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# Ships and Science: The Birth of Naval Architecture in the Scientific Revolution, 1600–1800

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While providing voluminous data on the economic effectiveness of naval blockades, the authors' conclusions are generally dismissive of their military usefulness, suggesting that an opponent's "military strength" and "productive capacity play a more important role in the outcome of war."

Yet this negative assessment of blockades seems to run counter to many of the book's case studies, such as the War of 1812, which the authors call "a military disaster for the United States." During the American Civil War, the Northern blockade against the South played "a significant role in the Union victory." In World War I, Germany's debilitating "food crisis" was mainly due to "the effectiveness of the Allied blockade." Finally, in World War II the U.S. blockade against Japan was so tight that "it may have been the most effective naval blockade in history."

Given these generally positive views, it comes as a genuine surprise when the authors conclude by suggesting that the success rate of naval blockades "does not seem very high," and that nations will continue "to deploy blockades, but greater success than that which has occurred in the past should not be expected."

One problem might be the tables, some 142 in all, which document in minute detail the impact of naval blockades on wartime economies. Unfortunately, virtually all these tables were adapted from previous works, and some have not been updated. Another possible problem might be the authors' too-narrow focus on economic factors rather than on how economic and military pressure jointly achieved victory. The inability of the Confederacy to obtain iron plates from abroad to construct its own navy, due mainly to the effectiveness of the Union blockade, is one case in point. The tight U.S. blockade against the Japanese home islands in combination with the use of the atom bomb may have been crucial in forcing Japan to surrender.

Before naval blockades are dismissed as an ineffective strategy, many other successful naval blockades that did not include large economic components would have to be considered. The authors of this book barely mention the U.S. "quarantine" during the Cuban Missile Crisis or Britain's use of maritime exclusion zones while retaking the Falkland Islands, both widely considered to be highly effective examples of naval blockades.

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Ferreiro, Larrie D. *Ships and Science: The Birth of Naval Architecture in the Scientific Revolution, 1600–1800.* Cambridge, Mass.: MIT Press, 2007. 432pp. $45

This is the first in a planned two-volume history of the application of scientific theory to ship design. Larrie Ferreiro is well qualified to take this on, having both trained and worked as a naval architect and having earned a PhD in the history of science and technology.

The sailing ship was arguably the most complex mechanical system in common use prior to the Industrial Revolution. Thus a natural development of the scientific revolution of the seventeenth and eighteenth centuries was, for emerging "scientists," to try to explain the behavior of the ship at sea. The initial goals were to understand how it was

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that ships floated and were propelled through the water, with the ultimate objective of applying scientific principles to optimize the design of ships before they were actually built. Ferreiro traces the pursuit of this emerging ship science through the work of key individuals, most notably Pierre Bouguer, the "father of naval architecture." The book also takes a topical approach, focusing on efforts to develop the major concepts of ship design, including the proper configuration and placement of masts and sails, hull resistance in water, hull displacement, buoyancy, the center of gravity, and the metacenter. Running through this history is the evolving process of naval architecture through the end of the eighteenth century, including the development and standardization of terminology, ship models and plans, and experimental techniques.

This is ultimately a story of failure, a succession of scientific dead ends on the road to eventual enlightenment. Most of the baseline theoretical work of this period was later determined to be incorrect due to a variety of limitations inherent in early science, including inadequate mathematics, limited experimentation techniques, a lack of reliable means to spread ideas, and not least of all, dogged adherence to Aristotelian physics. It is nevertheless an instructive account of how early theorists came to understand the phenomena they were trying to explain.

Beyond the basic science, this is also an interesting story of the process of innovation within an established bureaucracy. Up until the nineteenth century there was virtually no demand for the application of scientific principles to ship design among those actually building or operating ships. Science was seen both as unnecessary and undesired by ship constructors, whose designs had proven quite adequate and whose livelihoods depended upon safeguarding their specialized and unwritten knowledge. Ferreiro's thesis is that the primary impetus for developing and applying standardized scientific techniques to ship construction was an effort by administrators outside shipbuilding to impose increasing control over warship design and production. Although little actual change was evident by the end of the eighteenth century, Ferreiro reveals the elements of the eventual shift in bureaucratic control over ship design from individual craftsmen (ship carpenters) to members of an entirely new profession (naval architects).

This book well serves its primary purpose as a general history of the beginnings of naval architecture. It is also valuable as a broader history of technological innovation, offering insight into the relationship between science and technology and the social impact of technological change. I look forward to the second volume (post-1800) of the series.

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