

The Four Great Inventions: Technology, History, and Nationalism in Modern China

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# Table of Contents

**Abstract / ii**

**Acknowledgments / iii**

**Introduction / 1**

**Chapter One: The Great Inventions in the West / 10**

Francis Bacon and the Idea of Progress / 12  
 Invention versus Discovery in the Enlightenment / 20  
 Chinese Stagnation versus Capability in Age of Imperialism / 35  
 Conclusion / 62

**Chapter 2: The Great Inventions in Republican China / 65**

Education Reform and Textbooks, 1860s-1928 / 66  
 The Great Inventions in Textbooks, 1909-1923 / 73  
 Sun Yat-sen's Great Inventions, 1924 / 82  
 The 1930s Turning Point / 87

**Chapter 3: The Great Inventions for World Peace / 107**

Joseph Needham and the Roots of Internationalist History / 111  
 International Unity, on Whose Terms? / 140  
 Diversity versus Unity in World History / 145  
 The Great Inventions in *SCC* and *The History of Mankind* / 151  
 Conclusion / 165

**Chapter 4: The Great Inventions in the Mao Era / 167**

Mao's Great Inventions Narrative, 1939 / 169  
 The Great Inventions in the Popular Press, 1950-1954 / 173  
 The Four Great Inventions in PRC Academia / 198  
 Conclusion / 207

**Chapter 5: The Great Inventions in Reform Era China / 209**

Deng Xiaoping's Great Inventions / 211  
 The Great Inventions as Diplomatic "Edutainment" / 219  
 The Return of the "Needham Question" / 247  
 Conclusion / 267

**Conclusion/Epilogue / 270**

**Bibliography / 278**

# Abstract

## **The Four Great Inventions: Technology, History, and Nationalism in Modern China**

Despite the rapid political transformations in China from the late nineteenth century onward – the late Qing dynasty, the Republican period, and Communist rule – the quest to master science and technology remained vital to the goal of nation-building. But how did intellectual and political elites draw the Chinese people into this effort? In the early twentieth century, reformist intellectuals, nationalist politicians, and commercial publishers seized upon a long-standing narrative of the four great inventions of ancient China (*si da faming* 四大发明), which originated in sixteenth-century Europe, arguing that gunpowder, printing, paper, and the compass had changed the world. Popularizing this narrative not only provided an antecedent to China's modernization, it also offered an inspiring vision of China's becoming in the world. While many Chinese historians have focused on the great inventions as an example of the nationalist ideology that contributed to the establishment of the history of science in academia, fewer scholars have followed the great inventions narrative across domestic and global divides of knowledge production, where the inventions became evidence for *both* Westerners and Chinese supporting the logic of progress through science. I argue in this dissertation that the understanding of scientific progress and East-West relations have been intimately entwined since the beginning of the Enlightenment in the seventeenth century, and that it still serves as one of the most recognized motifs in discussions about China's past, present, and future integrations with the contemporary world.

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## Introduction

Despite the rapid political transformations in China from the late nineteenth century onward – the late Qing dynasty, the Republican period, and Communist rule – the quest to master science and technology remained vital to the goal of nation-building. But how did intellectual and political elites draw the Chinese people into this effort? In the early twentieth century, reformist intellectuals, nationalist politicians, and commercial publishers seized upon a long-standing narrative of the four great inventions of ancient China (*si da faming* 四大发明), which originated in sixteenth-century Europe, arguing that gunpowder, printing, paper, and the compass had changed the world. Popularizing this narrative not only provided an antecedent to China's modernization, it also offered an inspiring vision of China's becoming in the world. While many Chinese historians have focused on the great inventions as an example of the nationalist ideology that contributed to the establishment of the history of science in academia, fewer scholars have followed the great inventions narrative across domestic and global divides of knowledge production, where the inventions became evidence for *both* Westerners and Chinese supporting the logic of progress through science. I argue in this dissertation that the understanding of scientific progress and East-West relations have been intimately entwined since the beginning of the Enlightenment in the seventeenth century, and that it still serves as one of the most recognized motifs in discussions about China's past, present, and future integrations with the contemporary world.

This is not a dissertation on the history of the four great inventions, but a dissertation on what history made of them.<sup>1</sup> Since the 1950s, a minor subgenre of histories has emerged examining the power of particular historical myths, symbols, and narratives to shape popular beliefs and passions. An early work that inspired my methodology was Merrill D. Peterson's *The Jefferson Image in the American Mind* (1960), which followed the many contending interpretations in political and popular culture of the founding father's legacy in the 140 years after his death. In Chinese history, Paul Cohen's *History in Three Keys: The Boxers as Event, Experience, and Myth* (1997) demonstrated how effective this approach could be in shedding light on the intellectual and political currents of twentieth-century China, where reassessing and rewriting history were central to projects of reform, revolution, and state-making on every side of the political spectrum. Within the field of the history of Chinese science, Sigrid Schmalzer's *The Peking Man: Popular Science and Human Identity in Twentieth Century China* (2008) provided a valuable model for how to follow a scientific topic into the expansive and messy realms of popular culture and public perception. These and other works inspired the flexible methodology I utilize for this dissertation – to follow the trail of the great inventions narrative toward whomever embraced it, challenged it, and redefined it. Following these trails enabled me to reconstruct an ongoing dialogue across four-hundred years, in which historians, statesmen, revolutionaries, popular and children's writers from China and the West worked out the meaning of technological

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<sup>1</sup> This line is an homage to the cited work, which began, "This is not a book on the history of Jefferson by a book on what history made of him." Merrill D. Peterson, *The Jefferson Image in the American Mind* (New York: Oxford University Press, 1960), vii.

progress and China's place in the modern world in tandem. This methodology is especially appropriate for the history of paper, printing, gunpowder, and the compass, which philosophers imbued with mythic significance long before the historical facts of their origin were ascertained. Even today, popular perceptions of the great inventions seem almost disconnected from the great strides made by archeologists and historians in uncovering their origins and development. The flexible methodology I use here captures this reality by recognizing the great diversity of actors involved in shaping the master narratives of world history, and particularly history of science and Chinese history.

To explore these mutual entanglements between China and the world through the four great inventions, my research draws on a wide array of Chinese and Western sources from the sixteenth century to the present. These include Western sources in philosophy, history, and literature dating back to the origin of the great inventions narrative in the late Renaissance. My Chinese sources include textbooks and documents relating to education policy from the late Qing to today, which show how the Qing, Republican, and Mao and Reform Era Communist states incorporated the great inventions into the national history curriculum. I have also collected newspapers and popular magazines across the Republican and PRC periods showing how the great inventions narrative was popularized to a mass audience. As this dissertation moves into the latter half of the twentieth century, I shift attention to television documentaries and museum exhibits that tell the great inventions story to Chinese and foreign audiences. Far from being the project of a few patriotic historians a generation ago, the great inventions have been the locus of global narration of scientific progress. The idea of progress through science, the core of modernity, was rooted in this global narrative in which China played a central role.

This dissertation contributes a global approach to the study of modern China. Historiography in this field has overwhelmingly focused on explaining China's transition from empire to nation-state over the nineteenth and twentieth centuries, with a sustained attention to the shift in historical subjectivity that enabled that transformation. This dissertation offers a new framework of China's modern transformation as a continual negotiation between Chinese and Western actors, in which master narratives of Chinese identity and national origins were cowritten. Historians of the 1950s and 1960s such as Joseph Levenson and John K. Fairbank saw China's transition from empire to nation-state, and the embrace of modern science and "Western learning" generally, as an inevitable Chinese "response" to the overwhelming "impact" of Western imperialism. My research confirms what Levenson called the "patriotic schizophrenia" of early Chinese nationalists, who raised the history of the great inventions in the early twentieth century to assert a proud national history on the one hand, and on the other, to highlight how far China had fallen since the ancient past to bolster the demand for Westernization. However, extending my analysis into the second half of the twentieth century, I also show the way in which China was making its own "impact" abroad, in a process of continual negotiation.

A subsequent generation of China scholars advanced a China-centered approach, summed up by Paul Cohen, that focused on the Chinese, rather than foreign, causes for historical events. This necessary corrective pushed historians to take better account of developments on the ground – grassroots history of local places drawing on social scientific methodologies – rather than focusing solely on political elites and intellectual discourse. I have attempted to embody this principle by drawing connections between political discourse and popular culture. As I hope to show, elites did not merely dictate political messages that were reproduced ad-infinitum, but instead initiated specific arguments and interpretations of the great inventions narrative that were

adopted and often transformed as they were reproduced in the mass media of children's textbooks, popular magazines and newspapers, film, and museum exhibits. I depart from this approach, however, in its narrow focus on China in isolation. Tracking how both Chinese and Westerners wrote the great inventions narrative into the core of China's national identity over the twentieth century cannot be understood by looking at China in isolation, but only makes sense against the backdrop of world events.

Rather, this case study expands upon the more recent turn back toward a global approach pioneered by Prasenjit Duara and Rebecca Karl, who argued for the importance of the flows of people and ideas in modern Chinese history, and highlighted the constructed nature of China as a self-contained national space. Documenting how Western and Chinese actors learned from each other, competed with one another, and negotiated narratives of the great inventions over the twentieth century and beyond, this work supports their argument that China's global connections are essential in understanding its modern history. I argue that China's own national history – even when told by the staunchest of Chinese nationalists – is in part a global co-production.

This dissertation stands both outside of and within the history of science and technology, as an examination of how the field has played an important role in global politics and in meditating China's place in the world. The historiography of the compass, gunpowder, paper, and printing in China and the West serve as the main subject of this dissertation. I won't break any ground within that literature here, but rather treat it as rhetorical and ideological tools that intellectuals, political leaders, popular and academic writers used to shape public opinion of science and technology, guide the direction of China's national transformation, and negotiate its entrance into a Western-dominated world-order in the twentieth century. The great writers who

have pioneered and popularized the history of the great inventions – Francis Bacon, Karl Marx, Joseph Needham, Thomas F. Carter, Zhang Xiumin, Wang Zhenduo, Jin Guantao and many others – are the subjects of this work, not my intellectual predecessors. I hope this dissertation illuminates the social and political context in which these and future historians of ancient science and technology operate.

This dissertation is most firmly planted in the nascent but growing STS (Science, Technology, and Society) approach to the history of science and technology in modern China. Leading this trend was Benjamin Elman's edited volume *Science and Technology in Modern China, 1880s-1940s* (2014), which mobilized scholars to explain how Republican era China sought to use science to reboot itself in an unfamiliar global order. This produced a number of case studies that emphasized the mutually influential relationship of science and technology with politics, culture and society in nineteenth and twentieth century China, addressing for example, how science education, agricultural policy, and public health were shaped by Maoist politics (Andreas 2009; Schmalzer 2016; Gross 2016); the nationalist motivations of geologists (Shen 2014); and how the Chinese typewriter laid the foundation for modern information technology that could resist the hegemony of the Western alphabet (Mullaney, 2017). My dissertation expands on this body of work by showing how the history of science also became an important force that scientists, historians, journalist, and political elites, working within and without the Chinese state, used to redirect the Chinese people toward the goal of mastering modern science and technology. As this mission was shared by the late Qing, Republican, and PRC regimes, so too was the great inventions narrative embraced by all three. This makes its embrace a rare line of continuity across modern Chinese cultural and intellectual history.

I want to emphasize my argument that the Chinese party-state used science and technology as a source of legitimacy even during the era of Mao's rule, from the establishment of the PRC in 1949 to his death in 1976. Since the 1980s, it has been in the interest of both Chinese reformers and anti-communists everywhere to emphasize the devastation of science under Mao. It is true that political campaigns in the Mao era targeted intellectuals, banishing many scientists from their labs and sending them to the countryside for reeducation. Even more extreme, the Cultural Revolution included the outright shutting down of most branches of normal scientific research, training, and publication, only preserving a few fields deemed essential to national defense such as nuclear science. However, the CCP did not abandon science completely, but redefine it. Recent works on agricultural science in the Mao era by Sigrid Schmalzer (2016 and 2019) and on public health by Miriam Gross (2016) highlight the mass participation in science during the Mao era that yielded some positive results worthy of study today.

They also identify a strain of scientific nativism underlying those projects, a grassroots effort to propose an alternative to universal scientific theory based on the land and experience of the Chinese people themselves. This dissertation offers variation on this story, as I see the great inventions as similarly tied to Chinese claims of a native tradition of invention prepared them to excel in modern science. However, the power of that narrative never lay in establishing an alternative to Western science – no “alternative modernity” sprung from Chinese telling of the great inventions narrative. Rather, Chinese writers placed China square in the center of the standard, Western born narrative of the rise of modern science that Europeans had been reciting since the Enlightenment. Rather than scientific nativism, I argue this reveals a persistent strain of techno-nationalism in modern China: the view that the nation-states are the key agents of technological progress, that technological superiority was one key to China's past greatness, and

the critical to her future survival in a threatening world.<sup>2</sup> The struggle over the great inventions, as this dissertation will show, has always been in what manner China would be incorporated into a single narrative of world history. Would China play the role of a flourishing civilization that made “great contributions to humanity”, out-pacing Europeans in science and technology for centuries? Or as a backward, incurious empire, unable to keep up with the rational-minded and dynamic West? Indeed, it is only on the shared ground of world history that China’s inventions of paper, printing, gunpowder, and the compass acquire meaning. Only through spreading to the West and sparking the modern age do they become “great” or give the Chinese nation-state any claim to “greatness” itself.

The five chapters of my dissertation follow how the understanding of the four great inventions evolved in its journey from Renaissance Europe to contemporary China to become widely accepted by Chinese thinkers and leaders as key to evaluating China’s place in the world. **Chapter 1**, “The Great Inventions in the West,” traces the great inventions narrative to its origin in the late-Renaissance with Francis Bacon, through the Enlightenment to the Age of Industrialization and Imperialism, when the inventions were subsequently connected to China. I show how the inventions transformed from a symbol of scientific progress to a sign of China’s failure to develop intellectually in modern times. **Chapter 2**, “The Great Inventions in Republican China,” shows how discussions about the great inventions emerged in early-

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<sup>2</sup> For a discussion of the term techno-nationalism in policy studies, see David E.H. Edgerton, "The Contradictions of Techno-Nationalism and Techno-Globalism: A Historical Perspective", *New Global Studies* 1(1). For a discussion of techno-nationalism in China, see Evan A. Feigenbaum, *China's Techno-Warriors: National Security and Strategic Competition from the Nuclear to the Information Age* (Stanford, Calif. :Stanford University Press, 2003).

twentieth century China and became a mainstay in children's textbooks. First appearing in 1909, the great inventions narrative epitomized the move toward a modern, progressive, nation-focused history, and became associated with racial pride when Sun Yat-sen included it in his influential *Three Principles of the People*. **Chapter 3**, "Joseph Needham's Great Inventions," examines how Needham's *Science and Civilization in China* critiqued the dominant narrative of European progress versus Chinese stagnation in the 1950s. I show how both Needham and the Chinese Communist Party came to see the history of science as a means to bring positive international attention to the new regime. **Chapter 4**, "The Great Inventions in Mao's China," shows how the great inventions narrative shaped and was shaped by the politics of communism, from Mao's own reference to them in 1939 to the end of the Cultural Revolution in 1976. **Chapter 5**, "The Great Inventions in Reform Era China," traces the re-emergence of the great inventions in national discussions due to renewed academic interest in China's ancient culture, and the state focus on science and technology after 1978. The great inventions became a ubiquitous subject in academic and popular culture, appearing in films, museum exhibits, diplomatic speeches, and most spectacularly in the 2008 Beijing Olympics Opening Ceremony.

This dissertation argues that the quest to master science and technology has historically connected China and the West in a single narrative of human progress through discovery. Looking at how notions of the great inventions evolved since the sixteenth century, this dissertation shows how the happy idea of infinite progress intersected with the fraught politics of national competition, race, and ideology. As Westerners and Chinese understood the global reach of the great inventions, thinkers on both sides realized that technology is not an independent force, but was completely embedded in particular cultures and histories. In order to make sense of modern science, we also must examine how China was written into that world history.

## Chapter 1: The Great Inventions in the West

To 16<sup>th</sup> century Europeans, the three great inventions of printing, gunpowder, and the compass suggested a future of infinite progress. While the European Renaissance had seen a revival of Greek and Roman knowledge and culture, the idea that Europe could surpass the ancient world through science and technology would be the core idea of the Enlightenment and modernism. During the 16<sup>th</sup> and early 17<sup>th</sup> centuries, famous humanists like Francois Rabelais, Girolamo Cardano, Jean Bodin, and Francis Bacon wrote that the great inventions, along with the discovery of the New World (itself connected to the compass) suggested that man had surpassed the capabilities of Ancient Greece and Rome. They dubbed the compass, gunpowder and printing press the “three greatest inventions of modern times,” forming the original great inventions narrative that Europe had progressed through science and technology.<sup>1</sup>

As Europeans increasingly accepted the notion that the great inventions had originated in China, they added an Orientalist twist to the progress narrative: only rational Europeans were able to fully utilize the inventions to create the modern age, while the backward Chinese had squandered them. Following the great inventions narrative from its conception in the Renaissance, through the Enlightenment and into the twentieth century, this chapter shows how figures as diverse as philosophers, scientists, missionaries, historians, politicians and activists

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<sup>1</sup> Discussion of the great inventions in Renaissance Europe is chronicled in David A. Boruchoff, “The Three Greatest Inventions of Modern Times: An Idea and its Public,” in Klaus Hock and Gesa Mackenthun, eds., *Entangled Knowledge: Scientific Discourse and Cultural Difference* (New York: Wamann, 2012).

utilized it to express both their belief in progress through science and technology, and in Europe as the sole arbiter of that progress.

I have employed three criteria in narrowing the scope of material and actors that I analyze here, to those writings that were either 1) influential (especially those that were often quoted or referenced by future writers), 2) illustrate larger turning points and trends in the writing of the narrative, and 3) connected the great inventions to the issue of East-West relations, a crucial theme of this dissertation. Following these criteria, this chapter will examine references to the great inventions from writers both famous and obscure, as each help us understand the development of the great inventions narrative and its important place in the history of science and East-West relations. Famous quotes about the inventions by the “great men” of the Enlightenment, such as Francis Bacon, Voltaire, and Karl Marx have been reprinted ad-infinitum, particularly in China. This chapter will analyze them in the context of the author’s own time and larger body of work, identifying the original arguments about science and society that they served. Other materials here are significant as turning points – for instance, Diderot and d’Alembert’s *Encyclopedia* introduced theory of scientific discoveries as superior to technological inventions, an idea that I argue was a turning point, leading to widespread dismissals of Chinese achievements compared to the “genius” of Western science in the eighteenth and nineteenth centuries. Finally, I move on to a number of lesser known British and American missionary writers and historians who collectively illustrate the way in which the great inventions narrative was filtered through the politics of Sino-British and Sino-American relations with China in the Age of Imperialism. While these authors may not have had large individual influence, they were the first to wrap the great inventions into a narrative of China’s inclusion in a unified global order – an effort that would soon be taken up by Chinese themselves.

## Francis Bacon and the Idea of Progress



Title page of Francis Bacon's *Instauratio Magna* (*The Great Instauration*), 1620.

Though he was not the first, Francis Bacon's description of the great inventions as symbols of progress through science and technology has been the most influential by far. Bacon wrote of the great inventions as illustrating the material benefits possible through scientific discovery. Bacon was not only trying to prove a point about the history of science – he was also seeking to convince the public and the state to support science, then in its infancy. His telling of the great inventions narrative was adopted as an emblem of the early modern scientific community, particularly in his homeland of the England, and forever after has tied them to the promise of humanity's progress through science and technology.

Like his late-Renaissance contemporaries, Bacon saw the inventions alongside the discovery of the New World as evidence that man had surpassed the ancient world and entered a

new epoch. He symbolically depicted this in the title page image of his *Great Instauration* (1620). “Instauration” is a product of the Latin verb “instaurare,” meaning “to renew or restore.” The *Great Instauration* was Bacon's call to restore a state of paradise on earth, but whereas mankind was ignorant in the Garden of Eden, now mankind would be enlightened by knowledge and truth. In the foreground of this image stand the mighty Pillars of Hercules. According to Greek mythology, these pillars stood at the Strait of Gibraltar, the narrow strip of sea between modern-day Spain and Morocco that separates the Mediterranean from the Atlantic, and marks the furthest point to the west that Hercules travelled during his “twelve labors”. They were the borders of the Ancient world, beyond which lay the unknown. Plato wrote that the lost realm of Atlantis lay beyond them; this led to the Renaissance tradition that the pillars bore the warning *Non plus ultra*, “Nothing further beyond,” as a warning to sailors to turn around. The ships in Bacon’s image allude to Columbus, who had literally ventured into the Atlantic and found Atlantis – the New World. But the ocean also represented the unknown workings of Nature, which could be understood and mastered through science. Below the image is the text, *Multi pertransibunt et augebitur Scientia*, “Many will pass through and knowledge will be the greater.” Though firmly planted in the Renaissance, Bacon’s *Great Instauration*, a multi-part publication that summarized the history of natural philosophy and introduced the method of experiment and observation that laid the foundation of modern science. It also established the three great inventions of gunpowder, printing, and the compass as evidence that mankind could harness knowledge to go beyond the pillars of the ancient world, into the ocean of unlimited discovery and progress.

Bacon used the great inventions, along with Scripture, Ancient history, and comparison with the New World, as evidence that Europe had progressed through scientific and

technological discoveries. Like his peers, Bacon argued that the inventions had ushered Europe into a new age; but few modern readers recognize that Bacon was much less interested in history than he was in garnering popular and state support of natural philosophy in his own lifetime. The great inventions appear in the final aphorism of the first book of *Novum Organum*, the second book in the *Great Instauration*:

Again, it helps to notice the force, power and consequences of discoveries, which appear at their clearest in three things that were unknown to antiquity, and whose origins, though recent, are obscure and unsung: namely, the art of printing, gunpowder, and the nautical compass. In fact, these three things have changed the face and condition of things all over the globe: the first in literature; the second in the art of war; the third in navigation; and innumerable changes have followed; so that no empire or sect or star seems to have exercised a great power and influence on human affairs than those mechanical things.<sup>2</sup>

Though the trope that three great inventions had “changed the face and condition of things all over the globe” had become a common refrain amongst Renaissance intellectuals since the 1530s, it wasn’t held up by deep historical evidence, and Bacon even notes their “obscure and unsung” origins.<sup>3</sup> Rather, for Bacon and his contemporaries, the three great inventions were symbols of Europe’s shift into the modern age. Similar to how we in the twentieth century

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<sup>2</sup> Francis Bacon, *The New Organon* (Cambridge; New York: Cambridge University Press, 2000), 100.

<sup>3</sup> Historians did not make a case that the inventions sparked "revolutionary" historical change until the 19<sup>th</sup> and 20<sup>th</sup> centuries. The theory that Gutenberg's printing press led to the Protestant Reformation was made first by Lucien Febvre (1878-1956) in *The Coming of the Book: The Impact of Printing, 1450-1800* (London: Verso, 2010). First pub. 1958, in France. The theory that the use of gunpowder sparked a military revolution in Europe was first made by Michael Roberts in "The Military Revolution, 1560–1660" (1956) reprinted in Clifford J Rogers, ed., *The Military Revolution Debate: Readings On The Military Transformation Of Early Modern Europe* (Boulder: Westview Press, 1995). The only historian to claim that the compass had a "revolutionary" historical impact is Amir D. Aczel in the popular history *The Riddle of the Compass* (New York: Harcourt, 2001), though his argument is hardly convincing. Most historians see the "Age of Exploration" when European explorers travelled the world from the 15<sup>th</sup>-17<sup>th</sup> centuries as tied to several nautical technologies and financial innovations, excluding the compass.

reacted to the inventions of the nuclear bomb and the Internet as heralding the “Nuclear” and “Information” Ages, late-Renaissance intellectuals reacted to a spate of disruptive technologies "unknown to antiquity" by declaring a break from the past before their full effects were yet to be totally felt or understood. Indeed, *Novum Organum* is no history. Bacon did not bring up the three great inventions to make a historical argument, but to argue for the “force, power and consequences of discoveries” in general on “human affairs”; and more important still, the ability of *natural philosophy* to decode the principles behind inventions, and lead us to yet more beneficial discoveries.

