Book Review: Technology, A World History
Lisa Irving, Reviewer
Submitted to Hong-Ming Liang, Chief Editor, The *Middle Ground Journal*

Daniel Headrick's *Technology: a World History* (Oxford University Press, 2010) offers students of history a comparative and global approach to thinking about the role of technology in the development of human communities. This is a slim book – 179 pages that are jam packed with details. As a part of the series, *New Oxford World History*, it is intended to address "the total human experience", even of the "peoples without history", and to use a "Big History" vantage point, where even biological and geologic time become relevant to the narrative. (Intro, p. viii, ix) These are big goals, which seem outsized for such a small volume, and yet the author finds the means to deliver.

Organization is focused: human inventions that alter human control of and existence with natural environments are clustered in broad historic eras familiar to students and instructors of world history: Stone Age, Hydraulic Civilizations, Post-Classical and Medieval Revolutions. Technologies that served similar purposes are compared to one another in the narrative: intensive agriculture and water control in the Americas next to the irrigated river valleys of Mesopotamia. Headrick notes that although humans are not the only creatures to use tools, only humans cannot survive without tools, and only humans have been shaped by the tools used. (p. 1) This remark is not incidental. Each chapter explores the dominant technologies of the millennia, and how those technologies served particular human needs, but there is also an effort to comment on the drawbacks of each technological frontier, and to show the ways in which technology ultimately served to allow some groups of humans to dominate other human communities.

The result is a synthesis that only systematic comparisons can produce. Biology, climate change, human motivation, and social structure all have an impact on the technologies explored in this account. Some paraphrased examples:

- The wide variety of hand tools produced by *Homo erectus* contributed to population diffusion across the globe, as access to a more complex toolkit made more ecosystems exploitable by humans, particularly in colder northern climates. *Homo Sapiens* was able to venture into ecosystems where clothing and sophisticated knowledge of plants and their value to humans was required. (p. 5-7)
- The transition to agriculture was aided by the need to intensify foraging strategies as more hunting grounds became crowded. The concurrent development of plant and animal domestication in multiple parts of the world can be linked to a rise in world

population, shrinking hunting grounds, climate change, and a shared need to develop more reliable ways to secure foods. (p. 9-10)

- The water control systems of Mesopotamia and the Yellow River Valley in China are here compared to Mesoamerican exploitation of the wetlands surrounding Lake Texcoco. *Chinampas* (rectangular floating islands 15-30 feet wide by 300 feet long) were built using mud, debris, and floating vegetation to create rich, well watered plots for growing vegetables and herbs. This strategy allowed Mesoamericans to grow up to seven crops a year, from perhaps the first century BCE forward. (p. 21-22)

These topics are usually included in World History texts, but are often separated from one another in topical chapters organized by time and region. When examined side-by-side, the uniqueness of any one society's technologies and challenges is contextualized. It becomes clear that no one society anywhere had a lock on ingenuity or resourcefulness, particularly in the long run, and that all human communities had to respond to large scale phenomena: climate change, flooding, volcanic activity, earthquakes (the last two don't show up in this account, but seem logical), or disappearance of a primary food group (buffalo in North America).

The idea that new technologies always improve the standard of living for human communities is challenged by several examples presented here. Cutting edge technologies usually include the demise of an earlier strategy, and with that, the class of peoples whose living was connected to the previous tool base. As a result, sometimes technology was shunned because it threatened the livelihood of a dominant group in society. Japan eliminated use of guns in the 17th C., because their introduction by the Dutch during Japan's Feudal era demonstrated that even a poor peasant could fire one and kill higher caste Samurai. Rather than allow the class structure to be destroyed, the Tokugawa *Bakufu* gradually eliminated the use of firearms. (p. 79)

Both Song China and the Arab Abbasid Empire emerged from their clash with Mongol civilizations in the 13th Century scarred by the failures of their brilliant technologies and institutions to compete successfully with the threat of nomadic armies. In China's case, Headrick presents a now-familiar argument, that the Ming Dynasty, which came to power immediately following the demise of the Mongol Yuan had a generally conservative outlook on the value of technology. Technology and foreign ideas were associated with defeat and humiliation. (p. 87) Arab civilization is described as having been "cautious and conservative" in the wake of the destruction of Baghdad in 1258. (p. 87)

