40 (cloth).

For those who have always gazed in wonder at the machine drawings of Leonardo da Vinci or Agostino Ramelli, read the descriptions, and felt somewhat unsatisfied with modern commentary about what these drawings *mean*, this collection of nine essays by historians of science, historians of technology, and architectural historians happily takes their contextualization one step further. This volume is not about figuring out how particular machines in the drawings worked (or didn’t), but about how the pictures worked in their role as information memes, passing information from craftsman to craftsman in one city or region to another, from generation to gen-

eration within a trade, or from artisan to patron in a courtly context. In short, all the authors are interested in what it meant to bother to commit machinery to paper when, as the early contributions readily admit, drawings were largely irrelevant for the master craftsmen themselves, who already knew how to make mills, pumps, and the like—and, in fact, knew how to make them better than anything the artists could depict.

Opening with a moderately useful taxonomy of machine drawing functions and ending with an important essay on the relation of machines and the science of mechanics, the volume has three main sections that proceed in rough chronological order, as if to show the progression from fifteenth-century “pictures” to something more “modern” by the end of the seventeenth century. As the first section establishes extremely well, we should “see” the pictorial languages of early machine drawings not as immature or crude but as effective depictions, albeit using a different but remarkably consistent and useful grammar. The second section offers a close look at individual artist-engineers to get at the distinction (or coincidence) of “seeing and knowing.” The connection of tacit or craft knowledge to drawings has long vexed scholars, some claiming that the “crudity” of the latter implied a misunderstanding of the former. These essays argue quite the opposite: mental ideas are distinct from drawn plans, but they are related in the same way as “knowing” must precede “making” or as “showing” must relate to (although not necessarily imply) “using.” This sets the stage for the third section, on the evolution of drawing techniques such as perspective and isometry. Although there is some overlap in the three essays in this section, they connect the medieval and early modern machine drawing tradition nicely to the sphere of architectural delineation. Remembering that the men who did many of these drawings in the fifteenth through seventeenth centuries were *both* architects and engineers may help draw us out of the fallacy that they were all proto-scientists, as Michael Mahoney’s concluding paper in the volume shows very effectively. In focusing on Christiaan Huygens, a man who made the first successful scientific technology through the use of drawings for his pendulum clock, Mahoney reminds us that (despite lingering implications in the other contributors’ work) machine drawings *did not* enable the Scientific Revolution, which came from other, analytical, nonpictorial quarters. Readers would be well advised to read Mahoney’s chapter first, as a slight remedy to the occasional teleology that creeps

into the book earlier on. What the machine drawings from 1450 to 1700 did do, however, was transmit technical knowledge in numerous fashions to numerous constituencies—and did so quite effectively.

My one reservation about the volume is an issue that perhaps its organizers and authors never meant to address but that deserves to be raised explicitly if it is to be set aside. It concerns the question of how one understands machinery that is drawn, as compared to how one understands physical machines in the world. This volume draws heavily on the line of reasoning set forth in Eugene Ferguson's *Engineering and the Mind's Eye* (MIT, 1992), which considers the design process and how engineers *think* about machines. But it seems, too, that machine drawings are also about machine use, or what might be called a certain tactile—as compared to cognitive—understanding of machines. Some of the contributions in the volume fail to convey fully how well the historical artists and authors (or indeed the present authors) *tactilely* “understand” machinery themselves—something that is not to be confused with “tacit knowledge,” which they do cover. That is, were Leonardo or Francesco di Giorgio Martini or Christiaan Huygens comfortable or deft with a saw, chisel, and lathe to make their machines, or even with the hands-on use of the machines they depicted? But perhaps this is part of the question at hand: Can a verbal or even pictorial description ever replace hands-on knowledge? If so, or how so, or if not, then what is their relationship? Modern engineering education often tries to say that drawings do replace hands-on knowledge, but we as often find the opposite to be the case. I wish this volume might have clarified this issue as well, but perhaps that is for the next publication.

Picturing Machines is yet another excellent contribution stemming from the Max Planck Institute in Berlin and the Dibner Institute in Boston. Both institutions and the conveners of the conferences that gestated this book should be commended for asking broader penetrating questions of sources for the history of science and bringing scholars together to begin to answer them. This book will be an invaluable starting point for anyone who wants to work on early modern machinery and technical drawing. The combined bibliography itself is worth the price of the book, in particular bringing to an Anglophone audience a great deal of Continental work. The essays use a short author/date referencing scheme and refer to one another repeatedly, so this is not a copy-one-essay sort of edited vol-

ume; interested readers will definitely want most if not all of the articles anyway, and I hope that it will be released in a paperback version for class use. Although not all of these essays are the final word on their subject, they will initiate further conversations on what machine drawings meant to a world that didn't yet “need” them in the way we (assume we) do today.

STEVEN A. WALTON

Mary Sponberg Pedley. *The Commerce of Cartography: Making and Marketing Maps in Eighteenth-Century France and England*. xv + 345 pp., illus., apps., bibl., index. Chicago/London: University of Chicago Press, 2005. \$40 (cloth).

In the eighteenth century, the work of those men known as “geographers”—properly, a combination of textual geographer and mapmaker, for the word “cartographer” had still to be invented—was an important part of contemporary science. Through the map, the world could be pictured, put in order, scaled down, and made portable for soldiers, politicians, and, increasingly during the eighteenth century, the enquiring public. But maps do not simply mirror the world. Quite apart from the technical problems of representing an almost round world on flat paper while retaining any degree of proper area or shape, maps can distort. They can be made to depict what is not there. Indeed, maps may help constitute enduring falsehoods—about the shape of continents, for example, or the “natural” boundaries of nations. Before the advent of mass printing and of geographical and mapping agencies working to standard practices, mapmaking was an expensive and at times uncertain affair, often shrouded in secrecy. For as maps could reveal the scaled-down world, so could they lie and be copied, be symbols not of terrestrial accuracy but of political manipulation.

Mary Sponberg Pedley is a leading map historian who has written widely on the nature of map and atlas production, especially in eighteenth-century France. In this wonderfully written, beautifully illustrated, and deeply scholarly account, Pedley has produced a work of lasting significance, a book that is likely to be a way marker in the field for years to come. Her object is not so much to outline eighteenth-century claims about maps as straightforwardly accurate representations of the world or to present detailed considerations of the many social uses of the map, although both topics inform the book. Her main concern is with charting the manufacture of maps themselves, as a type of scientific