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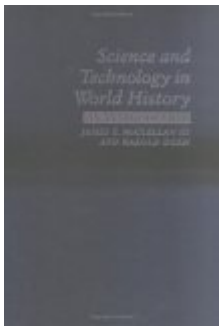

**James E. McClellan, III, Harold Dorn.** *Science and Technology in World History: An Introduction.* Baltimore and London: Johns Hopkins University Press, 1999. 404 pp. $65.00, cloth, ISBN 978-0-8018-5868-0.

**Reviewed by** Trudy Eden

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James McClellan and Harold Dorn, Stevens Institute of Technology professors of the history of science and the history of science and technology, respectively, intended this volume to be an introductory textbook that explains the historical importance of technology and science and the changing relationship between the two. Believing the close relationship between science and technology that exists in industrialized countries today to be a recent development in world history, they assert that for most of human history, technology "has functioned as a fundamental driving force in human history" (p. 371) often without the assistance of theoretical science.

They start their narrative with the simplest of human technologies, tools, and their use by Paleolithic humans to make other tools as well as to master the technology of fire. They move on to the Neolithic Age in which humans developed agricultural tools and constructed permanent, simple dwellings and monuments such as Stonehenge and the moai statues of Easter Island. The "Urban Revolution" began when simple communities aggregated into complex societies that built large cities, developed forms of writing, metallurgy and, perhaps most importantly, mastered the hydraulic technologies and more sophisticated agricultural techniques that enabled their civilizations to flourish in arid lands. Egyptians, Chinese, Mesopotamians, Indians living in the Indus River Valler, Mesoamericans, and Incans all refined the astronomical, mathematical, and monument-building skills of their forbears at different points in chronological time but within the trajectory of technological development for all human societies. These were the first great civilizations and McClellan and Dorn devote large portion of the text to describing their accomplishments and explaining how every single one supported some sort of scientific activity.

Scientific activity occurred within these civilizations in the fields of astronomy, mathematics and medicine, supported by governments hopeful for answers to practical problems. The first exception to this practice occurred in ancient Greece where individuals, Aristotle and Plato among them, independently pursued science as a strictly philosophical pursuit. These men created natural

philosophy, a "pure" science, which Aristotle described as the science that arose "when everything [practical] had already been provided: and which was concerned Ïneither with the necessities nor with the enjoyment of life." He believed it to be supreme among all intellectual pursuits because of its "detachment from social or economic objectives" and "from the lesser activities of the crafts and technology (p. 72)."

Aristotle may have believed that his society had no need of practical innovations but other Greeks clearly did not. Their technology surpassed prior developments in agriculture, pottery-making, transportation, and healing, among other areas. The Romans after them dramatically expanded the knowledge bases of engineering, military and naval technology, construction, and transportation. According to the authors, Roman practical accomplishments were the greatest of the ancient world.

While excelling technologically, the Romans did not continue the practice of natural philosophy started by the Greeks. Indeed, had it not been for the efforts Islamic scholars living during the ninth century that learning may have been lost forever. Unlike Aristotle and Plato, however, these scholars received the financial support of their ruler Al-MaMum, the caliph of Baghdad to translate, master, and expand upon Greek "pure" science because he believed it had great potential for practical application.

The development of European civilization after the first millennium differed from any of the previous great civilizations in that it was the first to develop in an area with plentiful rainfall. As a result, its technological development began not with hydraulic engineering but in agriculture, evidenced by the three-field rotation system and the heavy plow. The high expense of these innovations forced communal practices and supported the manorial system which, in turn, fostered what the authors believe to be the forte of European advances of the time, its military technology.

From this point, McClellan and Dorn focus on western civilization and explain the development of learning in and out of universities. They detail the practice of "pure" science by Copernicus, Galileo, Newton, Darwin, and Einstein and describe how unrelated it was to the practicalities of life until after the Industrial Revolution when "pure" scientists and developers of technology began to work in tandem.

I will use this text in teaching world history and western civilization. It places the traditional western-European based history of "pure" science (from the Greeks to nuclear physics and beyond) in its historical context. The authors have written it in lively, lucid prose and have woven the thread of their argument well throughout the entire text. In addition, they constantly summarize, if only briefly, to reinforce what they have written and keep the reader on track with the thesis. ***Science and Technology in World History*** should engage students, hold their interest, and prompt critical thinking. In addition, The Johns Hopkins Press has designed it well, by employing judicious typesetting, wide margins, and excellent placement of the many interesting and useful illustrations, maps and graphs. The authors have also included a useful Guide to Resources that lists traditional and electronic sources.

It has some shortcomings, two of which are worthy of note here. Both may result from the authors' experience as educators of students at a technical institute and can, I believe, be overcome with lectures and discussions. First, the scientific explanations on astronomy and mathematics assume a greater knowledge about the basics of those subjects than many students possess and may be confusing to students who have had little exposure to those subjects. While it may possible for students to understand the place of these sciences in history and in McClellan and Dorn's thesis without exactly understanding it, scientific content is important and these passages should be

presented with more clarity and basic background.

Another shortcoming may not be so easily corrected in subsequent editions. The authors have not clearly defined science and use so many terms for it that for most of the text it is difficult to understand just exactly what they mean by it. For example, they use terms such as "knowledge of nature" "science," "practical science," "useful science," "applied science," "hot-house science," (p. 187), "secular natural science," (p. 185) "pure science," "theoretical science," and "boiled-down science" (p. 367 ) without defining the differences between them. They contrast science with "expert learning" and "expert knowledge" (p. 164) with no clarification. At one point, in explaining the importance of Sanskrit to the Indus River Valley civilization, they refer to linguistic and grammatical studies as "science." Adding to this confusion is the fact that these sciences are unequal in the authors' minds and it is not until the latter part of the text that the reader understands why.

This situation stems from the fact that the story McClellan and Dorn is not so much one of science and technology as of the inception and spread of "pure" science, which the authors, like Aristotle, privilege as being the worthiest of intellectual endeavors. Theis text really shows that the definition of ÏpureÓ science has a history as well, one that changes with societies and their increasingly complex technologies.

By definition "pure" science and technology can never mix. Our civilization, like others before it, supports science as a solution to practical problems, a practice that we share with the great civilizations of the past. The difference between ours and those prior societies is that we have contracted the definition of "pure" science to the point where it is almost non-existent because of our strong belief in the potential utility of scientific endeavor. How we got here is an interesting story, one that McClellan and Dorn tell well.

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