Indeed, Bacon asserts a naïvely optimistic view that in the *Novum Organum* that discoveries were entirely beneficial for civilization, a view that became a hallmark of early modern scientists. The great inventions are the most famous piece of evidence he marshalled forth to prove this point. But he drew on Scripture, Bacon writes, "the introduction of remarkable discoveries holds by far the first place among human actions," noting that even the ancient Greeks and Romans honored discoverers with greater distinction than those who made achievements in political matters. This is because,

The benefits of discoveries may extend to the whole human race, political benefits only to specific areas; and political benefits last no mere than a few years, the benefits of discoveries for virtually all time. The improvement of a political condition usually entails violence and disturbance; but discoveries make men happy, and bring benefit without hurt or sorrow to anyone.<sup>4</sup>

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<sup>4</sup> Francis Bacon, *The New Organon* (Cambridge; New York: Cambridge University Press, 2000).

Bacon here describes discoveries as universal, timeless, beneficial. Their benefits extend "to the whole human race"; they "make men happy, and bring benefit without hurt or sorrow to anyone." Bacon's optimism is perhaps knowingly naïve – had it succeeded, the 1605 "Gunpowder Plot" to explode Parliament would have killed both Bacon and his patron, King James I. Bacon ignores the potential of gunpowder to cause harm. On the other hand, he sees politics as a zero-sum game that brings only narrow and short-lived benefits for some, and "violence and disturbance" for others. Bacon himself had survived a harrowing period of political violence over royal succession in England, tying himself to the Catholic king James I, who ultimately ruled a united Scotland and England from 1603-1625. James named Bacon his Lord Chancellor in 1618, the highest legal position in the kingdom. Despite all this, writing in 1620, Bacon still deemed political achievements as inferior to discoveries, effectively ranking his own achievements as a lawyer second to his work as a philosopher.<sup>5</sup>

The role of the natural philosopher in turning discoveries into knowledge that could advance civilization is strengthened in the final conclusion of the aphorism. Here Bacon writes that even more important than any one particular discovery, are discoveries "which may speedily lead to the discovery of all other things" – in modern terms, a scientific principle.<sup>6</sup> Although he does not spell it out here, later philosophers would sharpen this distinction between the discovery

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<sup>5</sup> Not too ironically then, in 1621, a year after the publication of *Novum Organum*, Bacon's career was brought crashing down when he was arrested and charged with bribery. Pleading guilty, he was publicly humiliated, lost his position, and his reputation was stained for years to come. He spent the rest of his life working even harder to reform learning and establish an intellectual community that practiced his method of natural philosophy. He died in 1626, supposedly testing his theory of the preservative and insulating properties of snow.

<sup>6</sup> Bacon, *Novum Organum*, 100.

of practical inventions versus scientific principles, enabling them to elevate literate, upper-class Western philosophers and scientists, and belittle the discoveries of practical-minded craftsmen, or “unscientific” Chinese.<sup>7</sup> The great inventions to Bacon were just one piece of evidence for the universal, timeless, and beneficial power of discoveries, which his own brand of experimental science could harness and reproduce.

In his later writing, Bacon envisioned exactly how the state might honor inventors and philosophers, and thus build up the institution of science. This is laid out in his early utopian novel, *The New Atlantis*, published after his death in 1627. Bacon describes how a ship of Europeans sails into the Atlantic, that great metaphor for the unknown, and are wrecked on the lost island of Atlantis. The society they find there is the ideal one Bacon had tried to create in his own lifetime, that hold science and inventions in the highest esteem. A minister of Atlantis takes the shipwrecked Europeans on a tour of the “House of Solomon,” a state institution dedicated to the funding, study and celebration of science and technology, foreshadowing the modern research university. In Bacon’s utopia, the great inventions are given their proper recognition in this speech by the minister of Atlantis describing the “House of Solomon” to his European guests:

For our ordinances and rites: we have two very long and fair galleries: in one of these we place patterns and samples of all manner of the more rare and excellent inventions in the other we place the statues of all principal inventors. There we have the statue of your Columbus, that discovered the West Indies: also the inventor of ships: your monk that was the inventor of ordnance and of gunpowder [a reference to Roger Bacon]: the inventor of music: the inventor of letters: the inventor of printing: the inventor of observations of astronomy: the inventor of

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<sup>7</sup> Historians of science and technology today emphasize that modern science was largely made possible by philosophers who reached into the world of craftsmen and mechanics, borrowing their instruments such as the compass, quadrant, telescope, etc., and turning them toward their own philosophical questions about nature.

works in metal: the inventor of glass: the inventor of silk of the worm: the inventor of wine: the inventor of corn and bread: the inventor of sugars: and all these, by more certain tradition than you have.... For upon every invention of value, we erect a statue to the inventor, and give him a liberal and honourable reward.

In this passage, Bacon recognizes that glorifying inventions, and giving credit to inventors was an important role the state could take in supporting science. In a society that cherished knowledge, inventions and inventors received the same glory as saints and kings. Therefore, the keepers of the “House of Solomon” knew the history of the inventions “by more certain tradition” than Europeans. And yet of all the inventions listed here (many now known to have come from China), Bacon could only suggest two inventors. Bacon recognized this as a problem. Just as political and religious institutions were fortified by ritual, recognition, and an accounting of their own histories, so too should the institution of science.

The state-sponsored institutionalization of science that Bacon envisioned would soon become a reality, and the great inventions were used to symbolize the practical benefits that the new institutions could garner. The "House of Solomon" served as the model for The Royal Society of London for Improving Natural Knowledge, founded in 1660.<sup>8</sup> Bacon’s call for empirical investigation into the natural world, with an aim toward achieving practical results was central to their mission. In *History of the Royal-Society of London* (Thomas Sprat, 1667), a book that proclaimed the intentions of the Society to the public, the frontispiece features a bust of Charles II, the King of England and patron of the Society, flanked by Francis Bacon and the

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<sup>8</sup> Michael Hunter, *The Royal Society and Its Fellows, 1660-1700: The Morphology of an Early Scientific Institution* (Chalfont St Giles, Bucks.: British Society for the History of Science, 1994).

Society's first president, William, 2nd Viscount Brouncker. Surrounding the scene are scientific instruments - of which Bacon's extended forefinger points at a gun hanging on the wall.

Although the gun was used in several experiments of the Society, this particular gun was commercial rather than experimental, meaning its inclusion here is more likely a reminder of the "great inventions" so prominently described in the *Novum Organum*.<sup>9</sup> Furthermore, the gun is a proclamation that this scientific organization was not only committed to scientific investigation, but also to technological innovation, in the words of the organization's charter, to "consider and improve all mechanical inventions". At the very roots of modern science, as it became an institutionalized, state funded and practical-minded endeavor, the "great inventions" narrative was central. They were recent historical examples of all that the empirical investigation of nature had to offer, the potential fruits of Bacon's vision for state-funded science.



The frontispiece to Thomas Sprat's *History of the Royal Society* (1667). The central bust is of King Charles II, the royal sponsor of the society. On the left is the Society's first president, William, 2nd Viscount Brouncker. On the right is Francis Bacon, pointing to a rifle.

<sup>9</sup> Jim Bennet, "The Instruments", in Michael Hunter, *the Image of Restoration Science: The Frontispiece to Thomas Sprat's History of the Royal Society (1667)* (London: Routledge, 2017).

Late-Renaissance intellectuals saw gunpowder, printing, and the compass as powerful evidence of the practical, material improvements that technology and natural philosophy could bring about. This was the key idea behind the formation of modern science and later in the 18<sup>th</sup> century, the Enlightenment. It was this belief that led to the establishment of scientific societies across Western Europe, and their financial support by royal patrons, who gradually came to see study of the natural world through empirical science as a path to their own empowerment. The great inventions narrative in late-Renaissance Europe was an argument that natural philosophy could lead to practical, technological progress; that it therefore deserved state support; and that its achievements ought to be honored above all others. The great inventions narrative in the 16<sup>th</sup> and 17<sup>th</sup> centuries was an attempt to institutionalize and popularize science in Europe.

## **Invention versus Discovery in the Enlightenment**

Though Bacon never entertained the theory, as other European writers increasingly accepted the Chinese origin of printing, gunpowder and the compass from the 16<sup>th</sup> century on, they gradually elevated the three, and later four great inventions into one of the most common tropes about China in the Western imagination.<sup>10</sup> The long tradition of writing about China for a Western audience began with Marco Polo in the thirteenth century, and was early on dominated by similar travelers and merchants who were the first to propose the inventions' Chinese origin in the 1580s. During the late sixteenth and seventeenth century, Jesuit missionaries used Western

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<sup>10</sup> However, many points of origin were entertained. 16<sup>th</sup> century sources discuss ancient Greece, various contemporary European cities, and China by way of the Moors or Scythians as possible origins of the inventions.

science to secure a place in the Imperial court, and brought a more complete picture of Chinese culture that praised their philosophy, but discredited their abilities in science. In the eighteenth century, Enlightenment philosophers adopted the Baconian idea of the great inventions as symbols of progress, but portrayed China as unable to capitalize on them. During the age of imperialism that brought the West into close contact with China in the nineteenth century, missionaries, American anti-immigration activists, and professional Sinologists wrote about the great inventions in their own efforts to shape Western attitudes and policies toward China. These writers used the history of the great inventions to pull China and Europe into a shared world history that informed their contemporary relationship - most often depicted as a developed West leading a backward East into modernity and Christendom. Surveying this history of the great inventions narrative shows how Europeans constantly referred back to it in forming an idea of what science and technology meant in their own societies, and the place of Europe in the world.

The first European to propose the Chinese origin of the three great inventions was the Spanish writer Juan Gonzalez de Mendoza, in *The History of the Great and Mighty Kingdom of China and the Situation Thereof* (*Historia de las cosas mas notables, ritos y cosvmbres, Del gran reyno de la China*) (1585). Although several travelers, missionaries and diplomats had recounted their travels to China since Marco Polo's *Travels* were published in 1300, remarkably none of them had described the use of the inventions, despite their probable ubiquity. Gonzales, however, published his history in the midst of pan-European celebration of gunpowder, printing and the compass as the "great inventions of modern times." When Gonzalez published his book in 1585 it was the most comprehensive history of China then available, and was quickly translated into many languages read widely across Europe.

The notion that China and Europe both possessed the inventions led some writers to make comparisons between the two societies that also served as a cultural critique. In 1588, French philosopher Michel de Montaigne speculated on the Chinese origin of the inventions in the third book of *Essays*, a work Bacon almost certainly read.<sup>11</sup> His essay in that volume, “Of Coaches”, reflected the ruin caused by the incessant religious wars of the 16th century, the vanity and corruption of the ruling class (represented by the horse-drawn coach), and argued that Europeans had something to learn from the so-called barbarians of the New World. Reflecting on the torture and slaughter of Peruvians by the Spanish conquistador Cortez, de Montaigne asked, who were the real barbarians? This built to an argument for skepticism: that knowledge passed down in tradition was limited, and that one should look outward to new places and cultures with curiosity and openness:

Even if all that has come down to us by report from the past should be true and known by someone, it would be less than nothing compared to what is unknown. . . We exclaim at the miracle of the invention of our artillery, of our printing; other men in another corner of the world, in China, enjoyed these a thousand years earlier. If we saw as much of the world as we do not see, we would perceive, it is likely, a perpetual multiplication and vicissitude of forms.<sup>12</sup>

Driven by turmoil at home and the essential Enlightenment thirst for knowledge outside of the old confines of Bible and Classical world, de Montaigne spun the “great inventions” narrative

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<sup>11</sup> Francis Bacon’s first published work is *Essayes: Religious Meditations. Places of Perswasion and Disswasion. Seene and Allowed* (1597), a which imitated the essay genre of philosophy and self-narrative that Montaigne pioneered. Later in his career, Bacon frequently cited Montaigne. This evidence suggests to me that Bacon was familiar with Montaigne’s *Essays*, and thus must have been aware of the possible Chinese origins of the inventions.

<sup>12</sup> Michel de Montaigne, “Of Coaches,” *Complete Works of Montaigne*, trans. by Donald Frame (Palo Alto: Stanford University Press, 1958), 692–93.

into a critique of Eurocentrism. The core idea of skepticism of tradition and progress through knowledge from new places is exactly why Enlightenment intellectuals saw the discovery of inventions like gunpowder, the printing press, and the compass alongside the discovery of America – while the explorer discovered new lands and species abroad, the scientist investigated the properties of nature at home. Both were part of the same grand project of expanding knowledge.

At the same time, the Jesuit missionary Matteo Ricci, who opened the first Catholic mission in China in 1583, would convince Europeans that China's best days in math and science were behind them, despite having originated the great inventions. This critical take influenced generations of European intellectual to dismiss China's great inventions as an aberration, representative of the perseverance of millions of nameless laborers and craftsman from which Western philosophers, with their superior capacity for reason, had nothing to learn. Arriving more than two-hundred and fifty years since the last Franciscan missionaries had been expelled, Ricci gained access to a permanent place in the court of the Ming Emperor Kangxi in Peking precisely because he offered up Western knowledge. Ricci established what historian Florence Hsia has rightly dubbed a "scientific mission" in China, in which the Jesuits offered the emperor the fruits of Western science in exchange for access to the country. They accommodated Chinese culture to a large extent, dressing in Chinese clothes, learning the language, and obeying the rules of official conduct essentially as employees of the emperor. They used Western knowledge – geometry, mathematics, astronomy, and methods of cannon casting – to lure the Chinese elite toward Catholicism. Essential to this strategy was their determination that Confucianism and ancestor worship was not a religion, but a moral system that was compatible with Christianity. In the face of a skeptical home audience at the Vatican and the European public at large, Ricci and

the Jesuits had to walk a fine line between accommodation and apostasy to ensure their continued financial and political support.

Ricci's account of China was better informed than any of its predecessors; but his writing also strategically portrayed China in a way that justified the scientific mission he had pursued. His account of China was published in 1616, and set a new benchmark for description of China. Like previous ones, it gave a highly positive image. Compared to Reformation Europe, which had witnessed bloody religious wars in France and the Netherlands, China was a vast, unified, well-ordered country, held together by the moral system of Confucius, who he portrayed as equal if not superior to the philosophers of ancient Greece. In fact, Ricci's only negative view of China was its science. Encountering resistance to his conversion efforts, he wrote that the Chinese have no "conception of the rules of logic," and that "the science of ethics for them is a series of confused maxims and deductions." Though "at one time they were quite proficient in arithmetic and geometry, in the study and teaching of these branches of learning they labored with more or less confusion."<sup>13</sup> For Ricci and the missionaries who followed him, failure to accept Christianity equated to a failure of reasoning. His notion that Chinese lacked reasoning, and that their best days in math and science were behind them would become more prevalent, overshadowing what had been a largely positive description of Chinese civilization.

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<sup>13</sup> Matteo Ricci, *China in the Sixteenth Century: The Journals of Matteo Ricci, 1583-1610* (New York: Random House, Inc., 1953), Ed. and trans. Louis Gallagher.

Enlightenment philosophers like Voltaire (1694-1778), Gottfried Leibniz (1646-1716), and François Quesnay (1694-1774), drew from the writings of Ricci and other missionaries to create an idealized image of China as marked by political stability and religious tolerance on the one hand, but on the other hand, incapable of social or scientific progress.<sup>14</sup> By replicating and embellishing Ricci's critique that China lacked science and reasoning, they also bolstered their own image of the West as an enlightened, scientific civilization. Flowing from this understanding, they inverted the great inventions narrative into an illustration of China's scientific failings, and European success. This assertion of European scientific superiority became, along with the promise of Christian salvation, a leading justification for Western imperialism and colonialism – the colonized would be introduced to superior Western learning.

Sharing this sense of European superiority in natural philosophy, Gottfried Wilhelm Leibniz was the first to write of the great inventions as evidence that because of their intellectual weakness, the Chinese were unable to make proper use of their own discoveries. Though Leibniz never visited China or even spoke to a Chinese person, he communicated frequently with Europeans who went there, and studied the language. He was influenced by Bacon, de Montaigne, and the humanist impulse to learn from other cultures. In his *Writings on China*, he wrote:

In profundity of knowledge and in the theoretical disciplines we are their superiors. For besides logic and metaphysics, and the knowledge of things incorporeal, which we justly claim as peculiarly our own province, we excel by far in the understanding of concepts which are abstracted by the mind from the

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<sup>14</sup> J.G. Lutz, *Opening China: Karl F.A. Gützlaff and Sino-Western relations, 1827-1852* (Grand Rapids: Wm. B. Eerdmans Publishing Co., 2008), 125.

material, i.e., in things mathematical, as is in truth demonstrated when Chinese astronomy comes into competition with our own.<sup>15</sup>

This comparison came directly from the experience of Ricci and the Jesuits, who had won their place in the Ming court by making astronomical predictions that surpassed the Chinese astronomers. But far from dismissing the Chinese, Leibniz saw how both civilizations could learn from each other. In his *Novissima Sinica (News from China)* published 1697, he argued that China would be an excellent source of knowledge because of its long, uninterrupted history.<sup>16</sup> Just as scientists had subjected the practical knowledge of artisans and mechanics to philosophical inquiry, the history of foreign places could also be mined by the tools of Western science. And increasingly in the seventeenth century, Europeans perceived that no place had a longer history than China. China also stood to gain from this exchange, for accumulated experience is useless unless subjected to the structure of logic, in which Leibniz said the Chinese were lacking.

He illustrates this through the example of the great inventions, writing that inventions depend on chance occasions, but also on reason, because only once subjected to reason can one “draw forth a thousand beautiful consequences and find a thousand inventions.”<sup>17</sup> Like Bacon, he distinguished between chance inventions, and the discovery of scientific principles that made them work – the discovery that could beget more inventions. Imagine the rewards, then, if these

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<sup>15</sup> Gottfried Wilhelm Leibniz, *Writings on China* (Chicago, Ill.: Open Court, 1994), d46.

<sup>16</sup> Ibid.

<sup>17</sup> Gottfried Wilhelm Leibniz, *Leibniz Korrespondiert mit China*, edited by Rita Widmaier (Frankfurt: V. Klostermann, 1990), 62.

chance occasions, recorded so well by the Chinese, were submitted to European reasoning. Leibniz thus added a new element to the “great inventions” narrative: by the sheer length and breadth of Chinese recorded history they had stumbled by chance upon useful inventions, but it was Europeans who used their superior reasoning to perfect them.

The French philosopher Voltaire (1694-1778) echoed this narrative. Raised with a Jesuit education, Voltaire praised China's morality while criticized its lack of logic and inability to progress. Reflecting the high estimation Confucian governance by the Jesuits, Voltaire wrote of China as a paragon of moral virtue and good governance.<sup>18</sup> However, he also repeated the critique of Chinese systems of knowledge, and saw China as historically stagnant. In his 1756 essay, *An Essay on Universal History: The Manners and Spirit of Nations*, Voltaire sees the great inventions as symbolizing Chinese failure to develop to their full potential because they lack Europe’s progressive scientific qualities. After describing how China originated porcelain, silk, printing, paper, the gunpowder, and the compass long before Europeans, he observes that they have failed to develop them:

It is surprising that this people, so happy at inventions, have never penetrated beyond the elements of geometry; that in music they are even ignorant of semitones; and that their astronomy, with all their other sciences, should be at once so ancient and imperfect. Nature seems to have bestowed on this species of men, so different from the Europeans, organs sufficient to discover all at once, what was necessary to their happiness, but incapable to proceed further: we, on the other hand, were tardy in our discoveries; but then we have speedily brought everything to perfection.<sup>19</sup>

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<sup>18</sup> Most famously in the play *The Orphan of Chao* (*L'Orphelin de la Chine*, 1755), and *An Essay on Universal History: The Manners and Spirit of Nations* (*Essai sur les mœurs et l'esprit des nations*, 1756).

<sup>19</sup> Voltaire, *The Works of Voltaire: A Contemporary Version, Volume 13, part 1* (Akron: St. Hubert Guild, 1901), 28.

Voltaire suggests that China's inventions are not a sign of its genius, but its child-like nature. Chinese happily stumble upon discoveries but lack the desire or capability of mind to develop them. Voltaire faults a Chinese reverence for the past and the nature of their language for this stagnation.<sup>20</sup> In his narrative, the past belongs to China, but the future clearly belongs to the more progressive and capable, though late-coming Europeans.

This narrative rested on a distinction between chance discovery and systemic knowledge that was definitively articulated in the quintessential Enlightenment document, *The Encyclopédie*, edited by Denis Diderot and Jean le Rond d'Alembert. Reflecting how essential the great inventions had become in Enlightenment thinking about science and technology, all three were covered extensively in the work. Published in 17 volumes of articles and 11 volumes of illustrations between 1751 and 1772, the work sought to bring all the world's knowledge into one work available to the public. What made it stand apart from previous encyclopedias is that it organized its contents according to a taxonomy of human knowledge as laid down by Francis Bacon in *The Advancement of Learning*, being "History," "Philosophy," and "Poetry," while "Theology" was subsumed as merely a branch of philosophy, a bold challenge to the authority of the Church. Also unique to the work was a focus on the mechanical arts, handiwork done by artisans and craftsmen, which the authors gave special attention to in their examination of discovery and invention. When discussing the great inventions, the authors emphasize their

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<sup>20</sup> Jonathan D. Spence, *The Chan's Great Continent: China in Western Minds* (New York: Norton, 1998), 97.



In the Preface to the *Encyclopedie*, d'Alembert uses the compass to illustrate the difference between the mechanical (or technological) invention, and philosophical (scientific) discovery. "Art", he writes in reference to the Liberal Arts and philosophy, is a "system of knowledge which can be reduced to positive and invariable rules independent of caprice or opinion." On the other hand, the mechanical arts "are dependent upon manual operation and are subjugated (if I may be permitted this term) to a sort of routine," and can be done by hand alone, while the liberal arts are a practice of the mind. But from this initial distinction, d'Alembert complicates the picture enormously, causing one to question the assumption that knowledge must come from philosophers alone, and the superiority of the liberal arts. The critical role of the overlooked mechanical arts is made evident with the invention of the compass:

But while justly respecting great geniuses for their enlightenment, society ought not to degrade the hands by which it is served. The discovery of the compass is no less advantageous to the human race than the explication of its properties would be to physical science. Finally, considering in itself the principle of the distinction about which we are speaking, how many alleged scholars are there for whom science is in truth only a mechanical art? What real difference is there between a head stuffed with facts without order, without utility, and without connection, and the instinct of an artisan reduced to mechanical operation?

The contempt in which the mechanical arts are held seems to have affected to some degree even their inventors. The names of these benefactors of humankind are almost all unknown, whereas the history of its destroyers, that is to say, of the conquerors, is known to everyone. However, it is perhaps in the artisan that one must seek the most admirable evidences of the sagacity, the patience, and the resources of the mind... Is not that man of genius, whose name is shrouded in oblivion, well worthy of being placed beside the small number of creative minds who have opened new routes for us in the sciences?

The heavy influence of Francis Bacon is evident in this passage, when d'Alembert praises inventors as "benefactors of humankind" superior to history's "destroyers." However, he is casting into doubt Bacon's final point in his own passage on the great inventions, that the work of philosophers to discover scientific truths could lead to even greater reward than the initial

useful discovery itself. The compass, which is useful with or without understanding of the principles of magnetism and Earth's polarity, is evidence that the discoveries of lowly craftsmen can be just as great as that of the learned natural philosopher. D'Alembert recognizes the distinction between "mechanical" versus "scientific" discoveries had in part derived from class prejudice, resulting in glory going only to philosophers, while craftsmen remained "shrouded in oblivion." Although country of origin is not at stake here, his case that the distinction between mechanical and scientific discoveries was a front for class prejudice would have a bearing on how others assessed the Chinese role in the great inventions narrative.

