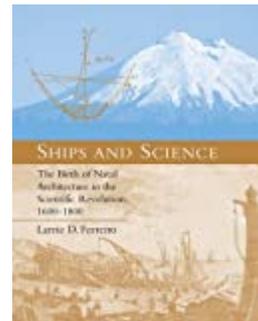




Larrie D. Ferreiro. *Ships and Science: The Birth of Naval Architecture in the Scientific Revolution, 1600-1800.* Cambridge and London: MIT Press, 2007. xvii + 441 pp. \$45.00 (cloth), ISBN 978-0-262-06259-6.



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History with Differential Equations

Personally, I have to admit that my preference for history with partial differential equations is more theoretical than real. There are very few historians equally at home in the realm of engineering maths and the historical profession, and I am not one of them. Worse for Ferreiro's work, it is unlikely that many of these paragons work on the history of naval architecture. The history of naval architecture that we have has largely been the work of naval architects turned historians. Unfortunately, in spite of the great contributions of David Brown and especially Norman Friedman, historians have had occasion to grit their teeth and read on. This has been, and continues to be, the great complaint against internalist histories of the learned professions: too much attention to arcane detail, too little attention to historical context.

That is certainly not the direction I am going to take with Ferreiro's work. This is an important book, and a long (I apologize in advance) review. Challenging as passages of it may be, there has been no book like this ever, and until someone does better, the burden of the challenge is on the reader to understand, not upon the author to find some elusive compromise between accessibility

and detail.

Is all the detail necessary? The first thing to say is that there is not enough detail by a long margin. This is not a comprehensive history of the building of ships in this period. Those details are still beyond us. Yet the fact that we do not have an adequate history of ship's rigging (for example) does not mean that the need for one is obvious. Against this I could cite the venerable controversies over ship design, but the argument is best made elsewhere, in the technological acid dream that is the introductory chapter of Gareth Menzies' enormously popular *1421* (2004).^[1] Anyone who has ever been convinced by Menzies' descriptions of the details of the ships with which the Ming dynasty *discovered the world* could benefit from reading *Ships and Science*.

Ferreiro frames his work with incidents in the extraordinary life of Pierre Bouguer, the French astronomer whose 1746 *Traitee de Navire* founded the discipline of naval architecture, as the overexcited book jacket puts it. Actually, Ferreiro locates the origins of the discipline in a conventional, perfectly convincing, narrative of increasing state surveillance, bureaucratic control, and scientis-

tic enthusiasm, particularly in the vast and fissiparous French state. The elder Colbert might have envisaged scientific design as a force multiplier (p. 66), but the real issue is the same as in the artillery and musket reforms of the next century, one of standardization and control. At no point in the eighteenth century did the *scientific* approach actually contribute to the design of a French (or other) warship in a meaningful way. Ferreiro joins many other recent writers in taking a run at the late eighteenth-century Society for the Improvement of Naval Architecture and its conviction that *scientifically* designed French warships were faster than British (pp. 176-80).

Never mind. Bouguer's definition of the metacentre and point velique provided the basics with which science could, indeed, make a contribution to the design of ships. His treatise was the basis for the first textbook at the first French school of naval constructors, and was adopted at the schools in other countries as well. Constructors trained at these schools were the first to calculate metacentres for the ships they designed, and if they did nothing with their results, this was largely because the calculations were so arduous and error-prone, and inclining experiments so expensive, that no one trusted them anyway. As the case of the *Royal Louis* demonstrates, they were quite right not to do so (pp. 243-44). The metacentre calculation did however provide the pretext for teaching young constructors the calculus, and this in itself would pay off in due time.