Headrick's first book on technology, *Tools of Empire* (1981), made huge contributions to deciphering the success of European imperialism in Asia, Africa and Latin America in the 16th

through 19th Centuries. Many of those earlier insights have been extended and improved in this account by more details (see Ch. 5, "An Age of Global Interactions 1300-1800."). Early Modern themes emerge here: differences between navigation in the Indian Ocean and navigation of the Mediterranean Sea and Atlantic oceans become the backdrop for European investments that improved shipping in rough seas (p. 73-76). Competition between small kingdoms in Medieval Western Europe created conditions for expanding the technologies of warfare, including exploding devices that could breach the walls of castles and fortresses. (p. 77-78) While Spain and Portugal were engaged in transporting plants and animals of the New World to Europe, and introducing grapes, wheat and citrus to the Americas, the older centers of Eurasia were perfecting other technologies: paper making, irrigation, refinements to agriculture and regional markets. (84-85) Technological change in the Early Modern and Industrial eras is shown as a process of domination, as well; Headrick acknowledges the edge the Spanish had in the Americas with horses, guns, steel swords, and metal-plated armor, as well as microbes to which the peoples of the Americas carried no immunity. (pp. 81-85)

By the time industrialization is introduced though, the narrative has shifted from an exploration of technologies that allow humans greater control of their environments to the story of how one group of humans – the industrial west – developed new technologies that allowed it to control and exploit much of the world for approximately four hundred years. Chapter five focuses on the age of global interactions (1300-1800); Chapter 6 details the industrial revolution (1750-1869). The last two chapters are focused on the acceleration of change in the late 19th and early 20th Centuries, and development of post-industrial technologies in the latter half of the 20th Century. In these chapters, technology appears to *cause* change. This narrative shift has limits, one of which is the ability to maintain a process of objective comparison. The first such challenge appears on p. 87:

> "China, once the most innovative civilization, saw its technology fall behind Europe. Likewise in the Middle East, the pace of technological innovation also slowed down. How can we explain these differing rates of technological change among cultures that were in frequent contact with one another? This is one of the questions that historians find most difficult to answer. Why did the rate of innovation in Asia slow down? The simple answer is the Mongols."

Scholars of China and the Middle East may find this explanation frustrating. The Mongol interregnum in Afro-Eurasia was phenomenal, and is credited in many world history accounts with multiple long term consequences, including more orthodox Islamic states, paranoia about security in East Asian states, and the emergence of a long-distance marketing system that connected the markets of Afro-Eurasia in ways they had never been connected previously. (see for example, Tignor, et. al. *Worlds Together, Worlds Apart,* Chapters 10 and 11).

But explaining the differences between Western Europe and the once powerful empires of Afro-Eurasia from 1300-1800 requires more than the after effects of the Mongol invasions. In several places within his discussion of the Early Modern era, Headrick notes that European states were small, competitive internally and externally, and did not limit the activities of groups such as merchants and craftsmen. Decentralization meant that innovation and change were continuous. Centralized states such as the Ming or Qing in China, or the Ottomans in Turkey lead the way in adopting new technologies for their societies, which had a big impact both when new strategies were backed by the government, and when the government withdrew support. The most commonly cited example is short-lived support for China's Treasure Fleet in the early 15th C. (p. 72-73) A change of ruler, dynasty or government policy could destroy continuity of technological innovation and development in states with strong centralized management. While China and the Middle East solidified control of their empires in the wake of the Mongol invasions, various kingdoms in Western Europe relentlessly explored strategies for breaking out of the Mediterranean and gaining access to the wealth of the older centers in Asia. (p. 70)

These explanations have two meanings for me. First, technology in the absence of its social context does not offer an interpretation of its origins, uses, and diffusion. Social dynamics create the framework for innovation. But beyond that, new technologies are a response to the spectrum of resources, needs and opportunities within each society. Diffusion of technology follows those needs through interactions between human communities. The needs of Western Europe at the end of the Medieval Era were considerably different than the needs of China and the Arab world, and both factors – needs and interactions – contributed to the kinds of technologies embraced. When the story line leaps ahead to follow the needs of Europe alone, it ignores crucial developments within human communities in the rest of the world. There is a strong current of "presentism" in such an approach as well; we *know* the world came to be dominated by industrial technologies, in the same way we know that empires came to dominate much of the world in the first millennium BCE. The dominance of the model does not serve to explain other peoples and other lifeways using different technologies.

In the case of Early Modern China, we would capture only a fraction of the technology story if we focused exclusively on why the Chinese were not devoting their time to navigation of the world's oceans. Janet Abu-Lughod demonstrated in *Before European Hegemony* (1991) that there were worlds of trade that preceded European domination of the seas, including Arab diaspora communities in South and Southeast Asia and China, and Chinese overseas trade. During the years Europe was trying to find a way to dominate the trade with Asia, Asians had a trading world with its own features, including strong regional markets. China's **internal**

markets and financial instruments have been explored in detail by R. Bin Wong[i], Richard Von Glahn and others.[ii] But there is also the whole history of maritime trade in China, the maritime activity *not* sponsored by the state, which was a major source of GDP for the provinces of Guangdong, Fujian, Zhejiang and Jiangsu from the 14th through the 19th Centuries. China scholars have written extensively about this "world within a world" for decades: Wang Gungwu, Ng Chin-keong, Diane Murray, Jane Kate Leonard, Robert Antony, Roderich Ptak and so many others.[iii] This "informal" trade represented a true regional economy with its own cultural traditions and methodologies, but it also made significant contributions to the coffers of the state. [iv] These are not stories that will turn up in a linear account of global technological development leading us to the present moment, but they are stories of communities who developed technologies - both tool-based and social technologies – to answer the needs of their communities.