However, d'Alembert returns to the example of the compass in an entry on "discovery," where he writes that because the compass must have been discovered by chance it is of lesser importance. While in the Preface he had questioned the hierarchy of scientific over practical knowledge, he now asserted scientific "discovery" as superior to technological "invention":

*Discovery.* In general this name can be given to everything that is newly found in the Arts and the Sciences; however, it is scarcely applied, and ought not to be applied, except to that which is not only new, but also curious, useful, and difficult to find, and which, consequently has a certain degree of importance. The less important *discoveries* are simply called *inventions*.

For the rest, it is not necessary for a *discovery* that its object be at the same time useful, curious, and difficult; *discoveries* that bring these three qualities together are, truly, of the first order; there are others which do not have all three advantages; but it is necessary that they have at least one of them. For example, the *discovery* of the compass was a very useful thing, but one which could have been made by chance, and which consequently does not suppose any difficulty overcome. The *discovery* of the electric shock is a very curious discovery, but one which was also made by chance, and which consequently did not require great

effort, and which from another perspective has also not yet proved very useful...<sup>21</sup>

He goes on to say that “discoveries...are thus the fruit of chance or of genius.” In the work of tradesmen and craftsmen, discoveries are made more often by chance, of efforts by several people over time, and of people that do not write at all, and thus we seldom know the name of the discoverer. Genius, on the other hand, makes discoveries of a higher order:

The discoveries made by genius have taken place principally in the reasoning Sciences: by this I do not mean to say that genius does not discover also in the Arts, I mean only that chance, in the matter of the Sciences, normally discovers less than genius does...<sup>22</sup>

D’Alembert goes on to detail discoveries that were the result of applied “genius” in the Liberal Arts that combined multiple other systems of knowledge together, including arithmetic, geometry, and algebra. “Genius” here referred to the deliberate and collective efforts of a community of intellectuals working within a certain system of knowledge, or what we could call the early modern scientific community. There was nothing to say that a craftsman couldn’t be a “genius”, but they just usually were not.

This is developed further in the entry on “invention,” written by Louis Jaucourt. The distinction of the lesser invention from the more significant discovery is actually based in the historical example of the compass, printing, paper, and others as well. Building on d’Alembert’s reasoning, Jaucourt further

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<sup>21</sup> d’Alembert, Jean-Baptiste le Rond. "Discovery." *The Encyclopedia of Diderot & d’Alembert Collaborative Translation Project*. Translated by Dena Goodman. Ann Arbor: Michigan Publishing, University of Michigan Library, 2012. <http://hdl.handle.net/2027/spo.did2222.0002.781> (accessed April 13, 2020). Originally published as "Découverte," *Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers* (Paris, 1754), 4:705–706.

<sup>22</sup> Ibid.

minimizes the moment of original discovery, while emphasizing the longer process of development of an invention into something more useful:

*Invention.* A General term which can be applied to everything that is found, invented, or discovered, and which is of use or interest in the arts, sciences, and crafts. To some extent this term is synonymous with "discovery," though less striking; I should like to be permitted here to use them interchangeably, without repeating the interesting things the reader should already have read under the word discovery.

The useful inventions of the thirteenth and fourteenth centuries did not at all result from the researches of those who are known as wits in polite society, nor did they come from speculative philosophers. They were the fruit of that mechanical instinct with which nature has endowed some men, independently from philosophy... The making of paper from pounded and boiled cloth was invented in the early fourteenth century. Cortusius speaks of a certain Pax who established the first paper-making factory in Padua a century before the invention of printing. This is how early discoveries happily produce their first fruit, and often thanks to men who remain unknown.

**I say the first fruit, for it has to be observed that the most interesting and useful things that we possess today in the arts were not found in the state in which we see them now. Everything was discovered in rough form or in parts and has been gradually brought to greater perfection.** At least this seems to be the case for those inventions of which we have spoken, and it can be proven for the invention of glass, the compass, printing, clocks, mills, telescopes, and many others....<sup>23</sup>

Here again, the unknown mechanical inventor is conjured, who due to time, luck, mechanical instincts, and patience (but not reasoning or philosophy) came upon their inventions. Referencing the murky history of papermaking, he indicates the importance of mechanical inventions made outside of the realms of philosophy. However, more important Jaucourt emphasizes, is the

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<sup>23</sup> Jaucourt, Louis, chevalier de. "Invention," in *The Encyclopedia of Diderot & d'Alembert Collaborative Translation Project*, translated by Nelly S. Hoyt and Thomas Cassirer (Ann Arbor: Michigan Publishing, University of Michigan Library, 2003). Originally published as "Invention," *Encyclopédie ou Dictionnaire raisonné des sciences, des arts et des métiers* (Paris, 1765), 8:848–849.

*development* of these “first fruits.” He continues by using the great inventions as examples of the process of technological development:

Guttenburg [ *sic* ] only invented movable characters, carved in relief on wood and on metal. It was Schöfer who improved this invention and found the secret of casting these characters. How much this art has been perfected since Schöfer is well known.

The invention of the compass in the twelfth century is of the same order as the invention of printing, whether its use was first discovered by the mariner Goya, a native of Malfi, or by the English, or the French, or the Portuguese. In the beginning men knew only how to place the magnetized needle on a piece of cork floating on water; later this needle was suspended on a pivot inside a box that in its turn was suspended. Finally it was fixed onto a mariner's card or a piece of talc upon which had been traced a circle divided into thirty-two equal parts to mark the thirty-two wind directions, together with another concentric circle divided into 360 degrees, which measured the angles and separations of the compass...

Often an invention illuminates a preceding one and throws a few flickers of light on one that is to follow. I am not saying that any invention is always productive in itself. Great rivers do not always rise in the waters of other great rivers. But inventions which seem to be without any general relationship still cross-fertilize each other; they reappear in a thousand ways that shorten and assist men's labors, and there is nothing more gratifying than the invention or perfection of arts that aim at the happiness of mankind. Such inventions have the advantage over political enterprises in that they bring about the public good without harming anyone. The most spectacular conquests are bathed only in sweat, tears, and blood. He who discovers some secret useful to life, such as, for example, the dissolution of stones in the bladder, would not have to fear the remorse that is inseparable from glory where crime and unhappiness are mingled. The invention of the compass and the printing press opened wider horizons and beautified and enlightened the world. If we scan history we will see that inventors were the first to be deified; the world adored them as visible gods....

Moreover, all those who, thanks to their astuteness, their labors, their talents, and their diligence, will be able to combine research and observation, profound theory

and experimentation, will continually enrich existing inventions and discoveries and will have the glory of paving the way for new ones.<sup>24</sup>

This entry took the examples of the compass printing to emphasize the importance of technological development. Echoing the ideals of Bacon, Jaucourt praises the benevolence of inventions, and recognizes the importance of properly according glory to inventors. However, his statement that “everything was discovered in rough form or in parts and has been gradually brought to greater perfection,” re-centers the narrative toward the development of knowledge, rather than its initial discovery. This was virtually the same line as Voltaire had used a decade earlier, when he wrote in 1756, “Nature seems to have bestowed on this species of men [the Chinese], so different from the Europeans, organs sufficient to discover all at once, what was necessary to their happiness, but incapable to proceed further: we, on the other hand, were tardy in our discoveries; but then we have speedily brought everything to perfection.” While never discussing their possible Chinese origin, the *Encyclopedia* changed how people thought about the great inventions. It provided new dichotomies between craftsman and scientist, accidental invention and genius discovery; furthermore, it shifted narrative focus away from the origins of the inventions, and toward their development by Europeans.

### **Chinese Stagnation versus Capability in Age of Imperialism**

As Britain, and later much of Europe established a semi-colonial presence in China over the nineteenth century, Western writers discussing the great inventions turned from the question of science

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<sup>24</sup> Jaucourt, “Invention,” in *The Encyclopedia of Diderot & d’Alembert Collaborative Translation Project*.

versus craft to characterizations of East versus West. While none of these works became famous in their own right, I argue that they collectively established the great inventions narrative as a means to influence perceptions of Sino-Western relations – a pattern that would continue to dominate throughout the twentieth century. This narrative was buoyed by the twin beliefs that science and technology was the source of national strength, and in the inevitability that China would conform to global capitalist system of nation-states.

By this time, Francis Bacon’s dream of a “House of Solomon” really had come into fruition, as states across Europe established funded scientific societies and established research universities that put science to work for the interests of national strength and global empire. For nineteenth century writers, the “great inventions” were no longer the topic of philosophical discussions about science, but assessments of the outside world in the age of imperialism. In fact, Bacon’s idea of progress through discovery gained such wide currency in Europe that science and technology became one of the most important gauges by which Western empires assessed their own superiority over other civilizations, an inequality made evident by her superior guns, ships, machines, and commodities.<sup>25</sup> Even Protestant missionaries, who saw acceptance of Christianity as the mark of civilization, began seeing modern science and industry as a defining attribute of the West, and attempted to use science as a lure to attract Chinese converts. The subject of the great inventions was thus eminently relevant to Western writers and audiences seeking to understand China’s ability, or lack thereof, to adopt modern science and industry.

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<sup>25</sup> This is argued persuasively by Michael Adas in *Machines as the Measure of Men: Science, Technology, and Ideologies of Western Dominance* (Ithaca: Cornell University Press, 1989).

At the same time, the Western reading public was intensely interested in learning about the Chinese Empire, which had been closed to them for centuries. The British had long sought entry into the interior of China, which since the 18<sup>th</sup> century was seen as the portal to vast wealth by commercial interests like the East India Trading Company, and for the conversion of China to Christianity by Protestant missionaries. The English sent Lord Macartney to on a mission to expand trade in 1795. The visit brought about a controversy over rites, when Macartney refused to kowtow and submit to the normal routines of tributary relations the emperor expected. Macartney's refusal to kowtow and failure to expand trade became a symbolic to the English of principle in the face of obstinacy, backwardness, and arrogance. Restricted to the tiny trade port of Canton, Western merchants only had access to trade goods like porcelain and tea, all at enormous cost in silver. For most Europeans, these material goods, the crude paintings of Chinese landscapes on vases, was their primary if only window into China. Corporate desires to break into the wider Chinese market sparked the Opium Wars in 1839-1842 and 1856-1860, in which Britain forced the Qing Empire to open its borders to Western trade and missionary efforts. These events heightened public interest in China back in Europe and the United States, prompting the publication of a slew of general histories and contemporary accounts. To the Western public, the culture, society, and politics of China had been sealed off from view, with export goods like silk, porcelain and tea, along with exotic but ill-informed accounts being the main impression. As suddenly the British Empire, and soon after much of the West, had access to the great interior of China, the great inventions became a reference point in contemporary writing to describe China's state of affairs, its racial character, and status in relation to Europe.

This section will examine a wide swath of British and American writers who framed the subject of the great inventions within the larger discourse of empire. Though none of them possessed the stature and fame of their Enlightenment predecessors, they instead represent the beginnings of modern Sinology

– the academic study of Chinese language, culture, and history of China that was established in the nineteenth century. As Britain, and then America, became increasingly enmeshed in Chinese affairs, these writers sought to influence the perceptions of the Chinese and the course of international relations in their home countries. Many of their accounts of the great inventions narrative were thus tightly wrapped to their own vision of the place they believed it should take in a world order that was rapidly shifting. In histories and public rhetoric, they celebrated discoveries in science and technology as evidence of their superior civilization, variably attributing these achievements to Christianity, good government, and race. British and American historians, missionaries, and political commentators used the great inventions in service of their sometimes-conflicting missions to dislodge China from its former place in the Western imagination as a vast, politically stable, economically flourishing and ethically pure empire. Rather than the Enlightenment belief in openness to new knowledge, these authors wrapped the possible Chinese origin of the “great inventions” into the Imperialist belief in total European superiority, and the beneficence of Chinese submission to Western religion, trade, and education.

One of the most consistent themes in these references was that China had not progressed since first creating the great inventions. During the late 18<sup>th</sup> and early 19<sup>th</sup> centuries, Britain and the United States had undergone the Industrial Revolution, during which the coal power and mechanization had led to a huge growth in productivity. Although only a century earlier Chinese and English quality of life had actually been quite comparable, British and American writers now imagined their recent advances were rooted in some permanent social or racial superiority, a

notion that legitimized the mission of imperial domination abroad, and oppression of non-whites at home.<sup>26</sup>

The “Chinese Museum,” an early exhibit of Chinese objects both artistic and quotidian, exemplifies how the great inventions conveyed Chinese backwardness in mid-nineteenth century popular culture. Collected and organized by the Quaker merchant and philanthropist Nathan Dunn (1782-1844) in Philadelphia in 1838, the Chinese Museum presented a vast collection of objects from China earning it the nickname “Ten Thousand Chinese Things.” Encyclopedic in scope, it contained fine painting and pottery, flora and fauna, insects, animals and fish, as well as life-size dioramas depicting everyday life with fifty life sized statues representing all strata of Chinese society.<sup>27</sup>

The great inventions were both individually featured in the exhibit, and referenced collectively in the catalogue, fitting into a larger narrative of a stagnant empire just now being pried open by the West. When Dunn moved the exhibit to London in 1842, his advertisement for the exhibit sought to capitalize on the “deep and powerful feeling of enquiry towards this singular and secluded people.”<sup>28</sup> The introduction to the catalogue, which sold up to eighty-thousand copies in the US and England, emphasized China’s lack of progress. Dunn wrote that

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<sup>26</sup> Kenneth Pomeranz, *The Great Divergence: Europe, China, and the Making of the Modern World Economy* (Princeton, N.J.: Princeton University Press, 2000).

<sup>27</sup> William B. Langdon. *Ten thousand things relating to China and the Chinese: an epitome of the genius, government, history, literature, agriculture, arts, trade, manners, customs, and social life of the celestial empire: together with a synopsis of the Chinese Collection* (London: The Collection, 1842), 3.

<sup>28</sup> Langdon, *Ten Thousand Things Relating to China and the Chinese*, 3.

“It is a wonder,” that China had “experienced but little change, comparatively speaking, and existed from century to century, with scarcely a phase observable upon its general and national characteristics and surface.”<sup>29</sup> Discussing the great inventions, Dunn reproduced the Enlightenment distinction between technology and science by praising the Chinese as an “original people,” whom were decidedly *not* scientific:

In whatever else a difference of opinion may exist respecting the Chinese, all must agree that they are an original people... Without any claims to be considered a scientific nation, the various contrivances by which they economize labour, and force nature to become their handmaid, are many of them equally simple, ingenious, and efficient.

The three inventions and discoveries which, in their results, have (previously to the invention of steam) contributed more powerfully than all other causes combined to give modern society its peculiar form and fashioning, and which are destined, instrumentally, to carry forward in connection with steam power-to its utmost limit of perfection, the civilization of the human race, first started into being in the Celestial Empire; and, whatever mortification the statement may inflict upon our vanity, there is much reason to suppose that those who, throughout Christendom, are generally considered as the inventors of the art of printing, the composition of gunpowder, and the magnetic needle and mariner’s compass, received their first promptings, and had their genius quickened into activity, by information flowing, through different channels, from the springs of Eastern Asia.<sup>30</sup>

While this passage at first seems full of praise for the genius of the Chinese, on closer inspection it establishes China as the “springs” of technological progress that the West has now dominated. Dunn repeats the great inventions narrative that printing, gunpowder, and the compass had given “modern society is peculiar form and fashioning,” and insists his Western readers to accept their

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<sup>29</sup> Ibid., XX.

<sup>30</sup> Ibid., 268.

Chinese origin no matter what “mortification” it may cause to their “vanity.” And yet, despite declaring China “the springs” of modernity, Dunn is careful to distinguish that it is not “a scientific nation,” and adds steam power, invented in England in 1712 and key to the Industrial Revolution, as equally significant to printing, gunpowder, and the compass. Much as d’Alembert in the *Encyclopedia* had imagined the valorous craftsman-inventor whose name was “lost to oblivion,” Dunn now imagines China as a technically clever, scientifically ignorant civilization, that nobly inspired Europe to its present position of global leadership in the industrial age.

Information accompanying actual Chinese compasses, guns and gunpowder, printed books, and paper in the exhibit similarly focuses on their primitiveness compared with their Western counterparts. Of the magnetic compass, the catalogue reads, “The Chinese junks that go to the islands of the Archipelago are often navigated by Portuguese of Macao; the Chinese themselves having no charts or instruments of any value, excepting the compass and hour-glass.” Of gunpowder, the text reads that the quality “is far inferior to our own,” and that in China, “the knowledge of gunpowder seems to be coeval with that of the most distant historic events.” About Chinese books and printing blocks, the text reads that the Song Dynasty (960-1279 AD) had made great achievements in printing, but “since that time, it is not known that any material alteration has taken place in its form. The Chinese have no presses similar to our own...” This underlined the central message of the exhibit that China was a closed kingdom, grown stagnant in isolation from the rest of the world. Dunn admired Chinese culture, had openly criticized the Opium War, and offered American and British publics a more intimate view of Chinese life than ever before available. But examining his portrayal of the great inventions, he encouraged an admiration of China as a great but diminished civilization.

A few decades later, Karl Marx also wrote about the great inventions as precursors to European derived inventions of the mechanical age – the mill and the clock. Karl Marx and Friedrich Engels are perhaps the most influential intellectuals of this period to rethink man’s relationship to technology. Though Marx never finished a volume on the history of science, he brought it up frequently in letters and footnotes, always insisting on how it is embedded in a local, particular social setting.<sup>31</sup> It was in a letter to Engels about the clock and the mill as the engines of European industrialization he raised the “great inventions” in comparison. In 1861 he wrote to Engels:

*Gunpowder, the compass, and the printing press* were the three great inventions which ushered in bourgeois society. Gunpowder blew up the knightly class, the compass discovered the world market and founded the colonies, and the printing press was the instrument of Protestantism and the regeneration of science in general; the most powerful lever for creating the intellectual prerequisites.<sup>32</sup>

Here Marx basically repeats Bacon’s reference to the three great inventions as having sparked Europe’s modern age. But he follows it up by arguing for an alternative set of great inventions that better explain the advent of the industrial age of the 19<sup>th</sup> century:

But the *water (wind) mill* and the *clock* are two machines inherited from the past. Their development prepares the way for the period of machinery, even during the time of manufacture.<sup>33</sup>

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<sup>31</sup> Dirk Struik, “Marx and Engels on the History of Science and Technology,” in *Amphora: Festschrift Für Hans Wussing Zu Seinem 65 Geburtstag = Festschrift for Hans Wussing on the Occasion of His 65th Birthday*, edited by in Herausgegeben von Sergei S. Demidov, et. al. (Basel; Boston: Birkhäuser Verlag, 1992), 738-40.

<sup>32</sup> Karl Marx, “Division of Labour and Mechanical Workshop. Tool and Machinery,” in *Marx & Engels Collected Works, Vol. 33, Marx’s Economic Manuscripts of 1861-63, Part 3: Relative Surplus Value* (Chadwell Heath: Lawrence and Wishart, 1991), 403.

<sup>33</sup> Marx, “Division of Labour and Mechanical Workshop. Tool and Machinery,” 1991.

The mill was the most important example of a connecting mechanism between the motive power - be it man, beast, water, wind or steam - and the working machine. The clock was the original idea of the automatic motion that was applied to production, and also made it possible to commoditize labor time, and thereby allow the pursuit of efficiency in production, the very basis of social relations between the workers and capitalist class. While this passage is usually taken as Marx's endorsement of Bacon's appraisal of the great inventions, it is also significant that he replaces them with a new set, the two great inventions of the industrial age. After all, Marx and Engels were out to explain the relation of capitalists and workers in the industrial age, and the great inventions of printing, the magnetic compass, and gunpowder were just not at the center of the social and political changes sweeping Europe and America.

Furthermore, Marx was unaware of the inventions' Chinese origins.<sup>34</sup> Adopting the view of German philosopher Georg Hegel (1770-1831) that "China had no history," Marx and Engels siloed Asia into its own category of labor relations with his theory of the "Asiatic mode of production," the oppressive rule of a despotic ruling clique concentrated in urban areas, that expropriated surplus directly from peasants in the countryside. Marx and Engels thus carved out a separate historical path for China as a civilization stuck in time, separate from the scientific, technological and social progress occurring in Euro-America. As Marx later reflected on the

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<sup>34</sup> While living in London, he wrote to Engels that visiting the London Museum, he confirmed that they probably came from Germany. He also came to embrace the narrative of China as a stagnant civilization.

Taiping Rebellion in the German press, he wrote of China as a "living fossil," and the Taiping revolutionaries as not agents of progress, but only destruction. "Only in China was this sort of devil possible," he wrote in 1862, "It is the product of a fossil social life."<sup>35</sup>

Across the Atlantic in the United States, anti-Chinese immigration activists and politicians also seized on the idea that Chinese were incapable of progress to portray them as unsuitable for citizenship. Ironically, just as Chinese immigrants finished building the trans-continental railroad, a coalition of mainly Irish labor union activists and politicians mounted full-scale campaign to ban Chinese labor migration to the United States in the 1870s and 1880s. They saw the Chinese as undercutting their wages, and becoming the pawns of capitalists for the detriment of the working class as a whole. They made the case that because of their inferior brain power, Chinese could not be members of a democracy, and would only be the cheap labor exploited by capital against other white laborers, and their presence would corrode the society in general. They subverted the idea that the "great inventions" were evidence of Chinese intelligence, instead arguing that it showed of both Chinese inability to operate modern machinery and to participate in a democracy.

During testimony in US Congress in 1877 over Chinese immigration, Senator Aaron A. Sargent (1827-1887) used the narrative of Chinese stagnation as proof of racial inferiority was used to support restricted immigration. The leading proponent of the Chinese Exclusion Act of 1882, Sargent argued that "there is not sufficient brain capacity in the Chinese race to furnish

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<sup>35</sup> Karl Marx, originally published in *Die Presse*, No. 185, (July 7, 1862). Reprinted in *Marx & Engels Collected Works, Vol. 19*, (Chadwell Heath: Lawrence and Wishart, 1991), 216.

motive power for self-government. Upon the point of morals, there is no Aryan or European race which is not far superior to the Chinese as a class."<sup>36</sup> He supported this conclusion with expert testimony about the stagnancy of Chinese government, technology, and culture, painting a picture of an eminently conservative, patriarchal, and corrupt society. The full exchange on the floor between the unnamed witness and the senators shows how the inventions helped Sargent form a negative judgement of the Chinese race as unfit for participation in American society. The person reading the account of China is only referred to as "The Witness":

The Witness: In the arts pertaining to a high civilization the Chinese have made no progress for many centuries. Originally the manufacturing of gunpowder and glass, the art of printing and the use of the compass, belong to China, but no improvements have been made upon the original inventions, and for many hundred years no new inventions have appeared in China.

By Senator SARGENT: Q. Do the Chinese understand the use of movable type --  
A. That is not their system. They may in the open ports now, where movable type has been introduced by foreigners. In Canton they have bought a printing establishment and set up type. Their system of printing from the first has been the same as now. They cut it on boards, the size of the page. It is cut out and stands in relief.

By Mr. Brooks: Q. Wood-cuts

A. Wood-cuts; and then the paper is laid on to the ink.  
In science, government, and religion everything is stereotyped; everything runs in the same old rut. Change or improvement in anything that was acceptable to their ancestors is not desired.  
The religion of the educated may be formulated as blind fatality; the religion of the masses, a heartless, superstitious idolatry. Of course their civilization is low, for it is an axiom that no people can rise above the plane of the gods they worship.

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<sup>36</sup>Aaron A. Sargent, *Report of the Joint Special Committee to Investigate Chinese Immigration*, report prepared for the Committee to Investigate Chinese Immigration, February 27, 1877, 44<sup>th</sup> Cong., 2<sup>nd</sup> Sess., 1877, Serial St. ID: 1734, S. Rep. 689.