With this emphasis, Ferreiro might have been forgiven for writing a scientific biography of Bouguer rather than a grand survey. We are fortunate that he took the high road. The substance of *Ships and Science* begins with a brief survey of the intersection of national shipbuilding efforts, strategy, and the embodied skills of the traditional naval constructor. These latter were essentially carpenters and traditional practitioners, for all that they built good ships. The general thesis of a survey of professionalization such as this one is that they had a good amount of social climbing to do, and embraced science as a means to an end. The great Spanish theorist and constructor Juan y Santacilla (the first figure to combine these skills and further reinforcement of N. A. M. Rodger's recently promulgated thesis that *Spain*, and not either France or Britain, was the most progressive of naval powers) indeed describes traditional constructors as "mere carpenters."^[2] Some reservations are necessary from the outset. French naval constructors may have been allowed to call themselves *Sieur* from 1765 to escape the stigma of the craft professions, but we need more social history here to understand the trajec-

tory of this stigma. There was a time when carpenters were kings. More to the point, when covering the British scene, Ferreiro lets drop the fact that British apprentice shipbuilders were premium apprentices, something that puts entirely a different spin on their social class of origin than calling them simply "apprentices."

Ferreiro then gives a brief introduction to the scientific revolution for the benefit of professional readers, placing an implicitly revisionist emphasis on the role of the Society of Jesus; but then he has to, as the first major theorist of naval architecture (and tactics) was a Jesuit father. From here he goes on to introduce Colbert's intervention and some famous model trials at Versailles under the eyes of the Sun King. Here he is revisionist. The traditional strong position is that these trials, and conferences incidental to them, set the direction for central and scientific control of French ship design for the next century. Ferreiro finds uncertain evidence that the famous conferences even happened, and strongly doubts their claimed significance (pp. 74-77).

Still, the problem of tactical maneuver introduces the first major scientific controversy over ship design, that over the *derive*. Combined with the discussion of the solid of least resistance in the next chapter, we have a study that is as much about the steady evolution of mathematics and physics to the ultimate *Newtonian* synthesis of the mid-1800s. Since this portion (roughly pp. 87-185) is largely either irrelevant today or just plain misconceived, it may seem to be of the least general relevance. Ferreiro demonstrates that this is not the case. The evolution of naval architecture occurs alongside and in the context of the development of hydrostatics and hydrodynamics. These were fields in which canal-builders, bridge designers and mechanical engineers took the lead. To this point the hydraulic history of Europe is woefully understudied, save for the northern Italian case, where it is clear that naval architecture is intimately linked with these other inquiries. If anything, Ferreiro's lack of familiarity with relevant archives suggests that he underestimates the importance of this connection. Again, the plea of a Habsburgist: the importance of Austria and Venice in these activities should not be sold short, nor Viennese archives neglected.

Moving on to the metacentre, we have the theoretical inquiry that made the case for theory in naval construction. There is a brief prehistory of the concept, followed by a heroic attempt to make the concept comprehensible to the lay mind without resorting to excessive simplification. Ferreiro is struck by the way that three

authors (Bouguer, the incomparable Leonhard Euler and the lesser known Charles Camus) converged on the concept in the same crucial years leading up to 1745, but explains this in terms of the recent availability of integral calculus rather than with metahistory. His approach has the advantage of showing why, even though French constructors calculated metacentres from the 1770s on, the results were only useful in the next century.

He concludes with a brief discussion of national constructor corps as they were raised, ending with the British case as late as the 1870s. While skeptical that this reflected British backwardness, Ferreiro here falls short, failing to ask properly reflexive, and especially political, questions about the 1790s controversy over the lack of

science in British warships.[3] This failing does not, however, undermine the importance of the book.

Notes

[1]. David B. McGee, "Floating Bodies, Naval Science: Science, Design, and the *Captain* Controversy, 1860-1870" (Ph.D. diss., University of Toronto, 1994).

[2]. N. A. M. Rodger, *The Command of the Ocean: A Naval History of Great Britain, 1645-1815* (New York and London: W. W. Norton, 2004), 408-425.

[3]. Peter Dear, "What is the History of Science in the History of Early Modern Roots of the Ideology of Modern Science?" *Isis* 96, no. 3 (2005): 390-406.

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