The difficulty of maintaining a more objective and global comparison from the Early Modern era into the 21st Century is complicated. The rise and dominance of the West must be taken seriously, or the narrative will lack authenticity. At the same time, if technology is the focus, it is difficult *not* to privilege the West, as the technologies that were changing the game between societies were coming primarily from Europe, especially Britain. Yet Kenneth Pomeranz argued in *The Great Divergence*(2002) that the experiences of China and Europe were not so dissimilar, and that China was as technologically developed and economically advanced as Britain right up to the 19th Century. Some accounts have made excellent use of primary scholarship to offer a synthesis of some of the resources that kept the Asian land-based empires successful. (see Robert Marks, Ch. 4, *Origins of the Modern World*). From Marks' work and another book by Headrick (*Power over Peoples: Technology, Environments, and Western Imperialism, 1400 to the Present*, Princeton U. Press, 2010), it is possible to see how much is missed when we gloss over other models and strategies. The history of Central Asia, and of pastoral nomads is one subject that has received much recent research, and provides an excellent counter point to the traditional focus on agricultural empires. The history of sub-Saharan Africa is another field that has added much to our understanding of the smaller kingdoms Europeans encountered at the beginning of the Atlantic World. But when we teach the Atlantic World, and all of the new research surrounding that era, we also discover that Caribbean peoples had tools and strategies that served them well within their ecosystems; the Guarani and Tupani in South America likewise had tools and strategies for living in the Amazon basin. Technologies that served daily life, women, children, the poorer classes, minority groups within empires, all need greater attention in contemporary histories. Depth and breadth are gained when "the peoples without history" are added to the narrative.

For a short introduction to global technological innovation, particularly from the Stone Age through the Early Modern Era, this text does a wonderful job. Professor Headrick weaves in so many details it leaves one breathless. Very few could have written this account in so few pages, and the sections on post industrial development contain a wealth of information about weapons technology. But I encourage the series editors to consider how our modern world preoccupations and Western outlook privilege the history of states, urban elites, urban centers, the written record, dominant models, the lives of males (still!) and the interpretations that global domination has created in the West. Michael Adas' work on the relationship between technology and dominance and how it has shaped a uniquely Western ideological framework serves as a reminder that there is a need to see the world from other vantage points.[v] Peoples and lifeways that were not dominant for the past five hundred years have peripheral parts in world history. The state or large centralized empire with tax collection and trade relationships is almost always the focus of any world history text, and by default, becomes the focus of most classrooms. For this new series of Oxford World Histories, and for today's students, who may hail from many parts of the globe and care about many corners of the earth, the histories of peoples who lived within, on the margins of, and adjacent to big centralized states should become a bigger part of the story.

---

[i] R. Bin Wong, *China Transformed*. Cornell University Press, 1997. See "State Formation in China" 90-133.

[ii] Richard Von Glahn, *Fountain of Fortune: Money and Monetary Policy in China, 1000-1700*, Berkeley, University of California Press, 1996.

[iii] Wang Gungwu and Ng Chin-Keong, *Maritime China in Transition, 1750-1850,* 2004; Ng Chin-Keong, *The Amoy Network on the China Coast, 1683-1735, 1983*; Jane Kate Leonard, *Wei Yuan and China's Rediscovery of the Maritime World*. 1984; Jane Kate Leonard and John R. Watt, *To Achieve Security and Wealth: the Qing Imperial State and the Economy, 1644-1911,* 1992; Robert J. Antony, *Like Froth Floating on the Sea: the Worlds of Pirates and Seafarers in Late Imperial South China*., 2003; Dian H. Murray, *Pirates of the South China Coast, 1790-1810,* 1987; Jennifer Wayne Cushman, *Fields From the Sea: Chinese Junk Trade with Siam during the Late Eighteenth and early Nineteenth Centuries,* 1993; Roderich Ptak, *China, the Portuguese and the Nanyang: Oceans and Routes, Regions and Trades, 1000-1600,* 2004; Angela Schottenhammer and Roderich Ptak, *The Perception of Maritime Space in Traditional Chinese Sources,* 2006.

[iv] See Jane Kate Leonard and John R. Watt on this question; also Jennifer Wayne Cushman, *Fields from the Sea.*

[v] Michael Adas, *Dominance by Design*, 2006