The Chinese truly verify the Scripture statement that in this world "there be that are called gods many, and lords many." The whole land is full of idols, and all the people are filled with idolatrous superstitions. The whole civilization of China has stood still for ages, and has become like one great stagnant pool. To purify it, it needs to be moved and stirred from center to circumference by contact and friction with the Christian civilization of America and Europe. The few thousands of European and American merchants and missionaries now in China, and the one hundred and fifty thousand Chinese now in America, are but the beginnings of mighty changes about to take place in the history of that wonderfully strange people.<sup>37</sup>

Here the "great inventions" are tied into the familiar narrative of Chinese stagnation. The back-and-forth between Senator Sargent and the witness over the history of printing establishes a familiar narrative of Chinese stagnancy, interrupted by Western impact – the introduction of modern technology. The arrival of Western printing foreshadows the larger movement of merchants and missionaries into China that concludes the passage. Technological stagnation is intimately connected to religious idolatry in this impression of the Chinese. This view of China as "one great stagnant pool," evidenced by their failure to develop the great inventions, can only be "purified" by the arrival of Western Christianity and capitalism.

Later, Sargent quotes from former Republican Secretary of State, Governor of New York and US Senator William H. Seward's (1801-1872) *Voyage Around the World* (1873), in which he works out the early achievements and subsequent stagnation of the Chinese:

The Chinese, though not of the Caucasian race, have all its moral and social adaptabilities. Long ago they reached a higher plane of civilization than most European nations attained until a much later period. The western nations have since risen above this plane. The Chinese have made no advancement...If we ask how this inferiority has come about among a people who have achieved so much in the past, and have such capacities for greater achievements in the future, we

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<sup>37</sup> Sargent, *Report of the Joint Special Committee to Investigate Chinese Immigration* (1877), 408.

must conclude that, owing to some error in their social system, the faculty of invention has been arrested in its exercise and impaired.<sup>38</sup>

In Seward's account, ponderings of Chinese morality and society is set in the larger category of race. Stagnant social practices have biological consequences, impairing the Chinese "faculty of invention" that it once possessed. Could new social practices alter Chinese racial qualities, and renew their "faculty for invention"? Proponents of Chinese exclusion in the United States did not follow this logical path, emphasizing instead the hopelessness of Chinese progress. As the great inventions had become a standard reference to inspire awe in the past greatness of Chinese civilization to western audiences, as Dunn had explained them in his "Chinese Museum," anti-Chinese immigration proponents defensively latched onto the racial stagnation narrative as a counter-argument.

The inventions reappeared in a later 1896 article by Irish clergyman and anti-Chinese immigration proponent Robert T. Ellis (1844-1924), which made this argument even more clearly. Ellis wrote in response to the visit to the US by Qing official and "Self-strengthening" reformer Li Hongzhang, who made a splash in national newspapers for criticizing the Chinese Exclusion Act, and suggesting that Chinese immigrants would be valuable to the US economy as a source of "cheap labor":

*The Chinese Good Imitators but Poor Inventors:* It may be objected here that China as a country eminent in the history of inventions; that the Chinese found the use of gunpowder, of the mariner's compass and of printing long before these were in use in

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<sup>38</sup> William H. Seward. *William H. Seward's Travels around the World* (New York: D. Appleton and Company, 1873), 413.

the West. This is largely a delusion... They went no further than the threshold of the subject.

*An Utterly Unprogressive People:* In later centuries they have been an utterly unprogressive and unintuitive people, doing everything just as their fathers did it a millennium ago, and abhorring change as inventions of their numerous devils. Such a people could not keep pace with the rest of mankind in use of civilized machinery.<sup>39</sup>

Thompson's great inventions argument came at the tail end of a four-decade long attempt by the Qing empire to modernize their military and economy, the "Self-strengthening Movement". The long effort for Chinese exclusion in the United States kept alive the racist great inventions stagnation narrative.

While merchants, intellectuals, and anti-immigration activists used the great inventions to signal Chinese stagnation and inferiority, at the same time, Christian missionaries used them to prove that the Chinese were capable of joining Western civilization. In addition to Western goods, the Opium Wars opened China to Protestant Christian missionaries in the mid-nineteenth century. Unlike merchants, missionaries depended on public support back home for the financing of their missions in China. They thus had incentive to convince their home audience that Chinese were capable of being brought into Christendom. Missionaries agreed with the mainstream notion of Chinese backwardness in religion, education, and science and technology; but they endeavored to explain these as temporary conditions that could be overcome, not permanent features of the Chinese race. This led them to see the great inventions as evidence of Chinese

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<sup>39</sup> Robert Ellis Thompson, "Cheap Labor Makes Cheap Men," *Irish World and American Industrial Liberator* (Sept. 26, 1896), from *Nineteenth Century U.S. Newspapers*, accessed 29 Nov. 2017: [tinyurl.galegroup.com/tinyurl/5aWsL9](http://tinyurl.galegroup.com/tinyurl/5aWsL9).

racial quality, and to blame the traditional education system as the reason for their failure to develop the inventions further.

One of the earliest missionaries to settle in China was the English Congregationalist William Henry Medhurst (1796-1857), who used the great inventions to illustrate China's superiority to other non-Christian civilizations, but ultimately its inferiority to the West. In his 1838 *China: Its State and Prospects, with Special Reference to the Spread of the Gospel*, Medhurst recognizes the three inventions as demonstrating that the "heathen" Chinese exhibited "many traces of civilization, and displaying them at a period when the rest of mankind were for the most part sunk in barbarism."<sup>40</sup> He begrudgingly acknowledged the "inventive genius" of the Chinese, and their contribution to European science, writing, "three most important discoveries, which have given an extraordinary impulse to the progress of civilization in Europe, were known to the Chinese previous to their being found out by us." Medhurst cuts against the typical Orientalist depiction of China as backward, decadent and amoral, undermining easy arrogance in the superiority of Victorian culture.<sup>41</sup> Medhurst wrote numerous substantial reference works, including a Chinese-English Dictionary and a translation of the bible, sought a greater understanding of China for the purpose of proselytizing. His depiction of the Chinese sought to

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<sup>40</sup> Walter Medhurst, *China: Its State and Prospects, with Special Reference to the Spread of the Gospel; Containing Allusions to the Antiquity, Extent, Population, Civilization, Literature, and Religion of the Chinese* (Boston: Crocker & Brewster, 1838), 87.

<sup>41</sup> Edward Said, *Orientalism: Western Conceptions of the Orient* (London: Penguin, 1978), 67.

convince the audience back home that it was possible to understand the Chinese, and that they were worth saving.

But ultimately, the Protestant missionary wanted to explain scientific progress as a product of Christianity. While their achievements are impressive, as a “heathen” country without Christianity China could not hope to rise to European standards, and the great inventions remained as an anomaly rather than a defining achievement. Medhurst saw this born out by the disparities between present day Europe and China. He writes that China lacks “that high degree of improvement, and those well-defined civil rights, which are in a great measure the effects of Christianity.” Neither does China possess those “advances in science, or improvements in the arts, which so distinguish Europe, and which are the result of that march of mind so characteristic of the age we live in. Railways, tunnels, machinery, and all the ramifications and operations of gas and steam, are not to be looked for in China.”<sup>42</sup> He even faults the printing press as contributing to China’s stagnation, as it had enabled them to easily reproduce ancient works, discouraging the compilation of new ones.<sup>43</sup> According to Medhurst, the three great inventions are testament to China’s stature as a civilized country, and Europeans ought to “accord due heed to praise to those who so early possessed” them; but they also symbolize their failure to develop them into the epoch changing technologies that had enabled the “railways, tunnels, and machinery” of Europe’s Industrial Revolution.

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<sup>42</sup> Medhurst, *China: Its State and Prospects...*, 98.

<sup>43</sup> *Ibid.*, 104

Another early such missionary-authored book on China similarly praised the Chinese for their great inventions, and reframed the conversion of China to Christianity as Europe's return payment. In William Wells *Middle Kingdom*, published in 1843 and again in 1861 because of renewed interest in China in the wake of the Opium War and opening of China, the great inventions are raised in the context of the history of cultivation of tea, one of the primary economic motivations behind Britain's role in the Opium War.<sup>44</sup> He uses the great inventions – adding tea cultivation to the original three – to rationalize the opening of China by the British Empire:

Among the branches of Chinese industry, the growth and preparation of tea has been most celebrated abroad, and the gradual introduction and use of this beverage among the nations of the west, and the important consequences of bringing the two into more intimate intercourse, and opening to the Chinese the blessings of Christian civilization, resulting from the trade, is one of the most interesting results that have ever flowed from commerce...Thus one influence and another, some beneficial and others adverse, have been brought into action, until the encouraging prospect is now held out that this hitherto secluded portion of mankind is to be introduced into the family of nations, and partake of their privileges...Tea, gunpowder, printing, and the compass, are four things which have worked marvelous changes in the social condition, intercourse, disputes, and mental improvement of mankind; and probably all of them are traceable to China and Chinese ingenuity; if Christianity, and its outflow of good government, intelligence, and improvement in the arts of life, can now be exchanged for them, both parties will be great gainers. No commerce is so profitable as that in mental and moral acquisitions, and upon none has there been so prohibitive a tariff.<sup>45</sup>

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<sup>44</sup> Medhurst, *China: Its State and Prospects...*, 1.

<sup>45</sup> Williams S. Wells, *Middle Kingdom; a Survey of the Geography, Government, Education, Social Life, Arts, Religion, &c., of the Chinese Empire and Its Inhabitants* (New York: J. Wiley, 1847, reprinted 1861), 126-127.

The author reasons that the tea, just like the great inventions, were the Chinese contribution that has been a “mental improvement of mankind”; now that China was “introduced into the family of nations,” Christianity could be “exchanged” for them, and “both parties will be gainers.”

The language is incredibly euphemistic, not mentioning that this process had involved the armed occupation of the Chinese capital and their humiliating defeat. It was this denial of violence that allowed the author to both admire the great inventions as ingenious gifts, and see Christianity as repayment in kind, a similar contribution to the “mental improvement of mankind.” Wells had spent 12 years in Canton (modern day Guangzhou and Hong Kong), and returning to the US, sought to correct the racist, conceited and ignorant views of China. He called the book *Middle Kingdom* not just in reference to the word “Zhongguo” (中国), but also “from the Chinese holding a middle place between civilization and barbarism - China being the most civilized pagan nation in her institutions and literature now existing.”<sup>46</sup> Holding China in this liminal place, worthy of praise as an accomplished civilization, and yet without Christianity falling just short of civilization, was the hallmark of nineteenth century missionary narratives.

Also published in the wake of the Opium Wars, *China and the Chinese* (1869) by the American Protestant missionary John L. Nevius used the great inventions to prove the racial fitness of the Chinese.<sup>47</sup> Typical of books on China published in this period, Nevius gives a

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<sup>46</sup> Wells, *Middle Kingdom* (1847), xv.

<sup>47</sup> John L Nevius, *China And the Chinese: a General Description of the Country and Its Inhabitants; Its Civilization and Form of Government; Its Religious and Social Institutions; Its Intercourse with Other Nations, and Its Present Condition and Prospects* (New York: Harper & brothers, 1869).

broad overview of the civilization filled with his anecdotal experiences in Canton. The inventions are referenced in a chapter that reviews the racial fitness of the Chinese, called “General Estimate of the Chinese Character and Civilization.” He begins by writing, “‘The Chinaman’ has almost become a synonym for stupidity, and his habits and peculiarities afford abundant occasion for pleasantry and ridicule.” But he cautions that Westerners have erred due to the common mistake that we “think of ourselves more highly than we ought to think.” The chapter anecdotally describes the physical and intellectual capability of the Chinese race, bringing in the great inventions as proof of Chinese intellectual ability:

The intellectuality of the Chinese is made evident, by so many obvious and weighty facts, that it seems strange that persons of ordinary intelligence and information should ever have questioned it... But it may be asked, “What have the Chinese ever done? What do they know? Have they ever made any contributions to science? Are they not utterly ignorant of all the modern arts and sciences?” It is true that the Chinese know hardly anything of the *modern* arts and sciences, and that there is no word in their language to designate some of them; but how much did our ancestors know two hundred years ago of chemistry, geology, philosophy, anatomy, and other kindred sciences? What did *we* know fifty years ago of the steam-boat, the rail-road, and the telegraph? And is our comparative want of knowledge a few years ago and that of our ancestors to be taken as evidence of inferiority of race and intellect? Perhaps this test which some are so ready to apply will, if we go back a few hundred years, establish the claims of the Chinese as the superior race. Printing, which is second in importance to none of the arts of civilization, originated with the Chinese, and was made use of by them hundreds of years before anything was known of it in the West. They have taken the lead also in the use of the magnetic needle, the manufacture and use of gunpowder and of silk fabric, and china-ware porcelain.<sup>48</sup>

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<sup>48</sup> Nevius, *China and the Chinese*, 279-281.

Nevius here challenges the argument that the West's superiority in science and technology equated to racial superiority, pointing out how recently the West had pulled ahead. He takes an almost conversational tone, gently undermining the grounds of Western superiority by raising the specter of a recent past in which it was the Chinese, with their many great inventions, that was far ahead of the West. If not innate ability then, what did explain the changing fortunes of Chinese and Western civilizations? Like many of his missionary peers, Nevius identifies education and religion as the cause of China's falling behind the West, which becomes the subject of the rest of the chapter:

I believe that the Chinese are not naturally deficient in ingenuity and originality, and that, when these qualities are encouraged, this race will show a fertility of brain the existence of which has hardly been suspected....We have been possessed of all the stores of knowledge of all the different nations of Europe and Western Asia for centuries; and it is impossible to imagine what our condition would be to-day, were it not for the advantages we have derived from the stimulus and teachings obtained from other countries, and more especially from Christianity.

Comparing the advantages that Westerners have enjoyed compared to the lower class Chinese laborers most Americans were familiar with, and the great performance of Chinese exchange students at Yale College, he concludes, "Wherever they have had an opportunity to compete with us on the same ground, and with equal advantages, they have shown that the difference between them and us in intellectuality is so slight, if it exists at all, that it does not become us to say much about it."<sup>49</sup>

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<sup>49</sup> Nevius, *China and the Chinese*, 282.

This is a powerful use of the great inventions in service of the idea that the Chinese were not racially inferior to whites, but religiously and educationally inferior. Nevius was reacting against a growing racism against the Chinese that came to full fruition with the 1882 Chinese Exclusion Act banning the immigration of Chinese laborers to the United States. Embodying the universal vision of Protestant Christianity, Nevius saw the inventions as proof of Chinese intelligence, and their capability for conversion. Furthermore, he gives some credit for the scientific achievements of the West to accruing of knowledge from all over the West and Asia, meaning that it is only the flow of knowledge, not racial qualities, that resulted in European advances in science and technology. His anti-racist argument and critique of Western arrogance foreshadowed later arguments that the Chinese nationalists themselves would make in the twentieth century.

Missionaries also merged Christianity with industrialization in their vision of the West's role in transforming China. William Speer, a Presbyterian missionary to Chinese in China and in California, expressed a much more favorable view of the great inventions in his book, *The Oldest and the Newest Empire: China and the United States*, published in 1870.<sup>50</sup> Speer was sent by the Presbyterian Church to preach in Canton in 1846, after it was opened by the first Opium War. Then, having learned Cantonese, he returned to California in 1852 to preach amongst the Chinese.<sup>51</sup> The preface of this book states his intentions to turn the tide against anti-Chinese

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<sup>50</sup> William Speer, *The Oldest and the Newest Empire: China and the United States* (Hartford, Conn.: S.S. Scranton and Company, 1870).

<sup>51</sup> Ibid. 3

immigrant sentiment in California: "It is a strange thing that we Americans have acquired the fashion of speaking of the Chinese with contempt and dislike. It is a fashion-and it should be changed.... This book is an attempt to make our people better acquainted with them, and to incite efforts which shall lead them to hold a better opinion of us. It will have served a good end should it accomplish no more than to bring their manly and indignant REMONSTRANCE TO THE CONGRESS OF THE UNITED STATES thoroughly before the attention of our legislators and people."

Speer's vision for China's modernization is made concrete in his discussion of the history of Chinese printing. He manages to both recognize early achievements in Chinese printing and literacy, while pointing toward their later adoption of superior Western printing:

Yet it was in these turbulent times (of the Tang Dynasty) that printing began to be practiced in China-an event which occurred about five hundred years before that art was known in Europe... [The method of Chinese printing] is necessarily very slow; and for this reason must yield in the end to the use of divisible metal type and of our swift machinery. The superior beauty of the typography of our books already wins the wonder and praise of the Chinese. Before the invention of printing there must have been a vast number of Chinese constantly employed in writing, as they were always a reading people, and even the poorest peasants were able to obtain books in manuscript, while in Europe a book was a thing unknown among the lower classes, and seldom to be met with except in monasteries or the palaces of princes.<sup>52</sup>

The Chinese here are rendered as educated and accomplished, but also admiring of Western technology, and on the road to adopting it. This contrasted the impression of Chinese by

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<sup>52</sup> William Speer, *The Oldest and the Newest Empire: China and the United States* (Hartford, Conn.: S.S. Scranton and Company, 1870), 192.

proponents of immigration ban in their discussion of printing, as slavish, ignorant, and impossible to assimilate. Speer merged the idea here that Chinese adoption of Western technology, with their similar conversion to Christianity. In the final chapter, “The Future of the Chinese Race,” Speer prophesies the rise of the Pacific and the fall of Europe as the center of world affairs, citing the all of the “Self-Strengthening” measures the Qing empire had taken as evidence of their awakening – the establishment of arsenals, manufacturing of arms and ships, opening of trade and telegraphic communication, opening of Peking University and teaching of Western science, and of course, the introduction of fine metal type printing machinery. All of these advancements, he argues, signal the importance of American missionary focus on the Chinese, to bring China – the “old empire” – into the fold as an industrial Christian empire, like America – the “new empire”:

Lift up your eyes! See the white spires of Christian churches and schools rise from those cities and towns. See the Sabbath spell stop the furnaces of factories and mills, which during the week enrich the inhabitants with all the products of Christian civilization, but now release their weary toilers to enjoy a holy rest and to throng with their swarthy faces the ways that lead to the houses of God. Yonder lie steamers waiting at the wharves for liberty on the morrow, panting to bear their vast and varied freight from city to city where they thickly border the mighty rivers. The iron railways, the telegraphic wires, stretch from valley to valley. You survey the same loveliness, the same peace, the same prosperity, which charm and satisfy the mind and the heart in a summer landscape of favored America or Britain. How complete, how wonderful, how delightful the transformation! Simply the faithful and unwearied preaching of the gospel of the Lord Jesus Christ has done it all. Men believed in him as the only Lord and Saviour; they cast away their idols; the blessings of modern Christian civilization all followed in their turn. It began feebly and slowly but progressed with ever multiplying rapidity and volume. And these changes which a few years have wrought in one nation are but a part of universal transformations, such as it were idle to attempt to conceive or to picture, which shall extend to all the race of man, and make this whole earth seem like a new earth, and these heavens above us like new heavens.

Then shall Jesus' kingdom become; then shall his will be done in earth as it is in heaven.<sup>53</sup>

This vision of industry and Christianity as twin universal forces spreading to the whole world is the framework in which the great inventions, evidence of Chinese intelligence and learning, make sense. Riding a wave of Western material superiority so eloquently described here, missionaries like Speer saw science, industry and Christianity universal goods that everyone should want. The only question is about the capability of the Chinese to be guided to Western political and religious life. Did they possess the brain capacity for democracy? The racial fitness for modern machinery? Westerners agreed that China was a heathen place – a “Middle Kingdom” in between civilization and barbarism. But British and American Protestant Christian missionaries saw its history of inventions as some evidence that Chinese were not beyond redemption. China’s efforts at modernization through its “self-strengthening” policies were interpreted as evidence of their capability to Westernize, and their strategic importance to America as a potential friend.

The fourth great invention – papermaking – was first added by missionary and scholar Joseph Edkins. A disciple of Walter Medhurst, Edkins was a prolific linguist, translator, and philologist, who specialized in translating Western scientific knowledge into Chinese. In a comparison between Japan and China, Edkins wrote in 1893:

It should be always remembered that they [Japan] boast of no remarkable inventions and discoveries, such as printing, papermaking, the properties of

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<sup>53</sup> Speer *The Oldest and the Newest Empire*, 671-2.

loadstone [sic], and its use in navigation...They must not be then regarded as equal with the Chinese for those things that constitute a great nation.<sup>54</sup>

Edkins was reacting to the rise of Meiji Japan, a nation that had impressed Europeans with the quick acquisition of Western science, industry and military technology. Despite China's contemporary weakness, Edkins used the four great inventions to convince readers that China was the birthplace of Asian civilization and Japan its derivative, and was "worthy of closer study," not to mention missionary effort.

The American missionary John Fryer, like Edkins, was also engaged in translating Western science and technological knowledge into Chinese. Reflecting Chinese indifference to the great inventions narrative in the nineteenth century, Edkins never referenced them in his Chinese publications, only raising them when writing to an American audience. Unique from other missionary Sinologists operating in late nineteenth century China, Edkins worked as an employee of the Qing Empire itself at the Jiangnan Arsenal. Established by Li Hongzhang in 1865, this institution was meant to educate a new class of Chinese scientist and engineer that could strengthen China's military and industry by helping to build modern armaments. At the Arsenal, Fryer published *The Chinese Scientific Magazine* (*Gezhi Huibian* - 格致汇编), the first scientific magazine in China. This magazine introduced Western printing presses, guns, and navigation technology to Chinese audiences, but did not emphasize or even confirm China's

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<sup>54</sup> Joseph Edkins, *Religion in China; containing a brief account of the three religions of the Chinese: with observations on the prospects of Christian conversion amongst that people*, (London: K. Paul, Trench, Trübner, & co., 1893).

own role in originating these inventions. For example, the issue about modern gunpowder, written by Xu Shou (徐寿) in 1877, began:

When, in what country, and what people discovered gunpowder - there is not sufficient evidence to verify the legend of various Western countries: that the method [of gunpowder making] came from the East, from ancient books recorded in China and India. From ancient times until now, this method of gunpowder making was already understood, unless it is discovered who was first and who was last in this remote and buried past, it is difficult to get to the bottom of this issue and discuss it. Generally speaking, this is because there are several places where the soil's surface produces saltpeter [the key ingredient in gunpowder].<sup>55</sup>

Despite appearing in a Chinese publication sponsored by the Jiangnan Arsenal, the author emphasizes how uncertain the origins of gunpowder are. Thought they could come from China, they might also come from India, or any place that naturally produces saltpeter. This hesitancy to positively claim Chinese credit for gunpowder reflects the fact that in the nineteenth century, the notion of the "great inventions" was not in currency in China. The doubt the author casts over its origins reflects the lack of historical certainty at this point. In a passage introducing the modern printing press, the Chinese history of print is made a bit clearer. Here, Xu Shou writes that China had wood block printing more than two-thousand years ago, but that "until today, this old system is still observed." Even speaking to a Chinese audience, Fryer and his Chinese staff at *The Chinese Scientific Magazine* reproduced the Western idea of China as not having developed the inventions since their early discovery.

When John Fryer returned to the United States to teach Chinese language and philosophy at the University of California, Berkeley, he often returned to the narrative of China as a

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<sup>55</sup> Xu Shou 徐寿, "Xipao shuolüe" 西炮说略 [A Brief Introduction to Western Artillery], *Gezhi Huibian* 格致汇编 2, no. 2 (1877).

fossilized civilization in addressing his Chinese history textbook, or in lectures. He became an advocate for Chinese education reform, cheering the efforts of reformers like Li Hongzhang, his previous sponsor at the Jiangnan Arsenal, and bemoaned as great set-backs the 1898 coup by conservatives in China, the Boxer Rebellion, and the Sino-Japanese War. Like other missionaries who had worked with the Chinese, Fryer tried to counter the widespread American notion, deeply rooted in California since the earlier anti-Chinese immigration movement, of the Chinese as racially – and mentally – inferior. Rather, Fryer blamed traditional Chinese education for China's ills. If only China were set on the right path, they could become a great nation equal to the West. At Berkeley, Fryer published the textbook *The philosophies and religions of China*, whose introduction referred to the great inventions.<sup>56</sup> Attempting to instill admiration for China amongst his American readers, he uses the inventions to show that until recently, China had been the more advanced race:

We have only to look at the magnitude of the problem the Chinese race has effectively solved, to see how they are entitled to our careful consideration, if not to our admiration. From comparative savagery they have risen by their own inherent force of character, step by step, through various stages of civilization till, 500 years ago [1400AD], they were undoubtedly one of the most civilized nations on earth. Since that time Europeans by their rapid advances in science and in the useful and ornamental arts have so far surpassed them that the Chinese appear to be left far behind. But we must remember that their civilization developed under quite a different form from our own, and the dissimilarity is perhaps as wide as can possibly exist between two races of beings having the same common nature and wants. Yet a people among whom inventions which are esteemed the pride of modern Europe —the compass, gunpowder and printing — were known and practised many centuries earlier —who have gone on increasing in numbers till they probably amount to more than 400 millions, united in one system of manners, letters, and polity —who already practice upon a vast scale the most

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<sup>56</sup> John Fryer, *Oriental Studies: The philosophies and religions of China* (Shanghai: Kelly and Walsh, 1900).

necessary of the industrial arts— who are noted for the frugality and ingenuity by which they can continue to live comfortably and happily where other races would starve — such a nation, when once it is fairly started in the direction of progress, must indeed occupy a conspicuous place in the future history of mankind.<sup>57</sup>

Fryer here is addressing the great inventions narrative of early progress and subsequent stagnation, steering his American undergraduates toward admiration, rather than a racist dismissal, of the Chinese. Fryer foresees that one day the Chinese may be "fairly started in the direction of progress," and one day rise to the status of a great nation. This was exactly the kind of path Fryer had attempted to set China on during his work at the Jiangnan Arsenal. The great inventions communicated to American audiences, steeped in decades of racist anti-Chinese discourse, that the Chinese were capable of becoming modern.

## Conclusion

The great inventions narrative was born in Enlightenment Europe, where philosophers used it to argue for a revolutionary idea – that technology had the power to change the world. Early modern scientists and philosophers held up printing, gunpowder, and the compass as evidence that their labor could lead to tangible results that would benefit all mankind. The historic origins of these inventions were hazy and disputed. Philosophers like Francis Bacon and d'Alembert bemoaned that no statues would ever be built to those unknown artisans who first discovered the inventions, but ultimately, they were more interested in explaining how they themselves had used science to make the inventions truly useful. From the early seventeenth

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<sup>57</sup> Fryer, *Oriental Studies*, 3.

century on, they held up the great inventions as symbolizing technology's power to change society, and the paramount role of the scientist in technological development. Because of the stature of these men as founders of the Enlightenment, their writing about the great inventions had immense influence on later generations of Europeans, and later Chinese, who saw them as the forefathers of contemporary efforts to master science and technology.

As Europeans were increasingly convinced that the great inventions originated in China over the age of imperialism in the eighteenth and nineteenth centuries, the narrative was broadened to explain the East-West relations. During the early Enlightenment, many philosophers admired China for its moral philosophy and social stability. But during the eighteenth and nineteenth century, it was that very quality of continuity since antiquity that Europeans now perceived as a negative. The original assertion made by Bacon and detailed by d'Alembert that illiterate artisans who stumbled upon great inventions were inferior to genius scientists, was transposed into an argument for European superiority. In this narrative, the Chinese had stumbled upon the great inventions in ancient times, but the highly rational Europeans could develop them into revolutionary technologies. During the nineteenth century, anti-immigration activists in the US, for merchants, and others spun this narrative into one of Chinese stagnancy, which legitimized a sense of European superiority that undergirded imperialism. At the same time, Protestant missionaries in particular called on the inventions as proof of Chinese capability, that the Chinese were uniquely poised to be ushered into Christendom and industrial modernity. If nothing else, the great inventions narrative reminded readers that just a few centuries ago, China was the most advanced civilization in the world, while Europe was still in the Dark Ages. As the Qing Empire finally crumbled in the early

twentieth century, it was this aspect of the narrative that finally gained it notice amongst the Chinese themselves.

## Chapter 2: The Great Inventions in Republican China

The first appearance of the great inventions narrative anywhere in China was in the 1909 *Western History Textbook*.<sup>1</sup> This textbook was a product of the national effort to build up the scientific and technological capacity of the nation through education. Although the text inserts China into a world history as the origin of gunpowder and the compass (printing is credited to Germany), the text is much more focused on the development of inventions in Europe, and hardly accentuates China's place in the story. By the 1930s, however, the Chinese role in producing the great inventions had gone from preamble to the main story. Through an expanding school system, the narrative of the inventions' Chinese roots appeared in a growing number of texts that reached audiences young and old around the country, in children's textbooks and academic histories. Leading intellectuals and revolutionaries, including Hu Shih (1891-1962), Sun Yat-sen (1866-1925), and Mao Zedong (1893-1976), also referred to China's role in originating the great inventions in the Republican period. More than inserting China into the story of Europe's rise, the great inventions narrative became a story that Chinese nationalists invoked to inculcate national racial pride in the masses, confirming the ability of the Han race to master modern science and technology.

What caused this transformation of the great inventions narrative, and what caused it to become so often repeated and widely known? I argue that the great inventions entered public

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<sup>1</sup> Fu Yueye 傅岳叶, *Xiyang lishi jiaokeshu* 西洋历史教科书 [Western History Textbook] (Shanghai: Commercial Press, 1909), reprint with revisions by Zhuang Yu 庄俞, (1912).

consciousness when they were included in textbooks, a product of state education reform that began in the late Qing at the very beginning of the 20<sup>th</sup> century, and the growth of the commercial publishing industry, which supplied the new schools with modern, nationalist history textbooks. I will show that the idea of the great inventions played a critical role in moving people to think about China's history as nation-state centered, progressive, and global. The terms under which textbooks were written, produced and distributed were determined by the state Ministry of Education, which was a product of late Qing and Republican educational reforms, and produced by the burgeoning commercial publishing industry. I also argue that the great inventions narrative grew in prominence and importance once it was reinterpreted by Sun Yat-sen, who linked it to the cultivation of national racial pride. As the Nationalist Party ruled China from 1928-1949 during years of war with the Chinese Communist Party and Japan, the Ministry of Education, independent intellectuals, and textbook writers adopted Sun's version of the narrative. This chapter will bring into focus the combined efforts from intellectuals, the state, and the commercial publishing industry to craft a great inventions narrative in middle school history and civics textbooks published between 1909 and 1949. This shows how China's history of science became an important subject around which China's modern fate was contemplated, and a vehicle for popularizing the Nationalist Party's vision of national reform and salvation.

## **Education Reform and Textbooks, 1860s-1928**

Discussion of the great inventions in the early twentieth-century was informed by efforts at education reform since the 1860s, which had sought to acquire for the wavering Qing Empire science and technology that would enable it to stand up to Western gunboat diplomacy. For much of Chinese history education was reserved for a tiny elite. The traditional curriculum and

imperial examination system, which focused on Confucian moral education, was mainly a means for the empire to recruit members of the bureaucratic class. The goal of universal education was not important to Chinese elites until the 19<sup>th</sup> century. New ideas of citizenship in the late Qing called for the mobilization of the entire population for the sake of the nation, and led to the call by reforming elites, especially after the Opium War of 1860, for universal (male) education.<sup>2</sup> They looked to foreign-established missionary schools (a concession granted to Western countries after the Opium War) and especially Meiji Japan, as models for imitation. In the late 19<sup>th</sup> century, Chinese intellectuals and political leaders looked to the West with its superior ships and cannons, and saw education as the key to attaining similar wealth and power. They came to see education reform as the key to China's national ills.

The first major effort at education reform was part of a larger range of activities to shore up the empire in the wake of the Taiping Rebellion and Opium War, collectively called the Self-Strengthening Movement. After the Opium Wars (1839-1842 & 1856-1860) leading to the humiliating Anglo-French occupation of Beijing in 1860, Qing officials began using the phrase "self-strengthening" to describe a series of regionally based initiatives for economic, institutional, and educational innovation. The strategy of the movement was to accommodate the Western powers diplomatically, while building up China's military strength through education, technology acquisition, and later industrialization. Though many of the initiatives were ultimate

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<sup>2</sup> Peter Zarrow, *Educating China: Knowledge, Society, and Textbooks in a Modernizing World, 1902-1937* (Cambridge: Cambridge University Press, 2015), 11.

failures or half-measures, the period opened debate on what was necessary to acquire that technology, especially how far China needed to go in changing its institutions.<sup>3</sup> The first such efforts were led by the powerful Qing statesman Li Hongzhang (1823-1901), including the establishment of the Jiangnan Arsenal and the Fuzhou Navy Yard in the 1860s. This educational-military complex produced relatively modern warships, taught Western science, technology, and foreign language, but still included instruction in the traditional Confucian curriculum. Between 1872-1881, Li Hongzhang organized the first Chinese scholars to study abroad in the United States, many of whom studied science, agriculture or engineering. The program ended abruptly when students began cutting their queues (the hair-style mandated for all men by China's Manchu leadership), neglecting their study of traditional Chinese learning, and converting to Christianity. Worse yet, the leader of the program, Yung Wing, had converted to Christianity himself and married an American woman. Yung Wing was reprimanded, and the remaining students ordered home, where many of them went on to work in the new Fuzhou Navy Yard, the Jiangnan Arsenal, the Telegraph Administration and other positions related to the "Self-Strengthening Movement" in which they would build up the empire's military and technological capabilities.<sup>4</sup> The logic behind self-strengthening was that Western science and technology was purely material, and could be acquired without changing traditional Chinese culture and learning. This was the meaning of the contemporary slogan "Chinese knowledge as the essence, Western

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<sup>3</sup> Kwang-Ching Liu and Ting-Yee Kuo, "Self-strengthening: The pursuit of Western technology" in *The Cambridge History of China, Vol. 10, Late Ch'ing, 1800-1911, Part I*, edited by Denis Twitchett and John K. Fairbank (Cambridge: Cambridge University Press, 1978), 491.

<sup>4</sup> Edward J.M. Rhoads, *Stepping Forth into the World: The Chinese Educational Mission to the United States, 1872-81*, (Hong Kong: Hong Kong University Press, 2011), 196.

knowledge for use” (*zhongweiti xiweiyong* 中为体西为用). Whatever the accomplishments of this movement, China’s humiliating loss in the Sino-Japanese War of 1895, in which the Japanese easily defeated the supposedly modern Beiyang Navy, signaled to Chinese elite and the world the inadequacy of its reforms.

A generation of more radical reformers emerged from the ranks of the “Self-Strengthening” programs, who looked to Japan and the West for superior models of national reform and began to see China’s crisis as a Social Darwinist struggle to the death between the races. The most important intellectual in this shift was Yan Fu (1854-1921). Yan studied naval science in England between 1877-1879 and helped train the Beiyang Navy. In 1895 he translated the work of Thomas Huxley and Herbert Spencer into Chinese, and popularized the idea of Social Darwinism that would reframe reform and revolution as the Han retaking their country from the foreign Manchu minority. During much of China’s history, boundaries between “Chinese” and “foreign barbarians” were defined culturally, and could be crossed by adoption of Chinese culture. But to Han nationalists in the late Qing, Social Darwinism suggested that the Chinese race was defined not by culture but by shared lineage. Drawing on traditional Confucian practices of ancestor worship, Han nationalists extended family loyalty to race loyalty. The Yellow Emperor (*Huangdi*), a mythical figure thought to have reigned between 2697 to 2597 BC, was elevated to the position of first ancestor of the Han.<sup>5</sup> In this view, the Han were pitted in an all-out-war against whites in which only the fittest would survive. Surveying the wreckage of

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<sup>5</sup> Frank Dikötter, *The Discourse of Race in Modern China*, (Stanford, Calif.: Stanford Univ. Press, 1992), 101.

Western imperialism on the “black” and “red” races, reformers increasingly saw the “yellow” Chinese as engaged in a struggle for survival against the white race.

In the late 1890s, intellectuals Liang Qichao (1873-1929) and Kang Youwei (1858-1927) channeled this deeper sense of national, racial crisis into a more radical platform of institutional and educational reform than had ever before been attempted. They looked to Japan as racial brethren with a superior model of reform. There, the “Meiji Restoration” (1868-1912) had coordinated a national overhaul of Japanese education, its political system, and society toward a Western model that simultaneously protected conservative, Confucian values and shored up the Emperor as the national divine leader. Liang and Kang advocated for this type of reform, and focused foremost education. For them and their allies, popular education seemed like a panacea for China’s problems. On the one hand, schools could teach a new generation the skills necessary to modernize and strengthen China. On the other, they could promulgate nationalism and loyalty to the state.<sup>6</sup> In 1898, these intellectuals won support of the young Guangxu Emperor, and began what would posthumously be called the “One-Hundred Days Reforms”, an attempt to overhaul educational and political institutions along Western lines with guidance from Japanese advisors. Unlike the regionally-based “Self-Strengthening Movement,” this program was centrally led and national in scope. A coup led by the Empress Dowager Cixi spelled its defeat and the exile of its leaders. Nonetheless, a decade later the Empire would enact the “New Policy reforms” (*xinzheng* 新政) of 1902 to 1908, which repeated some of the earlier 1898 plans. Most significant was the

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<sup>6</sup> Peter Zarrow, *Educating China*, 17.

abolition of the civil service examinations, the establishment of modern schools, and the sending of students abroad.<sup>7</sup>

The 1911 Revolution that transformed China from an empire into a republic led to a long period of tumult in education. The new government opened a Ministry of Education, that set a national curriculum standard and accelerated of educational reform. However, when General Yuan Shikai (1859-1916) orchestrated a coup and declared himself the new emperor of China in 1915, he also sought to turn education back toward the Confucian curriculum of the past. But as Yuan quickly lost control and the country devolved into a long period of fractured local warlord control, the Warlord Period (1916-1928), the Ministry of Education in Beijing also lost its authority over curriculum beyond its borders. Scholars of the Republican era have retrospectively seen the period as a golden age in culture, when the weakening of the central state allowed the blossoming of a vibrant media culture in China's urban centers, nurturing a public sphere amongst an increasingly literate population.<sup>8</sup> It was also a period of experimentation and diversity in education. Education became much more locally determined, resulting in what some have seen as a golden age of experimentation in pedagogy, in which liberal intellectuals dominated key positions in state institutions and publishing companies. Rather than follow a centrally directed curriculum, provinces, counties and individual schools took the reins, and introduced many foreign methods and textbooks. Rival administrations

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<sup>7</sup> Immanuel Hsu, *The Rise of Modern China, 6th ed.* (New York: Oxford University Press, 2000), 412.

<sup>8</sup> Eugenia Lean has most strongly argued for the growth of a public sphere in urban centers during this period in: Eugenia Lean, *Public Passions: The Trial of Shi Jianqiao and the Rise of Popular Sympathy in Republican China* (University of California Press, 2007).

operating their own school systems in Guangzhou, Hankou, Shanghai and Nanjing. While some provinces like Shanxi heavily invested in education and drew on modern education philosophies like those of John Dewey, up to forty percent of government schools were still made up of the traditional private schools with their Confucian curriculum.<sup>9</sup>

The growth of popular education from the first several decades of the twentieth century created demand for modern textbooks that transformed the economics and politics of textbook production. The traditional private schools had managed their own purchase of textbooks that taught the Confucian classics, a curriculum that was largely dictated by the need to prepare students for success in the imperial examination. But now the state itself was negotiating with publishers over the production and purchase of textbooks. The largest publisher to serve this new demand was the Commercial Press (*shangwu yinshuguan* 商务印书馆, f. 1897), whose editors shared the mission of reformers to educate the broader population, and saw in the new school system a financial opportunity in textbook publishing. Once it began setting the curriculum for schools in 1905, the state suddenly had a never-ending demand for textbooks to be used in the new schools, and became the publishing industry's biggest, and most reliable customer. From the financial standpoint of the publishing industry the fracturing of the market during the Warlord Period was a challenge, as they now had to compete fiercely from province to province, amounting to a "textbook war" to court local contracts.<sup>10</sup> More publishers emerged, largest

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<sup>9</sup> John Cleverley, *The Schooling of China: Tradition and Modernity in Chinese Education*, 2<sup>nd</sup> ed., (North Sydney: Allen and Unwin, 1991), 45.

<sup>10</sup> Christopher A. Reed, *Gutenberg in Shanghai: Chinese Print Capitalism, 1876-1937* (Vancouver: UBC Press, 2004), 204.

among them the Zhonghua Books (*Zhonghua Shuju* 中华书局, f. 1912) and World Books (*Shijie Shuju* 世界书局, f. 1917), also based in Shanghai. But the Commercial Press would still dominate, controlling 65 percent of the textbook market by the 1930s.<sup>11</sup>

### **The Great Inventions in Textbooks, 1909-1923**

The great inventions narrative deeply resonated with the modernizing mission of the new state schools and the historiography adopted by the Shanghai-based textbook publishers, which was characterized by progressivism, the integration of world and local history, and the taking of the nation as the subject of history. Prasenjit Duara has most eloquently made the case that the transition of China from empire to nation-state was mediated by the advent of a progressive, Enlightenment history, which had the power to define the national community, its values and dilemmas, and its potential future. The logic of progressive history and the question of China's own history of science and its potential to become "modern" were topics of obsession for the most prominent intellectuals involved in the new education system, like Yan Fu, Liang Qichao, and Kang Youwei. After the establishment of China's first Republican Government in 1912, the new progressive, nationalist historiography dominated the growing state school system. I will examine the key features of the great inventions narrative as it appeared in textbooks in this period.

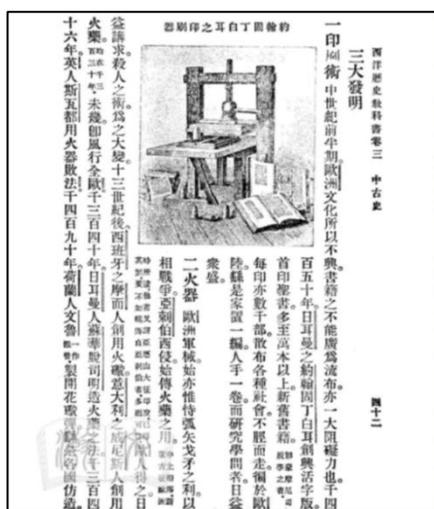
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<sup>11</sup> Hsu, *The Rise of Modern China*, 6th ed., 281.

First, the great inventions narrative established the Chinese nation, with a strong racial component, as the subject of history. This was apparent in the oldest example of the great inventions narrative I have found, the 1909 *Western History Textbook*; this is also the first time the phrase “three great inventions” (*san da faming* 三大发明) was used in Chinese.<sup>12</sup> Written during the final years of the Qing Dynasty, the only part of the text mentioning their Chinese origins reads:

[On gunpowder:] People of the Central Plains (*zhongtu* 中土) passed it through the Mongolian Empire to Europe....

[On the compass:] The [people of the] Central Plains (*zhongtu* 中土) invented it the earliest. The Duke of Zhou created the south-pointing cart, and promptly used it. Afterwards it spread to the Western Regions (*xiyu* 西域), where the Hui people obtained it, and it transferred toward Europe.<sup>13</sup>



The earliest appearance of the three great inventions (*san da faming* 三大发明), in *The Western History Textbook* (1909), with illustration of Gutenberg's printing press.

<sup>12</sup> Fu Yueye 傅岳叶, *Xiyang Lishi Jiaokeshu* 西洋历史教科书 [Western History Textbook], 1909.

<sup>13</sup> *Ibid.*, 42-43.

In this textbook's telling, the three great inventions (printing, gunpowder, and the compass) had enabled the spread of books across Europe, unleashed the "wanton killing-power" of cannons, and led to Columbus' discovery of the New World. The inventions are credited *zhongtu* (中土), a synonym for China (*zhongguo* 中國) that specifically refers to the central plains region located in the middle and lower reaches of the Yellow River, including most of Henan, western Shandong, Hebei, and southern Shanxi. But in the late 19<sup>th</sup> and early twentieth century, words like *zhongtu*, *zhongyuan* (中原), and *zhongguo* (中国) became mixed with new racial language of the "people of the Central Plains" as a homogenous ethnic group, that Han, which stood apart from the Manchu rulers of the Qing and other ethnic minorities. In an era when race-by-lineage was gaining currency, we could understand *zhongtu* as code for "the Han race". As historian Mark Elliot has written, the very definition of "Han" is as "a label for people who, by descent, language, and cultural practice, were recognized as Central Plains dwellers (or their descendant)."<sup>14</sup> The text thus makes *zhongtu*, or the Han of the Central Plains, into the subject of history, suggesting their equivalence to the other Western countries with which they share the narrative. Nevertheless, there is only brief mention that gunpowder and the compass originate from *zhongtu* before the narrative goes off to other countries like Italy, Spain, or Holland. Printing is not even said to originate in China, but is credited to the German Empire and

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<sup>14</sup> Mark Elliot, "Hushuo: The Northern Other and the Naming of the Han Chinese", in Thomas Mullaney et. al. (eds.), *Critical Han Studies: The History, Representation, and Identity of China's Majority* (Berkeley: University of California Press, 2012).

Gutenberg, whose printing press is given a large illustration.<sup>15</sup> Though the Han of the central plains are elevated to nation-state in this narrative, their role is relegated to a kind of footnote. The narrative makes little of the inventions' origins, treating them as merely the preamble to the story Europe's rise.

After the Nationalist Revolution in 1911, textbooks used the great inventions to project the Chinese national community far back into the past. The first example of the great inventions in a textbook about Chinese history is Fu Yunsen in 1913.<sup>16</sup> Published immediately after the establishment of the Republic of China, this famous textbook series was in use in elementary schools throughout the decade. Fu's passage on the great inventions put China at the center of a story that spanned millennia.

Chinese technology has three successes in the world: First is the compass. The Yellow Emperor (2698–2598 BC) and the Duke of Zhou created the south-pointing cart, the compass arose from this. In the age of the Tang and Song (618–1279 AD), maritime trade was at its prime, through the Maritime Transport Department in Guangzhou and Hangzhou, Chinese sailing days were many, the compass was even more useful for navigation. Second is printing. Three generations of Chinese script, and characters cut in bamboo, and written on silk cloth, in the Han era (206BC–220AD) paper began to be used, but hand copying required a lot of labor, to make a book was not easy; by the Five Kingdoms Era (907–960AD) the method of wood-block printing was tested. Third is gunpowder. China since ancient times, used bows and artillery to shoot weapons at a distance. In the Song Dynasty (960–1279AD), the art of gunpowder began to flourish, and it was already used in warfare. These three items all entered Europe, and thereupon began Euro-American modern-day culture.

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<sup>15</sup> Zhang Zhongmin 张仲民, “*Lishi shuxie yu jiyi suzao (xia) – gutengbao zai jindai zhongguo*” 历史书写与记忆塑造(下) - 古腾堡在近代中国 [Historical Writing and Memory (Pt. II) – Gutenberg in Modern China] (*Xueshu yuekan* 学术月刊 [Academic Monthly], No. 5, 2012). This article describes the appearance of Gutenberg in Chinese historical writing of the late Qing and early Republic, but does not mention any such textbooks that ignore printing's Chinese origins like this one does. So, this is probably an unusual case.

<sup>16</sup> Fu Yunsen 傅运森 (a.k.a. Fu Weiping 傅緯平), *Gongheguo jiaokeshu xin lishi* 共和国教科书新历史 [New History Textbook of the Republic] (Shanghai: Shangwu yinshuguan [Commercial Press], 1913).

By tracing the development of the inventions, the narrative unites thousands of years of Chinese history into one narrative. Crediting the compass to the Yellow Emperor anchors the entire narrative to the origin of the Han race. The Yellow Emperor had since the Han dynasty been revered as the mythical founder of China, who supposedly invented Chinese medicine, wheeled vehicles, the calendar, Chinese script, and the south pointing cart. But his reinvention as the initiator of the Han race gave him an important place in the new history textbooks, as father of the Chinese nation. However, textbook writers had to walk a thin line in their representation of race in Chinese history. After the 1911 Revolution, anti-Manchu sentiment had to be replaced with an effort to unite the diverse country under one flag. Thus, history textbooks offered multiple visions of the national community, be it racial, cultural, or territorial. They pointed to the religious, cultural, and linguistic diversity of China, as well as its economic unevenness, indicating that the unification of the nation-state was yet to be achieved. Ultimately, they reproduced the position of the Republican government that China's national people was a "union of the five peoples in the Chinese Republic" (*wuzu gonghe* 五族共和), but they differed in portraying that union as one of Sinicization in which minorities adopted Han culture, or of an inter-mingling of equal races and cultures.<sup>17</sup> Many accounts of the great inventions during this period emphasized the role of the Yellow Emperor, which points to an emphasis on the Han race as the dominant subject of Chinese history. In the final sentence of this passage, the fruits of this self-contained Chinese subject is transferred to the Western other, sparking Western modernity.

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<sup>17</sup> Robert Culp, *Articulating Citizenship* (Cambridge, Mass.: Harvard University Press, 2007), 56-7.

Mongols and the Middle East, the conduits of the inventions from East to West, are written out of the story.

The other aspect of the new historiography contained in the great inventions narrative was that it linked China to a progressive world history. After the establishment of the Republican Government in 1912, the new curriculum required that students learn about the rise and fall of famous nations, the flourishing of various civilizations, and “connections” between foreign and Chinese history. During the 1920s and 1930s, this curriculum evolved into an “integrated history” approach that suggested combining Chinese and foreign history into a single narrative. In 1923, New Culture Movement intellectuals like Hu Shih, Gu Jiegang (1893-1980), and Liang Shuming (1893-1988) rewrote the curriculum, stressing that equal time be given to Chinese and Western history. Historian of Chinese education Robert Culp has written that this “subsumed Chinese history within a master-narrative of progressive change, European-style modernization, and imperialism.”<sup>18</sup> The 1923 curriculum required that students master the following material: “I. Know the circumstances of human cultural evolution; II. Know the general circumstances of this and other countries’ change in political form.”<sup>19</sup> This was part of emphasizing China’s participation in the overall evolution of world culture toward the end-point of the modern, Western empire, the epitome of civilization’s evolution and model for Chinese imitation. In one

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<sup>18</sup> Reed, *Gutenberg in Shanghai*, 214-215.

<sup>19</sup> *Ibid.*, 215.

junior-high school textbook mention of the great inventions, this amounted to a history of mutual exchange between China and the West, through the Mongolian Empire:

“The Mongolian Khan repeatedly summoned people from afar, the Semu [a class of Central Asian allies of the Mongols in China] allowed them all to be hired. Through this Western astronomy, mathematics and artillery were introduced into China. The Chinese compass needle and printing also at this time were transmitted into Europe.”<sup>20</sup>

As can be seen here, the importance of the great inventions is minimized, even compared to the earlier 1913 textbook. In this period of 1906-1927, the great inventions only rarely rises up to even take on a life of its own, beyond being a footnote in China’s imperial history.

The importance of the great inventions were also diminished by New Culture intellectuals, who saw science and technology as the key to national salvation, but saw China’s own history of science as a dismal failure. Springing from the May Fourth Movement of 1919, members of the New Culture Movement formulated a new idea of science and program for China’s intellectual, educational change. New Culture intellectuals like Chen Duxiu (1879-1942) made “Mr. Science”, along with “Mr. Democracy”, the mascots of their vision for China’s future. But the “science” Chen and his allies envisioned was more than just the practice of science in the lab, or the acquisition of new technology. As historian Wang Hui has argued, it was a “moral awakening” that amounted to a new religion in and of itself, a rational, critical attitude toward ethical and social life that would totally replace Confucianism.<sup>21</sup> Summing up

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<sup>20</sup> Zhao Yusen 赵玉森, *Xinzhe Benguoshi - Shang* 新着本国史 - 上 [New National History – Vol. 1], Shanghai: Zhonghua Shuju, 1922.

<sup>21</sup> Wang Hui, “The Fate of “Mr. Science” in China: The Concept of Science and Its Application in Modern Chinese Thought,” *Positions: East Asia Cultures Critique* 3, no. 1 (1995).

this notion of science as the opposite of superstition, Chen declared in the inaugural issue of *New Youth*, the defining journal of the movement, “Be scientific, not imaginative.”<sup>22</sup> New Culture historian Hu Shih funneled this spirit into a “scientific” approach to history, influenced by John Dewey, that emphasized the need for empirical evidence for historical claims. Hu Shih hoped that bringing Western enlightenment logic to bear on Chinese history and culture would bring about a “Chinese Renaissance”. Rather than planes, the telegraph, and modern guns, science to this group was a cultural, intellectual principle of study. Only through personal, internal change in thinking by individuals, they reasoned, could the nation be transformed.

A disciple of Hu Shih, historian Gu Jiegang, conveyed this philosophy in his 1923 junior-high school textbook series, *History of China*.<sup>23</sup> Hu and Gu became the leaders of the “Doubting Antiquity School” (*yigupai* 疑古派) of scholars, advancing more rigorous methods of textual analysis and archeology in the writing of history, criticizing ideological or imprecise mythologizing of past histories, and rejecting the entire Confucian view of early Chinese history as later forgeries.<sup>24</sup> Gu also argued that intellectuals should stand apart from the interests of the state to be apolitical seekers of truth, and strip Chinese history of “myths” (a new concept itself)

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<sup>22</sup> Chen Duxiu 陈独秀, “*Jinggao qingnian*” 敬告青年 [Call to Youth], *Qingnian zazhi* 青年杂志 [New Youth Magazine], vol. 1, no. 1 (Sept. 15, 1915).

<sup>23</sup> Gu Jiegang 顾颉刚 and Wang Zhongqi 王鍾麒, *Benguo shi - xiandai chuzhong jiaoke shu* 本國史—現代初中教科書 [History of China for Junior High School], 3 vols. (Shanghai: Shangwu yinshuguan [Commercial Press], 1929), originally published in 1923 and 1924.

<sup>24</sup> Endymion Wilkinson, *Chinese History: A Manual* (Cambridge: Harvard University Asia Center. 2000), 345.

that supported political ideologies, like the legend of the “Yellow Emperor”.<sup>25</sup> In the first volume of his 1923 textbook, Gu Jiegang challenges the actual existence of the “Three Sovereigns and Five Emperors” (*sanhuang wudi* 三皇五帝), the legendary founders of that included the Yellow Emperor. Listing the inventions of fire, farming, and government these figures supposedly bequeathed to the Chinese people, Gu writes that “Probably the emperors of ancient legend can only be said to be symbols of several important changes in the history of culture,” (24) that the Yellow Emperor “represents the period of political organization” that actually occurred over more than a thousand years, and that he is more of an “ideal character” whose “legend represents the embryonic period of the nation”.<sup>26</sup> The compass, which other textbook writers had credited to the Yellow Emperor, is not mentioned, nor is gunpowder. Printing however is given a lengthy and glowing passage on the very last page of the first volume, described by Gu as the “bright star” that brought China out of the “deep darkness” of the Five Dynasties and Ten Kingdoms period (907-960 AD), transferred to Europe, and “contributed to the civilization of the world”.<sup>27</sup> Gu’s appraisal of printing was much in line with previous textbook accounts that saw it as having a profound and positive effect on Chinese and European civilization, but he ignored the compass and gunpowder as significant Chinese inventions worthy of mention, not to mention the possibility of the possible invention of the compass by the Yellow Emperor. His dismissal of the

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<sup>25</sup> Laurence A. Schneider, “From Textual Criticism to Social Criticism: The Historiography of Ku Chieh-Kang.” *The Journal of Asian Studies* 28, no. 4 (1969): 771–88.

<sup>26</sup> Gu and Wang, *Benguo shi*, 24.

<sup>27</sup> *Ibid.*, 193-194.

Yellow Emperor as mere “legend”, and the inventions of the founding sages of the nation as merely “symbols” of longer periods of history would flew in the face of the more stridently nationalist history that would soon bubble to the surface.

## **Sun Yat-sen’s Great Inventions, 1924**

This roots of the turn in the great inventions narrative came in 1924, when Sun Yat-sen, the revolutionary leader of the Nationalist Party (*Guomindang* 国民党), included it in his grand philosophy, *Three Principles of the People* (*sanmin zhuyi* 三民主义). One of the most influential treatises in modern China, Sun’s three principles - nationalism, democracy, and livelihood - would serve as a guiding ideology of the Northern Expedition to reunite China, and subsequent Nationalist rule.<sup>28</sup> Much less known, however, was Sun’s reference to the great inventions in the same text, which suggested how they, like nationalism, democracy, and livelihood, were also part of the blueprint for uniting China. Sun wrote:

China invented such important things as the compass, printing and gunpowder; today, foreign countries know how to take advantage of them, so today, they are strong... From this it can be seen that in ancient times China did not lack ability; because of subsequent loss of ability, our nation’s status gradually deteriorated. Now, to recover our inherent status, we must first restore our inherent abilities together.<sup>29</sup>

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<sup>28</sup> The three principals were: nationalism – to bind the nation together and overthrow its oppressors; democracy – to awake the nation and unify it politically; and livelihood – to alleviate poverty through cooperative effort.

<sup>29</sup> Sun Yat-sen, *The Triple Demism of Sun Yat-sen*, translated by Paschal M. D’Elia (New York: AMS Press Inc., 1974), 203.

In this passage, Sun's idea of the "ability" of the Chinese is rooted in a progressive Social Darwinism that suffuses his political philosophy. Appearing in chapter six, "China as a Great Power: Three Practical Means to Attain that End", Sun embeds a great inventions narrative into the discourse of China's national survival through mastery of modern science and technology. Rather than sweep away the past as his more iconoclastic New Culture contemporaries urged, Sun Yat-sen proposed to rebuild the nation on it. Sun writes that in order to become a great power again, Chinese must reclaim native morality - Confucianism - and return to ancient knowledge and ability - of which the great inventions are a prime example. Only by restoring those shared values and abilities could the nation successfully adopt the modern science and technology necessary to stand up to foreign powers. Sun poses this challenge entirely in the terms of a Social Darwinist struggle for survival between the races. Sun saw the Chinese race as facing the threat of extermination, as they had fallen behind the West in previous centuries. But the great inventions narrative suggests that the Han have an "inherent ability" (*guyou de nengli* 固有的能力) and "inherent status" (*guyou de diwei* 固有的地位) that can be reclaimed, despite centuries of decline. This racial ability suggests that China's national crisis in the 1920s reflected a temporary loss, not a permanent lack of the Chinese nation-state.

The great inventions became a cornerstone in this progressive narrative, in which the Chinese could *learn* (*xue* 学) their way out of the crisis, as laid out in the following passage:

But is it very difficult for us to learn from the foreigners? The Chinese always believed that the knowledge of foreign machinery was very difficult and that it was not easy to learn it. They did not know that flying in the air is considered by the foreigners as the most difficult (accomplishment). Their latest invention was the airplane. Now we daily see at Dashatou (大沙头 in Guangzhou) airplanes flying in the air. And are these aviators not Chinese? If the Chinese could learn to fly, what other difficult thing can they not learn? With their excellent foundation (of knowledge) and with their civilization dating back thousands of years, the

Chinese can learn anything if they will but go and learn from the foreigners. With our abilities we can learn all the good points of the foreigners.”<sup>30</sup>

In Sun’s telling, the ability of Chinese pilots to master the airplane is like the great inventions, because it proves that the Chinese can master technology. Contemporary readers would have been familiar with exciting new inventions like the airplane, the apogee of Western technological ability according to Sun. In fact, in Chinese newspapers of the 1910s and 1920s, it was these kinds of contemporary, Western inventions that transformed everyday life - the airplane, electricity, the telephone, submarines - that received the most coverage. The Chinese press and popular literature celebrated the inventor of electricity, Thomas Edison, and inventors of the airplane, the Wright Brothers, while at the same time, many Chinese intellectuals had declared that China had no history of science to be spoken of at all.<sup>31</sup> But once one accepts the Social Darwinist logic that race determines ability in science, this lack of scientific achievements equates to a racial deficiency, and an inability to modernize. The racial determinism Sun bought into turned the history of science into a heritage of the race that was the basis of future achievements. Sun argued that Chinese could catch up with and surpass the other great powers, the logic went, because China had her own Thomas Edison’s and Wright Brothers’, her own great inventors who had made great contributions to the world in her ancient past. From the basis

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<sup>30</sup> Sun, *The Triple Demism of Sun Yat-sen*, 203.

<sup>31</sup> The most important examples of this argument as identified by Nathan Sivin: Jen Hungchün, “Shuo Chung-kuo wu k’o-hsueh chih yuan-yin” (The reason for China’s lack of science), *Ke Xue*, 1915, I: 8-13; Yu-lan Fung, “Why China Has No Science - An Interpretation of the History and Consequences of Chinese Philosophy,” *The International Journal of Ethics*, 1922, 32: 237-263; Homer H. Dubs, “The Failure of the Chinese to Produce Philosophical Systems,” *T’oung Pao*, 1929, 26: 96-109; Derk Bodde, “The Attitude toward Science and Scientific Method in Ancient China,” *T’ien Hsia Monthly*, 1936, 2: 139-160; and Rhoads Murphey, “The Nondevelopment of Science in Traditional China,” *Papers on China*, 1947, 1:1-30.

of inherent abilities proven in the past, Chinese can “study foreigners” (*xue waiguoren* 学外国人), and “no matter what issue it all can be learned” (*wulun shenme shi doukeyi xuededao* - 无论什么事都可以学得到). Scientific ability, therefore, is not an *essentialized trait*, but an *acquired skill* available to a capable race.

Unlike those “New Culture” intellectuals, Sun saw his mission as more than inculcating a cultural renaissance; Sun’s revolutionary *Three Principles of the People* was a call to arms. In the context of the dissolution of the Republic and the scourge of warlordism, his document, hastily drawn up from lectures given in 1924, was an attempt to create national unity. It soon became a rallying cry for the Northern Expedition, which would begin shortly after its publication, to reunite China. Near the end of this chapter, Sun writes, “Thus the next ten years will be years of life or death for us. If we awake, as the Japanese did; if, trembling with fear, we recapture our national standing, in ten years we shall be able to rid ourselves of any kind of foreign oppression, political, economic, and ethnic, and any kind of misfortune.”<sup>32</sup> Though Sun would die a year after the book’s publication in 1925, his party - the Nationalist Party - would attempt exactly that, launching the Northern Expedition against warlords and the Beiyang Government to unify China in 1926. After several years of war and bloody intra-party struggles, Chiang Kai-shek emerged as the leader of the Party, and established the capital in Nanjing in 1927. Chiang instituted a period of military rule as a theoretically temporary first phase while the

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<sup>32</sup> Sun, *The Triple Demism of Sun Yat-sen*, 205.

regime unite the country. Chiang took the *Three Principles of the People* as the Party's guiding ideology and blueprint for democratic republican government that it intended to form.<sup>33</sup> But even more than this, the regime made a posthumous cult of Sun Yat-sen and his writings.

Although the great inventions had already appeared in history textbooks as early as 1909, during the years of Kuomintang rule in China from 1927 to 1949, pressure from the regime and wide-spread wartime patriotism led to the dominance of Sun's version of the narrative. This cultural and political shift was made vividly clear in 1929, when the Kuomintang in Shanghai brought a fine of one million six-hundred-thousand dollars against the Commercial Press for publishing Gu Jiegang's *History of China for Junior High School*, citing Gu's dismissal of the "Three Sovereigns and Five Kings" as merely a myth. According to the Kuomintang complaint, by denying the existence of China's beneficent founders, Gu's textbook "disrespected the sages and broke the law... Only by having the common ancestors" the charge went, "can the Chinese be unified."<sup>34</sup> Facing a fine that would push them into bankruptcy, the Commercial Press ceased publication of Gu's textbook. In this incident, the Kuomintang signaled to textbook writers that the place of the Yellow Emperor in history was not to be questioned. Ignoring censure from the regime himself, Hu Shih came to Gu's defense, criticizing the regime as "reactionary" for their banning of the textbooks. He wrote that instead of the anticipated cultural liberation that the 1920s had promised, in their campaign to oust the Communists and unify the country under

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<sup>33</sup> Lloyd Eastman, *The Nationalist Era in China, 1927-1949*, (Cambridge: Cambridge University Press, 1986), 19.

<sup>34</sup> Chan Wai-keung, "Contending Memories of the Nation: History Education in Wartime China, 1937-1945," in Tze-ki Hon and Robert J. Culp ed., *The Politics of Historical Production in Late Qing and Republican China* (Boston: Brill, 2007).

conservative Sun Yat-sen thought, the Kuomintang had drained literary culture of all spontaneity and created “an absolutely despotic situation.”<sup>35</sup> Judging by the subsequent shift in textbook content, publishers got the message. Increasingly after 1929, the great inventions narrative in textbooks was embedded in a discourse of nationalistic self-congratulation and reference to the nation’s present need to develop science and technology. Not science in the sense that New Culture intellectuals like Gu Jiegang and Hu Shih meant, as a spirit of rigorous empiricism held above ideological, political, even national affiliation; but science as a means to state power.

### **The 1930s Turning Point**

The great inventions narrative did not acquire a consistently significant role in textbooks until the 1930s. This change was entirely due to the rise of the Kuomintang and their tighter control of education and textbook publishing. In 1927-1928, the Kuomintang Party unified China through the Northern Expedition, and at the same time instituted education reform policies that put the state in greater control of textbook content, orienting it toward ideological indoctrination. “Three Principles of the People” became the basis of the new curriculum, and the version of the great inventions Sun Yat-sen laid out there was reproduced in history and civics textbooks, appearing more often, with greater detail, and communicating a more stridently nationalistic message.

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<sup>35</sup> Hu Shih 胡适, “*Xin wenhua yuandong yu Kuomintang*” 新文化运动与国民党 [The New Culture movement and the Kuomintang], *Xin Yue* 新月, II: 6-7 (Sept. 10, 1929), 4.

That education would be the servant of the Party was made evident when during the fifth Party Plenum of August, 1928, when the Central Executive Committee voted to wrest control over educational policy away from educators themselves (a plan advocated by Peking University president and New Culture leader Cai Yuanpei), and put it entirely into the hands of the Ministry of Education, which was now under control of the Executive Yuan, and thus directly appointed by Chairman Chiang Kai-shek.<sup>36</sup> Party leadership agreed that “the nation should be ruled through the party” (*yidang zhiguo* 以党治国), but once they had control, they disagreed on what educational policy to pursue. As historian Suzanne Pepper has written, despite central control of education after 1928, its main feature was still constant flux, such that “no single generation of students between 1900 and the onset of the Japanese war (1937) would have found the system they entered as first-graders unchanged by the time they graduated from the secondary level.”<sup>37</sup> In the day-to-day running and financing of schools from 1928 to 1937, local government and elites still dominated. Nonetheless, the Ministry of Education did manage to enforce national regulations and curriculum of China’s schools.<sup>38</sup> They injected them with the nationalist ideology of *Three Principles of the People* - and along with it, Sun Yat-sen’s version of the great inventions narrative.

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<sup>36</sup> Allen B. Linden, “Politics and Education in Nationalist China: The Case of the University Council, 1927-1928,” *The Journal of Asian Studies* 27, no. 4 (1968): 763-76, 773.

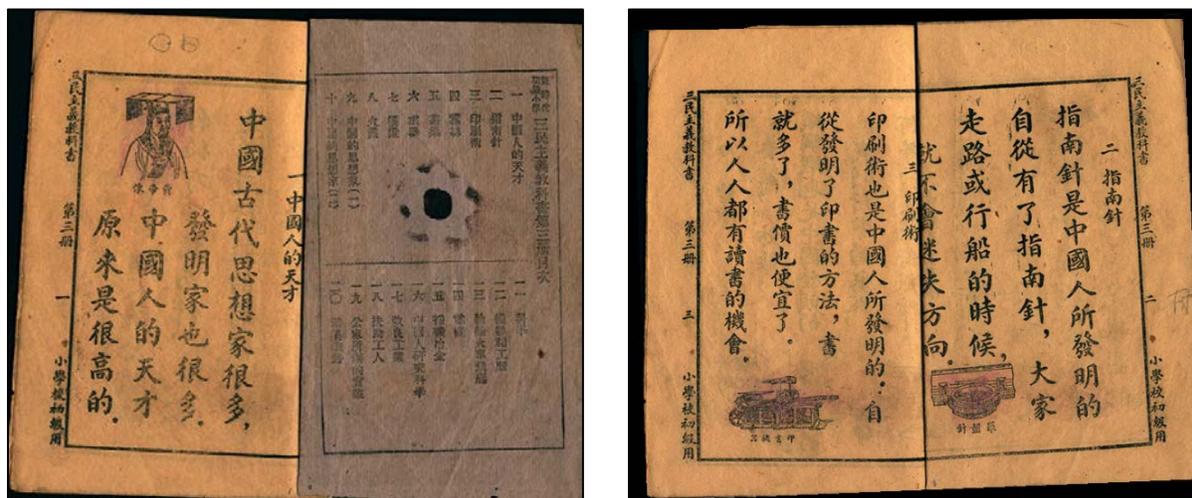
<sup>37</sup> Suzanne Pepper, *Radicalism and Education Reform in Twentieth Century China: The Search for an Ideal Development Model* (Cambridge: Cambridge University Press, 2000), 60.

<sup>38</sup> *Ibid.*, 70.

After 1928, all the features of the nationalist historiography - progressivism, the integration of world and local history, and taking the nation as the subject of history – remained consistent in textbook accounts of the great inventions. However, the tone of these narratives began to change. From 1906-1927, the inventions were usually embedded in a history of China’s mutual exchange with the world, most often only receiving a paragraph or a sentence within a longer section including flows of people and learning from outside of China in. After 1927, the great inventions were given more and more space in textbooks, including their own chapters. The effect of the inventions on the West was more accentuated. Some textbooks began to attribute the inventions to the Han race, and the role of the Mongolians, who were previously given more credit, was minimized. New buzzwords were attached to the narrative as well – “glorious” (光荣) in 1928; “contribution” (贡献) in 1933; “great contribution” (伟大的贡献) in 1939. These buzzwords, which glorify the inventions as national achievements China bequeathed to the world, became almost inseparable from the great inventions narrative up to the present day. Some textbooks even made a point of quoting Western historians who credited the Chinese with the originating the inventions, showing that even Westerners recognized China’s “contribution”.

The best example of this shift can be found in the *Three Principles of the People* textbooks, which were published beginning in 1927 as a replacement for civics readers. In that year, the Ministry of Education replaced the standard civics readers for children in grades 1-6 with *Three Principles of the People Textbooks*. While the original civics books had focused on teaching family, community and civic values, the new books focused entirely on loyalty to the

state. One of these readers from 1927 perfectly crystallizes the great inventions narrative from this period<sup>39</sup>:



**(Left image)** The natural talent of the Chinese people: Ancient Chinese thinkers were many, and inventors were also many. The genius of the Chinese people was originally very high. (Image: Portrait of the Yellow Emperor)

**(Right image)** Compass: The compass was invented by Chinese people. Since the compass, whenever anyone is walking the road or travelling by boat, they cannot get lost and lose their direction. (Image: compass)

Printing: Printing was also invented by the Chinese. Since inventing the method of printing books, books are numerous, the price of books is cheap, so everyone has the chance to read books. (Image: printing press)

<sup>39</sup> Zhu Zichen 朱子辰, *Xinshidai sanmin zhuyi jiaokeshu* 新时代三民主义教科书 [New Era Three Principles of the Peoples Textbook], (Shanghai: Commercial Press, 1927).



**(Not pictured) Science:** Although ancient China had many inventors and thinkers, because in the last one-hundred years we have not paid attention to science, everything has fallen behind.

**(Left image) Machines and Factories:** Because foreigners study science, they invented many kinds of machines. They opened factories, and produced huge sums of products.

Paddleboat, train, airship: Foreign scientists also invented the paddleboat, train, airship. Travelling on the water, on the ground, in the air is all convenient.

**(Right image)** [More Western inventions are described such as the electric light, telephone, telegraph, and methods of mining]...

**(Not Pictured) Chinese people research science:** The usefulness of science is extremely wide. We must solve the problem of the social welfare (*minsheng* 民生 – one of the “three principles” of Sun Yat-sen), we must make a supreme effort to promote science. Now the organization of Chinese scientific research is improving day by day.



**(Above Image)** Increase Construction of Railroad: Now China only has 6 or 7 thousand miles of railroad, it is really not enough to use. To make transportation convenient, transit quick, at least want to add 60-70 thousand miles of track.

Lifted straight from *The Three Principles of the People*, this narrative uses the great inventions as proof of the native talents of the Chinese people, but within a larger narrative of China's having fallen behind the West, and finally the urgent need to catch up in science and technology. Rather than tied to a historical narrative, the inventions along with famous philosophers are confirmation of national value, that the Chinese race innately has talent and potential. These past achievements confirm the task at hand – to embrace the spirit of invention, to study science, and to build more railroads. Past glories, the contemporary crisis, and the nation's salvation through science and engineering are all contained here, in this book that shows the dominant ideological narrative into which the great inventions was thrust during and after 1927.

Sun Yat-sen's use of history in service of political ideology also bled into history textbook accounts of the great inventions in the early 1930s. This especially came through in how textbook authors shifted the connection of China to the world. While previously they emphasized two-way exchange and the flow of information across the Eurasian continent, in the

1930s, the great inventions received more space before, and the mutual exchange was minimized. No longer were the inventions set beside the reception of Western science in China through Jesuit missionaries, but now stood alone as a glorious national achievement. A new phrase appeared at least in 1933, referring to the “contribution” of the Han race, which later was modified to the “great contribution”. These excerpts capture this new stridently nationalist version:

From *New Era History Textbook* (1928):

Printing, gunpowder, compass these three inventions, have the greatest influence on the world, this is the most glorious thing in Chinese culture.<sup>40</sup>

From *Revival Senior Elementary History Textbook* (1933):

The three great inventions of that era, can be called the Han race’s contribution to the world.<sup>41</sup>

From *Senior Middle School National History, vol. 1* (1933):

In the modern era, it seems unlikely that the Chinese nation has made any contribution to the world. However, in the past, we really did establish many glorious achievements. Namely, take the four great inventions into consideration, Chinese people do not know how many people of all humanity they have helped! Paper and printing, undoubtedly are the prerequisite objects for modern civilization; in military affairs the use of gunpowder, in maritime travel the use of the magnetic needle, how could the effect of these be sparse and small? Yet, these

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<sup>40</sup> Xu Jingxin 徐景新, *Xinshidai lishi jiaokeshu* 新时代历史教授书 [New Era History Textbook] (Shanghai: Commercial Press, 1928).

<sup>41</sup> Xu Yingchuan 徐映川, *Fuxing lishi jiaokeshu* 复兴历史教科书 [Revival Senior Elementary History Textbook] (Shanghai: Commercial Press, 1933).

four things, all were discovered the earliest in Chinese history!... Western people that strut about feeling complacent recently, cannot but praise our country.<sup>42</sup>

This final passage most fully represents the stridently nationalist great inventions narrative of the 1930s in history textbooks. Appearing in the introduction explaining “Why study our country’s history?”, it was also the first use of the term “four great inventions” (*si da faming* 四大发明) in a textbook. Divorced from the normal historical narrative of dynastic China, it more fully takes up the contemporary-facing nationalist themes. First, the author points out that it may be hard to believe China had a glorious past, indicating the depth to which China has fallen in its present state. Second, it makes a larger claim for the significance of the inventions historically, claiming that through them the Chinese people have helped all of humanity. Third, it turns this achievement into a competition, as it is noted that Chinese discovered them the earliest, before the Europeans. Finally, it criticizes foreigners for their complacency and registers their admiration. Rather than an integral part of one world story, the language here racializes China, making it discrete, its connection to foreigners not part of a process that might in turn change China, but a one-way “contribution”. This is a world history in which China remains bounded.

However, New Culture intellectuals did not go along with Sun Yat-sen’s version of the great inventions narrative, and contradicted, or even mocked, the idea that they proved anything positive about the Chinese people. Rather, much like many Westerners who saw China as a backwards and conservative country, they saw Chinese failure to fully utilize the inventions as a

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<sup>42</sup> Chen Dengyuan 陈登原. *Gaozhong benguoshi, shangce* 高中本国史 - 上册 [Senior Middle School National History, vol. 1] (Shanghai: Shijie Shuju [World Books], 1933).

mark of shame, a wrong turn in history that had led to Chinese inferiority in science. In 1930, Gu Jiegang wrote:

The armillary sphere...the compass-oh, what things the Chinese knew about natural science. But a group of The Orthodox Ones considered the Sagely Way to be important, while making light of ingenuity. Thus: Lost traditions! Decadence! (For example, the use of the compass by geomancy to determine feng-shui!)<sup>43</sup>

This comment was part of Gu's larger argument that the intelligentsia of antiquity had restricted Confucianism according to strict orthodoxy, and that these "Orthodox Ones" were committed to serving the ruling class, while ignoring quest for truth that could have led to natural science. It was the detachment of intellectuals from politics, of thought from action, that Gu argued had been necessary to take advantage of the compass, and in modern times would allow "pure" science to thrive in contemporary China.<sup>44</sup> Thus for Gu, the China's failure to develop the great inventions was due to its failure to grow an independent class of intellectuals.

Hu Shih similarly bemoaned the failure of China to develop the inventions in lectures delivered at the University of Chicago in 1933 titled "The Chinese Renaissance":

I am the last man to take pride in priority as such. Mere priority in invention or discovery without subsequent efforts to improve and perfect the original crudities can only be a matter for regret, certainly not for vainglory. When I look at a mariner's compass and think of the marvelous discoveries which the Europeans have made therewith, I cannot but feel a sense of shame to recall the superstitious

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<sup>43</sup> Gu Jiegang 顾颉刚, "Lun Kang Youwei bianwei zhi changzhi" 论康有为辨伪之成绩 [On the Contributions of K'ang Yu-wei's Critiques of Spurious Literature], *Guoli zhongshan daxue yuyan lishi xue yanjiusuo zhoukan* 国立中山大学语言历史学研究所周刊 [Journal of the National Sun Yat-sen University Institute of Advanced Philological and Historical Studies], 11:123 (May 26, 1930), 3.

<sup>44</sup> Laurence A. Schneider, *Ku Chieh-kang and China's New History: Nationalism and the Quest for Alternative Traditions* (Berkeley: University of California Press, 1971), 211.

uses which I myself have seen made of this great invention of ancient Chinese genius.”<sup>45</sup>

Speaking to a Western audience (in English) about his effort to revive certain aspects of ancient Chinese philosophy, Hu Shih here takes pains to recognize the failures of the Chinese past, the waste of the compass to “superstitious uses which I myself have seen made”. Having failed to utilize it, the invention of the compass instills “regret” and “a sense of shame”. The “pride” others had taken in the inventions, surely a reference to the stridently nationalist great inventions narrative advanced by Sun Yat-sen and reproduced in textbooks of the 1930s, was “vainglory”. In fact, Hu Shih was repeating a point many Westerners had made since at least the Enlightenment, that it was the development of the great inventions in Europe, rather than their initial discovery in China, that was historically important and worthy of praise.<sup>46</sup> Like them, Hu had seen elements of Chinese philosophy as having stifled the potential to develop modern science. But in this context, his derision of the proud great inventions narrative was also a critique of the conservative nationalism that he saw as stifling the flourishing of science and democracy in China.

Also in 1933, the famous left-wing writer Lu Xun (1881-1936) referred to the inventions in his essay, “The Advantages and disadvantages of Electricity”, in which he compared the

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<sup>45</sup> Hu Shih 胡适, *The Chinese Renaissance* (Beijing: Foreign Language Teaching and Research Press, 2013).

<sup>46</sup> This is laid out in Chapter 1 of this dissertation. For example in 1756, Voltaire wrote of the Chinese, “Nature seems to have bestowed on this species of men, so different from the Europeans, organs sufficient to discover all at once, what was necessary to their happiness, but incapable to proceed further: we, on the other hand, were tardy in our discoveries; but then we have speedily brought everything to perfection.” From Voltaire, *The Works of Voltaire: A Contemporary Version, Volume 13, part 1* (1901), 28.

benign use of objects like electricity, gunpowder, the compass, and even chili oil in China, versus their use in war and torture by foreigners. He made a mockery of the proud great inventions narrative:

Abroad, gunpowder was used to make bullets to fire at the enemy, in China, to make bamboo fire-crackers to ward off evil spirits; abroad, the compass was used to navigate the oceans; in China, it was used for fengshui; abroad, opium was used as a medicine, in China, it was eaten like food. It is the same type of object, but in China and abroad the use is not the same, electricity is also like this and that's all.<sup>47</sup>

Here, the historic mis-use of the compass and gunpowder is related to the more recent opium epidemic, and the contemporary torture of Chinese soldiers by the Japanese Army. In the context of the struggle against Japan, whose army had occupied Manchuria and even Shanghai the previous year, the notion of claiming pride in the great inventions was really an example of “Ah Q” (阿 Q) spirit – the famous subject of Lu Xun’s 1921 novel that won a victory in his own mind while failing utterly in reality.<sup>48</sup> For these New Culture intellectuals, the great inventions was evidence of the failures of Chinese culture to develop modern science and technology that was made painfully clear in the military and political crises of the 1930s. Celebrating the inventions, as Sun Yat-sen and now many textbooks had begun to do, could only blind Chinese to the cultural intellectual revolution that would allow science to flourish, and the nation to rejuvenate itself.

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<sup>47</sup> Lu Xun 鲁迅, “The Advantages and Disadvantages of Electricity” (*Dian de libi* 电的利弊), in *Complete Works of Lu Xun (Lu Xun quanji* 鲁迅全集), vol. 5. Beijing: People’s Literature Publishing House, 1981 (originally published 1933), 14-15.

<sup>48</sup> Lu Xun, *The Real Story of Ah-Q and Other Tales of China: The Complete Fiction of Lu Xun* (London; New York: Penguin Books, 2009).

## Political Consequences of Nationalist Turn in Textbooks, 1931-1949

This stridently nationalist turn in textbooks also raised the ire of foreign onlookers, which would have vital consequences for China's foreign diplomacy. In 1931, the Mukden Incident occurred, which was a staged event engineered by the Japanese military as a pretext for the invasion of Manchuria. Nationalism in Chinese textbooks became a way for Japanese to place the blame for this event on the Kuomintang Party. In 1931, Japanese author Motosada Zumoto published, in English, *Anti-Foreign Education in China*. It began,

No country has ever taken such pains to inculcate the hatred of foreigners in the minds of its young boys and girls as modern republican (?) China. [sic. The question mark here is in the original, pointing out the irony that China call itself a republic.] Special textbooks have been written on geography, history, civics, arithmetic, and so forth, skillfully incorporating in them well written lessons describing in insinuating language the wrongs, real or fancied, which the Chinese people have had to suffer at the hands of foreign Powers...<sup>49</sup>

Zumoto alleged that the textbooks had resulted in the Chinese developing an "abnormal mental condition", and that it was "Japan's misfortune to feel in a vital way the shock of an unavoidable clash with China in her headstrong pursuit of a fatal policy of antagonism to all foreign interests and claims within her borders."

A more serious study of Chinese textbooks, *Nationalism in Chinese Education* was published the next year by Robert Peake, and similarly rose alarm bells with the United States State Department. Based on research conducted from 1928-1929, Peake interviewed editors of

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<sup>49</sup> Motosada Zumoto, *Anti-Foreign Education in China* (Tokyo: The Herald Press, 1931), 1.

the Commercial and Zhonghua Press. Both editors bemoaned the new *Three Principles of the People* readers, one of them saying,

He thought these texts were not so good as the civic readers. Moreover, they were very difficult to write. A little too much emphasis in one direction, he said, led to Communism, and in the other direction to Imperialism...The San Min Chu I texts are striking in their lack of the conception of citizenship, and fail to show the child his relation to home, the family, and the community and to the international society. Nationalistic political thought predominates and all problems and relationships of life are seen from the national viewpoint....<sup>50</sup>

At the very moment that fascism and Nazism were gaining momentum in Europe, the notion of the Chinese regime inculcating a spirit of virulent nationalism in children, of skating a line leading in one direction to “Communism, and in the other direction to Imperialism”, was threatening indeed.

The Lytton Report, a commission conducted by the League of Nations to investigate the Mukden Incident, made a similar criticism of the textbooks. In their 1932 report, they wrote that a certain amount of nationalism was normal for a country in political transition, but saw the textbooks as evidence that the Chinese regime was taking this nationalism into a direction that could lead to a desire by Chinese to revive their former greatness, kindle the flame of hatred, and thus threaten Western interests in Asia:

In addition to the natural desire to be free from any outside control in a people that has become conscious of national unity, the influence of the Kuomintang [the Nationalist Party] has introduced into the nationalism of China an additional and abnormal tinge of bitterness against all foreign influenced, and has expanded its aims so as to include the liberation of all Asiatic people still subject to “imperialistic oppression”. This is partly due to the slogans of its early

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<sup>50</sup> Cyrus H Peake, *Nationalism in Chinese Education* (New York: Columbia University Press, 1932), 119.

communistic connection. *Chinese nationalism today is also permeated by memories of former greatness, which it desires to revive.* [emphasis added]

...June 1 1931 Provisional Constitution of China says “The Three Principles of the People” shall be the basic principles of education in the Republic of China.” The ideas of Dr. Sun Yat-sen are now taught in the schools as if they had the same authority as that of the Classics in former centuries. The sayings of the master receive the same veneration as the sayings of Confucius received in the days before the Revolution. Unfortunately, however, more attention has been given to the negative than to the constructive side of nationalism in the education of the young. A perusal of the text-books used in the schools leaves the impression on the mind of a reader that their authors have sought to kindle patriotism with the flame of hatred, and to build up manliness upon a sense of injury.<sup>51</sup>

By the time the Lytton Report was published, Japan had already exited the League of Nations, the sponsor of the report, thus guaranteeing its demise. In retrospect, the critique of an aggressive Chinese nationalism in 1932, when the Japanese Empire occupied Manchuria by force, seems absurd. Nonetheless, the report showed the diplomatic consequences China had to pay for the kind of nationalism being pursued under the Nationalist Party, whether or not the accusations were justified. In response to the Lytton Report, the state ordered the textbooks to be revised yet again, in 1933. However, the government’s concession to Japan directly contributed to the December 9th Movement, a patriotic mass protest in Beijing that called on the Chinese government to actively resist Japanese aggression.

During the war with Japan in 1937-1945, textbook writing was taken over by the Ministry of Education entirely. The Minister of Education, Chen Lifu (陈立夫 1900-2001), the former personal secretary to Chiang Kai-shek and head of the Investigation Section of the

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<sup>51</sup> George Hubbard Blakeslee, *The Lytton Report* (New York: Foreign Policy Association, 1932), 19.

Organization Department of the Nationalist Party, was appointed in 1938. In the first meeting of the History and Geography Team in May 14, 1940, he made the ideological work of history education explicit. This meeting was a chance for administrators to organize the curriculum requirements for each area of history. Chen delivered the opening remarks:

If we can teach history well, we can develop nationalism, if we can teach geography well, this can be used as the basis for construction of infrastructure, and promotes the people's livelihood [one of the "three principles of the people"]. Then add citizenship, and political science [two other core classes in addition to history], then the reality of civil rights can be made clear. If these three things together, it truly is the most perfect "Three Principles of the People" curriculum...

The method of history should be focused on seeking truth, therefore the work of textual criticism can be handed over to a few specialized scholars to pursue to the best of their ability, and the matter of history in itself depends on devoted effort. But outside of method, we must bear in mind, the object of history education is for the sake of present day people, not people of the past, our aim must be for most people now to borrow the lessons of the past, to be aware of their current duties, and counsel them diligently. In short, in writing and teaching history, textual criticism is important, but when writing and teaching history, one should especially emphasize national glory (*minzu guangrong* 民族光荣) and exemplary people in making the narrative.<sup>52</sup>

Chen's speech shows the continuing commitment of the Kuomintang to Sun Yat-sen's *Three Principles of the People* as the basic ideology of education. Like Sun, Chen impresses on the many educators gathered at this that the "object of history education is for the sake of present day people" – this meant that history ought to play its part in bolstering the nationalism of the

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<sup>52</sup> *Jiaoyubu shidi jiaoyu weiyuanhui gaikuang* 教育部史地教育委员会概况 [Ministry of Education, History and Geography Education Committee Overview], "*Jiaoyubu shidi jiaoyu tuiyuanhui di yi ci quanti huiyi jilu*" 教育部史地教育委员会第一次全体会议记录 [Recording of the first plenary meeting of the Education Committee of the Ministry of Education] (May 14, 1940), Nanjing No. 2 Historical Archive box 5(2): 92.

people, and ultimately secure their loyalty in building up the country economically. In calling out the importance of textual criticism and “seeking truth” in the writing of history, Chen is referencing the historiographic principles of Nationalist Party critics like Hu Shih and Gu Jiegang. But this is immediately balanced by the demands of the present to inculcate nationalism. Rather than seek truth alone, history textbooks should “emphasize national glory (民族光荣) and exemplary people in making the narrative.” During the war, the Ministry of Education took full control of textbook writing, leaving the printing and publishing to the Commercial Press. Despite the difficulties of the war, education and textbook production in the service of promoting nationalism was still made a priority. The great inventions, as a source of racial and national pride, found a prominent place in this era of history education.

History textbooks written by the collaborationist government of Wang Jingwei also invoked the great inventions narrative to advance their own political objectives. During World War II, Japan supported a collaborationist government under the rule of Wang Jingwei in Nanjing, from 1940-1945. This regime also published their own history textbook that featured the great inventions.<sup>53</sup> The textbooks tell us how the Japanese collaborationist regime wrote a history that would combine admiration of China’s past, with its modern position as the “little brother” to Japan in a Pan-Asian empire. This Pan-Asianist vision is symbolized on the imagery of the textbook cover, which shows two boys sheltering from the rain under an umbrella.

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<sup>53</sup> Editorial Board of the Ministry of Education 教育部编审委员会. *National Textbook: Higher Primary School History, vol. 2* (*Guoding Jiaokeshu: gaoxiao lishi, dierce* 国定教科书：高小历史，第二册) (Shanghai: Huazhong Books, 1943).



The cover of *National Textbook: Higher Primary School History, vol. 2* (1943) produced under the Wang Jingwei regime, depicting two figures sheltered under an umbrella.

One striking feature is that this is the only textbook to truly attempt an “integrated history.” Rather than following dynastic history, the textbook mixes foreign and Chinese history, organizing chapters around famous figures and topics, with five out of twenty chapters devoted to foreign topics. Printing gets a stand-alone chapter in the Chinese context, as do the three great inventions, in a chapter that focuses on the world connections. Like the Nationalist textbook, this version expresses the idea that the Han race had made important contributions to world history. It was not the intention of the Japanese regime to diminish the nation-hood of China or diminish the esteem of China’s place in history. Rather the textbook sought to de-center it within a larger world history, and undermine the idea of its racial and cultural cohesion by emphasizing a history of racial conflict. In the spirit of undermining Kuomintang resistance to Japan, militaristic heroes of history were de-emphasized in favor of diplomats. But when it came to the value of science and technology - the collaborationist Regime, Japan, and the Nationalists were all on the same page.

After the end of World War II and just before the Communist Party would take China, UNESCO, a new international organization formed by the United Nations, sent a survey to the

Ministry of Education. The survey asked member states to analyze their textbooks from 1918, with attention to how the UN and its specialized agencies were represented, but also how the ideas behind them, of anti-racism and world-interdependence, and human equality were represented. The nationalist government had already been criticized before about the nationalism in their textbooks. Even if such attacks were unfair, they had clearly been sensitive to the opinion of their Western allies. UNESCO sent the letter April 13, 1949. It came with a survey, and also “Model Plan for the Analysis of International Understanding”. Many questions were focused on the coverage of the league of nations and UN, but the other half asked about the values represented in textbooks:

12. Are all races, nations, and nationalities treated fairly and justly? Are their contributions recognized? Are the same standards of scholarship, justice and morality applied to all?
13. Are controversial issues presented objectively and justly?
14. Are words and phrases which develop prejudice, misunderstanding and conflict avoided?
15. Are the ideals of human freedom, dignity, equity and brotherhood given adequate stress and support?
16. Is the world interdependence stressed? World ideals and heroes? The obstacles to the development of international co-operation? Is the need for international organization and co-operations recognized? Are the advances made in international co-operation since 1918 discussed?
17. Is there adequate background information on the efforts to develop peaceful relations between nations?
18. Is the concept of a just peace through international co-operations and law made clear?<sup>54</sup>

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<sup>54</sup> *Lian jiao zuzhi guanyu gaijin jiakeshu zengjin guoji xiangyu liaojie de wenjian je guanyu shu* 联教组织关于改进教科书赠进国际相互了解的文件及关于书 [Documents and related books of the Associated Organization on

Only ten days after the letter was received, on April 23, 1949, the Nationalist regime fled the capital at Nanjing when it was taken by Communist forces. Clearly the requested analysis was never completed. Nonetheless, the values it espoused were an important turn in the politics of history education globally that would affect the writing of history in China, and its perception abroad. The questions from UNESCO point to a new reigning set of values espoused by the UN to counter the nationalist turn that Sun Yat-sen, and many other leaders around the world, had taken history education in. Twentieth century history was given the greatest scrutiny in this survey, but the values represented in this passage also have an impact how one tells the history of science, and the great inventions narrative. Sun Yat-sen had made the inventions into proof of the racial ability of the Chinese, proof that it could master Western technology and stand up to foreign threats. The turn in the inventions narrative after 1927 moved it away from showing how China was part of a flow of mutual exchange of knowledge, to one of national pride and self-sufficiency. UNESCO asked for histories that were fair to all “races, nations, and nationalities”, and “recognized their contributions”; that avoided prejudice; that stressed “world interdependence” and “world ideals and heroes”.

In fact, the great inventions would have a central place in the new vision of the history of science promoted UNESCO, through the efforts of Joseph Needham, the man who put the S (for

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improving textbooks for international mutual understanding] (April 1949), Nanjing No. 2 Historical Archive box 5-15258.

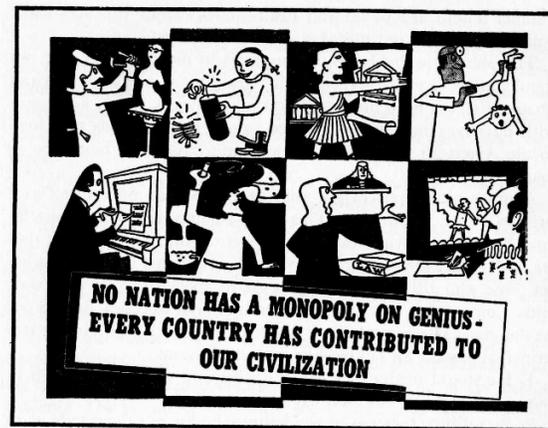
science) in UNESCO. Before the first volume of his famous *Science and Civilization in China* was published, he already brought its fundamental argument forward working with UNESCO. While studying the history of science in China during the war, he had developed the internationalist view that science “was the result of co-operation between men and the accumulation from one age to another,” and that “the peoples of the whole world have all made their contributions.”<sup>55</sup> Needham saw science as a unifying power in history, and hoped that UNESCO could unite scientists across the world into one cooperative community.<sup>56</sup> The great inventions, still considered by many Europeans as Western inventions, were the most well-known of the thousands of ideas and technologies that Needham would argue had originated in China. Needham was writing the new moral, political landscape into which the great inventions would soon be fit, both in the West, and by a new cohort of historians of science in the budding People’s Republic of China.

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<sup>55</sup> Joseph Needham and Dorothy Needham, *Science Outpost: Papers of the Sino-British Science Co-operation Office* (London: The Pilot Press Ltd, 1948), 120–121.

<sup>56</sup> Thomas Mougey, “Needham at the Crossroads: History, Politics and International Science in Wartime China (1942–1946),” *The British Journal for the History of Science* 50, no. 1 (2017), 83–109.

## Chapter 3: The Great Inventions for World Peace



From *America's Stake in Human Rights* (1949)<sup>1</sup>

The great inventions had a little-known intersection with the history of internationalism, the effort to ensure world peace through institutions of world governance. This 1949 cartoon is a prime example. The text makes a moral statement of equality that undergirded twentieth century-internationalism: “No nation has a monopoly on genius: every country has contributed to our civilization.” Identified by their national garb, the images above represent Greek architecture, French sculpture, English theater, Western music, chemistry, medicine, and British law. The sole non-Western nation pictured here is China, represented by a figure in Qing-era dress and queue lighting dynamite, signifying the invention of gunpowder. The illustrator here mistakes a dynastic identity as a national one. Gunpowder was invented around 850 C.E. during the Tang Dynasty (618-907 C.E.), long before the queue became the required national dress code of the

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<sup>1</sup> Ryland Wesley Crary, *America's Stake in Human Rights* (Washington: National Council for the Social Studies, 1949), 41.

Qing Empire. Yet the Qing queue, like the French beret, the Greek toga, the English judicial wig, are all easily recognizable symbols of nations in the modern era – even if they are anachronistic and stereotypical. The image raises China as the only non-Western nation to stand with European nations as an important contributor to “our civilization.”

Reacting to the rise of virulent nationalism and racism that had fueled World War II, educators, diplomatic and intellectual elites around the world produced images like this to build support for global governance. This image was produced by the National Council for the Social Studies, a professional association that made curriculum recommendations for K-12 teachers in the United States, and included in their 1949 pedagogical text, *America's Stake in Human Rights*. This text guided middle-school social studies teachers in how to prepare their students to participate in a new world order unified under values of equality between nations and races. It was the product of the efforts of the United States, the United Kingdom, and the Republic of China to establish a new body of global governance - the United Nations - that would not just usher in multilateral alliances, but also shared values. Images like this one promoted belief in human rights, universal brotherhood, and diversity that many hoped would build grassroots support for world governance and world peace.

This world history for world peace was defined by two important ideals – broadening the subject of history from nation-state to all humanity, and emphasizing progress through cooperation rather than competition and war. The above image exemplifies these ideals in action. First, the subject of history is expanded by the text, which text reads that “every country has contributed to *our civilization*.” What exactly is “our civilization” here? The narrative of human civilization had long been a pan-European story, but this book now included *all* nations as part of

one human community. The broadening of the historical subject beyond the confines of the nation-state, while at the same time maintaining national integrity, was a central and thorny issue amongst educators promoting the new world history. Second, science and technology are emphasized over politico-military achievements. The text reads that “every country has made contributions.” What constituted a “contribution” to this broadened subject of civilization? The images here do not represent political or military history, but culture, fine art, science and technology. As historians sought to find histories that might support the dream of world peace, the history of science was elevated in importance around the world. Besides celebrating achievements of the past, this history showed that science was a universal language in which all peoples could communicate and work together toward common goals, and the scientific community could even be a model for international relations. The great inventions earned China a seat at the table as an important nation that had contributed to world civilization. Just as the Republic of China was the sole non-Western nation on the original 1946 UN Security Council, so was it the sole non-Western nation in this new world history. As international politics were in the midst of a sea-change, so too were the terms of participation in world history.

But this image also shows that although the new world history ostensibly sought to tell stories of international connection and shared struggle, it could just as easily establish new hierarchies and narratives of individual national achievement. The images here, stereotyping each foreign nation’s contributions with images of their traditional national garb, ultimately reinforce national difference rather than the unity of humanity. In the balance between national autonomy and internationalism, “our civilization” is in danger of being reduced to an assemblage of reified nation-states. Gunpowder, like the Qing queue, reduce China to a contained national package that can easily be added into this hodge-podge representation of world civilization.

As *America's Stake in Human Rights* makes clear, the struggle to remake the world order after World War II led educators, political leaders, and publics around the world to reinterpret China's history of science. Into this moment of enormous potential change stepped Joseph Needham (1900-1995), a Cambridge scientist, political activist, and historian. More than anyone else in this period, Needham promoted study and recognition of the history of Chinese science and technology as integral to the success of world government and world peace. Needham is well known for his epic *Science and Civilization in China* (1954-2014), a multi-volume history of Chinese science and technology written with numerous other scholars that has turned the subject into a subfield in its own right. Less well known is that between 1937 and the early 1950s, Needham's promotion of the history of Chinese science was instrumental to his larger goal, to unify all humanity under world government, which he saw as mankind's natural evolutionary path. He pursued this agenda in his positions first as director of the Sino-British Scientific Cooperation Office (SBSCO) during 1942-1946, and from 1946-1948 as the director of the Natural Sciences Section of the United Nations Educational, Scientific, and Cultural Office (UNESCO), the cultural branch of the United Nations. Needham and the first Director of UNESCO, Julian Huxley (1887-1975) led the charge to promote the history of science and their own vision of human evolution toward unity. However, their dream of unity was dashed on the rocks of Cold War. By the mid-1950s, Needham had been ousted from UNESCO for his support of communism and the new People's Republic of China. As his hopes for Western acceptance of a communist-led China were dashed, Needham's writing on the history of Chinese science turned away from the theme of unity, toward building up the prestige of China in the Western public by publicizing their past scientific and technological "contributions" to world history. UNESCO's own world history epic, *The History of Humanity* (1966-2009), similarly was unable

to rise above the desires of UNESCO member state representatives to highlight their own national achievements in the history of science. This chapter will show how China's history of science became suddenly essential in advancing science as a universal language, undermining Eurocentrism, and defining Chinese participation in the post-war world order.

## **Joseph Needham and the Roots of Internationalist History**

The post-war promotion of internationalist history built on previous efforts to reform history writing in support of world peace. In the wake of World War I, the League of Nations as well as some regional associations reformed history and geography textbooks, seeing them as the prime culprits in encouraging nationalism and militarism. While these efforts enjoyed limited success, particularly in the Nordic countries, by the 1930s many participating European intellectuals saw them as having failed to curtail the rise of nationalism and militarism in history education. Despite the collapse of the League of Nations and the fragmentation of the international relations during this time, a scattered transnational group of intellectuals coalesced around an audacious dream that the entire world could unite into a single society under one government. The British biochemist-turned-historian Joseph Needham was a key member of movement, and along with several others, successfully elevated science and the history of science as a key component of the entire project. Before World War II, Needham had enjoyed a successful career as a Cambridge biochemist. Specializing in embryology and morphology, in 1931 he published what reviewers called his “magnum opus,” the three-volume *Chemical Embryology*, a history of the field from ancient Egypt to the 19<sup>th</sup> century. In 1937, the arrival of three Chinese graduate students to his laboratory sparked his engagement with China, and he set

on a lifelong mission to both convince the Western public that how China had contributed to Western science, and to unify the scientific communities of China and the West.

### **Unifying the sciences, 1937-1954**

Needham is most famous for his monumental series, *Science and Civilization in China*, a multi-volume history of Chinese science and technology created in collaboration with numerous other scholars. Needham published the first volume in 1954, seeking to answer the question, why hadn't China developed modern science? This question soon led him to embark on an ever-widening project to document all Chinese scientific and technological history, according to Western categories such as mathematics, physics, chemistry, and biology. Though Needham died in 1995, the Needham Institute in Cambridge is still publishing new volumes in the series to this day; as of 2019, this includes 26 publications. Because of the massive scope of *Science and Civilization in China*, which involved the participation of an entire generation of scholars, Needham has had an outsized influence on the field of the history of Chinese science.

But from 1937 to the early 1950s, Needham's writing on Chinese history was in service to his larger mission to integrate Chinese and Western scientific communities, and more broadly to speed the evolution of humanity into a single unified community. Needham was part of a larger liberal interwar movement in the West, which saw the scientific community as a model for international unity. In 1946, Needham became a founding member of UNESCO, and along with its first director Julian Huxley, turned it into an engine for the internationalization of science and the reform of history education. However, the dreams of both Needham and UNESCO were dashed on the rocks of the Cold War. By 1948, the United States government suspected that the entire UNESCO project and Needham were part of a communist plot, and he left the

organization to begin work on *Science and Civilization in China* back at Cambridge. This chapter will analyze how Needham adapted the history of Chinese science to the project of world government, and how the many participating nations within UNESCO negotiated and propagated their own version of this narrative through pedagogical materials and their own textbook of world history.

Much analysis of Joseph Needham begins with his *Science and Civilization in China* (1954-2016; hereafter *SCC*) and looks backward for its intellectual roots in his earlier life and career.<sup>2</sup> Fewer scholars have pointed out that his study of Chinese history during 1937-1952 was in pursuit of immediate political goals to support the United Nations, boost China's place in the emerging international order, and spread the ideology of universalism. Needham himself encouraged this blind-spot on his biography, by eschewing his past political goals when recounting his activities during this period.<sup>3</sup> This both shored up his reputation as a historian of science, and distanced himself from the considerable attacks he sustained during the 1950s for being a Marxist, and his allegations against the United States, which he said used chemical

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<sup>2</sup> For example, Gregory Blue, "Joseph Needham, Heterodox Marxism and the Social Background to Chinese Science," *Science and Society* 62, no. 2 (1998): 195-217; and, Robert Finlay, "China, the West, and World History in Joseph Needham's *Science and Civilisation in China*," *Journal of World History* 11, no. 2 (2000): 265-309.

<sup>3</sup> Thomas Mougey pointed this out in "Needham at the crossroads: History, politics and international science in wartime China (1942-1946)," *British Journal for the History of Science*, 50 (1), 83-109. He points to *The Grand Titration* (1969) as an important example.

weapons against North Korea in 1952.<sup>4</sup> Furthermore, analysis of Needham's intellectual and personal history have mostly come from his many collaborators, who also tend to look for the roots of *SCC* rather than investigate his earlier lofty political goals and activism. Because Needham and the ongoing *SCC* project has involved nearly the entire first generation of scholars of the history of science in China, their reflection on the strengths and weaknesses of Needham's assumptions and methods have been very productive for the evolution of the field.<sup>5</sup> However, returning to the early political context shows that the history of science was not merely about understanding the past, but also an expression of Needham's vision that East and West could evolve toward a unified society through the shared language of science.

A few scholars have focused on Needham's activity during 1937-1952, seeing his writing on Chinese history as an extension of his mission to unify the sciences and humanity. Simon Winchester's popular book *The Man Who Loved China* was a personal history of Needham's time in China during 1942-1946 told through his travel journals, focusing on his romantic life and progressive politics.<sup>6</sup> Thomas Mougey pointed out the continuity between Needham's earlier

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<sup>4</sup> The most important controversy was his involvement in the panel of scientists who charged South Korea and the United States with using chemical weapons in their war against North Korea in 1952. Needham was banned from travel to the US after this event.

<sup>5</sup> For instance, Gregory Blue, "Science(s), civilization(s), historie(s): A Continuing Dialogue with Joseph Needham," in *Situating the History of Science: Dialogues with Joseph Needham*, ed. By D Irfan Habib and Dhruv Raina, New Delhi; New York: Oxford University Press, 1999, 29-72. H.F. Cohen, *The Scientific Revolution: A Historical Inquiry* (Chicago: University of Chicago Press, 1994): 418-482. Nathan Sivin, "Science and Civilisation in China. Volume 7, The Social Background. Part 2, General Conclusions and Reflections by Joseph Needham; Kenneth Girdwood Robinson; Ray Huang; Mark Elvin (REVIEW)," *China Review International*, Vol. 12, No. 2 (Fall 2005): 297-307.

<sup>6</sup> Simon Winchester, *The Man Who Loved China: The Fantastic Story of the Eccentric Scientist Who Unlocked the Mysteries of the Middle Kingdom* (New York: Harper Perennial, 2009).

political activism and worldview, his activity in China, and his view of Chinese history of science.<sup>7</sup> Expanding on these efforts, I will show how the widespread enthusiasm for world government and world peace in the wake of World War II opened the door for the global promotion of the history of Chinese science, and particularly this new version of the great inventions narrative.

Needham's interest in creating world government was rooted in his belief that humanity was evolving both biologically and socially into one unified community. This was a social Darwinism that saw communism and international cooperation, not laissez faire capitalism, as the natural product of human evolution. In the biological realm, he defined evolution as "primarily the passage from simplicity to complexity, from homogeneity to heterogeneity, from low to high organization."<sup>8</sup> Needham embraced this exact same formulation in the evolution of society, writing that "history is a continuation of Natural History."<sup>9</sup> The earliest proponents of sociological evolution, most importantly Herbert Spencer, interpreted Darwinian evolution to equate to a "survival of the fittest" in human society, a continual war of all-against-all that was used to justify laissez-faire economics and eugenics policies of the early twentieth century. Regimes outside the west also were attracted to social Darwinism as a means to scientifically

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<sup>7</sup> Thomas Mougey, "Needham at the crossroads: History, politics and international science in wartime China (1942-1946)," *British Journal for the History of Science*, 50(1), 83–109.

<sup>8</sup> Joseph Needham, "The Gist of Evolution" (1931), reprinted in *History is On Our Side* (New York: The Macmillan Company, 1947).

<sup>9</sup> Joseph Needham, "History is On Our Side" (1937), reprinted in *History is On Our Side*, New York: The Macmillan Company, 1947, 22-34.

strengthen and purify their populations, and the nation-state as a whole. In the 1896-1898, the translator and intellectual Yan Fu introduced this view of social Darwinism to China in his translation of T.H. Huxley's *Evolution and Ethics* (1893).<sup>10</sup> Although Huxley argued in this book that the theory of evolution should not be used as the basis of any ethics of social policy, Yan Fu suffused his translation downplayed this argument, promoted Spencer's notion of social Darwinism, and synthesized it with traditional Chinese philosophy. In the wake of China's loss in the disastrous Sino-Japanese War of 1895, Yan Fu's translation of the Darwinist terms *wujing* (things struggle) and *tianzhe* (heaven selects) gained wide popularity not just as explaining the dire struggle that the Chinese nation must commit itself to in order to survive.<sup>11</sup> By the 1930s, Yan Fu's popularization of social Darwinism as a nationalist ethic became an ideological cornerstone of Chiang Kai-shek's New Life Movement, and the basis of eugenic policies.<sup>12</sup> Needham railed against this trend as a capitalist, fascist misinterpretation of Darwin.<sup>13</sup>

In Needham's view, biological and social evolution was the gradual submission of the individual to the collective, marked by increased cooperation rather than competition. From the moment that the "first free-living single cells had to give up their 'freedom,' such as it was, in

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<sup>10</sup> Yan Fu 严复, *Tiyanlun* 天演論 [On evolution] (Shanghai: Commercial Press, vol. 1 1896, vol. 2 1898).

<sup>11</sup> Il Mo Yang, "Translating Darwin's Metaphors in East Asia," *Trans-Humanities*, Vol. 6, No. 3 (October 2013), 157-178.

<sup>12</sup> Chung, Yuehsen Juliette. Better Science and Better Race?: Social Darwinism and Chinese Eugenics. *Isis* 105, no. 4 (2014): 793-802.

<sup>13</sup> Joseph Needham, "The Biological Basis of Sociology", in *Time: The Refreshing River (Essays and Addresses, 1932-1942)* (New York: The Macmillan Company, 1943), 160-177.

uniting together to form the metazoan organisms,” to the first segregation of classes, such as warriors, peasants, merchants and governors,” social evolution favored the collective over the individual. This meant that the present moment was on a continuum toward an ultimately united humanity. Needham writes that those future peoples looking back on the twentieth century would remark that “the world was divided up into a rather large number of states and nations,” characterized by vast inequality, profit-seeking, and misery. Who are these evolved future humans? “We are, in short, to use the ancient term, communists.” In biological and social life, Needham argued in the 1930s, “collectivism is inevitable.” Just as single-celled amoebas had evolved into human beings, human society would evolve ever larger, more complex, and unified.<sup>14</sup>

Although Needham saw evolution to a single global society as inevitable, he argued that individuals still must struggle toward that end, and devastating pitfalls were always possible along the way. With the triumph of fascism in Spain, and its rise in Italy and Germany in the 1930s, the collapse of Western civilization as Needham knew it very much did seem a possibility. Writing just before he began his study of China in May 1937, Needham conjured up the image of a stagnant China as a metaphor for Europe's possible fate, writing:

It is true that we might envisage a long period of stagnation as the outcome of our present civilization. China offers us a century-long spectacle of such stagnation. But whereas this is compatible with an agricultural, bureaucratic, isolated community lacking good communications and so able to sterilize revolutionary

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<sup>14</sup> Needham's unique take on Marxism is analyzed in Gregory Blue, ‘Joseph Needham, heterodox Marxism and the social background to Chinese science’, *Science and Society* 62, (1998): 195–217. However, this article investigates the way Marxist theory operates within SCC, rather than how it informed Needham's activism in the 1930's and 1940's.

movements within itself, it is much more difficult to imagine such a state of affairs existing in a civilization based on scientific technology.<sup>15</sup>

Needham's description of China as a stagnant “agricultural, bureaucratic, isolated community” reflects Needham’s basic acceptance in the 1930s of Marx’s theory of the Asiatic mode of production – a model in which a bureaucratic state owns the land, organizes essential public works, and the historic development evident in Europe is entirely absent. Though Marx himself knew little of Chinese history, Needham was heavily influenced by twentieth-century historian Karl Wittfogel’s explanation of Chinese stagnation under the banner of “hydraulic despotism,” focusing on how the geography of China and other Asian civilizations led to the rise of all-powerful despotic states that justified their rule through the building and maintenance of irrigation and flood-control systems. In the 1930s, Needham largely bought into this geographic explanation of Chinese stagnation.<sup>16</sup> But as he notes here, even the West may become trapped in a “scientifically stabilized, stagnant, class-stratified, totalitarian, social organism” that would cause immense set-backs in social progress. He sees the catastrophe of world war as potentially empowering the proletariat and colonized everywhere. But fascism is “a screen for the maintenance and stabilization of existing class-stratification,” that “substitutes for Reason a

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<sup>15</sup> Joseph Needham, “Integrative Levels: A Revaluation of the Idea of Progress,” (Herbert Spencer Lecture at Oxford University, 1937), reprinted in *Time: The Refreshing River (Essays and Addresses, 1932-1942)* (New York: The Macmillan Company 1943), 268.

<sup>16</sup> Blue, “Joseph Needham, heterodox Marxism and the social background to Chinese science,” 62.

fantastic irrational mythology,” and resorts to barbarism and militarism to maintain the dominance of bourgeois national and imperial power.<sup>17</sup> Needham nonetheless assures us that this tragic delay would be “temporary”, and that a “higher integrative level” was inevitable.<sup>18</sup>

Needham saw this evolutionary struggle between division and unity also playing out in the sciences. One of the legacies of Marxist theory shared by much of the British left was the recognition of how thoroughly science was embedded in society. Therefore, its application for the betterment or destruction of mankind would be determined by larger political struggles. Needham expressed this thesis in his 1935 speech at Yale, “Limiting factors in the history of science, observed in the history of embryology”. Surveying approaches, triumphs and failures of the field as they related to social patterns, philosophy and economics from ancient Greece to the present, Needham argues that “the social and political ruling ideas of an epoch thus play a large part in the scientific thought of the time, and may act as limiting factors to further advance.”<sup>19</sup> This emphasized the “external”, or the wider socio-political context of the history of science, rather than seeing the narrower “internal” activities and ideas of scientists themselves as the most important source of change over time.

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<sup>17</sup> Needham, “Integrative Levels,” 266-268.

<sup>18</sup> *Ibid.*, 269.

<sup>19</sup> Joseph Needham, "Limiting Factors in the History of Science, as Observed in the History of Embryology (Carmalt Lecture at Yale University, 1935), in *Time: The Refreshing River*, 142.

This insight was shared by a group of elite leftist British scientists collectively called the “Science and Society Movement,” who not only shifted the historiography of science but also its governance during the 1930s and 1940s.<sup>20</sup> The most prominent member of this group was J.D. Bernal, who in his influential *The Social Function of Science* (1939) argued for greater funding of scientific research, and the implementation of well-defined science policies by the central government.<sup>21</sup> Pointing to the Soviet Union as example, he further argued that these benefits could best be delivered under socialism, with scientists in charge of social policy. During World War II, Great Britain and especially the United States took up the call for a coordinated and massive investment in science in the interest of national defense, the most famous outcome being the Los Alamos Project that produced the first nuclear bomb. But more important to Bernal, Needham, and their community of British leftist intellectuals, was protecting the democratic and communal spirit of the international scientific community itself. World War II in Needham’s view was a battle between fascist and democratic science.<sup>22</sup>

In Needham's 1940 lecture at Cornell University, “The Nazi Attack on International Science,” he warned that fascism threatened to take modern science back to the Dark Ages. The Nazis, he said, had risen to power through division, playing on the “mutual fear of the capitalist classes and the working masses,” and likewise the fears “between nations,” telling the German

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<sup>20</sup> Gary Werskey, *The Visible College: A Collective Biography of British Scientists and Socialists of the 1930s* (London: Free Association Books, 1978, reprinted 1988).

<sup>21</sup> J. D. (John Desmond) Bernal, *The Social Function of Science* (New York: The Macmillan Company, 1939).

<sup>22</sup> Joseph Needham, “The Nazi Attack on International Science,” (1940) in *History is on Our Side: A Contribution to Political Religion and Scientific Faith* (London: Allen & Unwin, 1947).

people that “We are your only possible bulwark against barbarous Mongolian Bolshevik Asiatics.”<sup>23</sup> Needham continued that science in Nazi Europe was bent to serve the sole purpose of Nazi world domination, imprisoning it “within the sharp bounds of what is of military value, and the discouragement of all pure research and free scientific speculation.”<sup>24</sup> The anti-intellectualism of the Nazis, their irrational belief in racialism and the superiority of Germany, their assertion that “science is a product of blood,” had degraded science in Germany. If the Nazis won the war, Needham warns that “science in Europe may disappear for several generations, and all social progress with it.”<sup>25</sup>

However, Needham believed that that science, like religion and social progress, possessed a universal and eternal quality that would ultimately transcend the crisis of world war. Because science was the study of the external world which all people shared, in the end it could not be twisted to serve it to insane nationalist, racialist beliefs. In his same 1940 lecture he said:

The nazis furiously rage together against all three Internationals, the Black, the Red and the White. The Black International of the Church rests, it is true, primarily upon, certain beliefs, but these have arisen in history from the very nature of man himself, and so can never disappear... The Red International of Labour has been based on the existence of deep-lying forces of social evolution, glimpsed, as it were, by social astronomers, and never to be overcome by fascist ranting, however desperate. But above all, the White International of Science is

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<sup>23</sup> Ibid., 160.

<sup>24</sup> Ibid., 162.

<sup>25</sup> Ibid., 198.

founded in the ever-changing ever-constant rock of Nature herself, and is impregnable thereon.<sup>26</sup>

Here Needham adds science to the pantheon of great universal movements that had historically claimed to unite humanity: religion and Communism. Needham's effort to synthesize Christianity, communism, and science into a trinity of a universal philosophy was totally unique to Needham. However, his notion of science as a universal movement gained strong support across Western democracies in the inter-war period, and was especially strong amongst leftist Cambridge scholars. The ideas behind this movement were that science was unified by certain knowledge, a common method or a general attitude, which could be extended outside of science to transcend political divisions. Scientific approaches, for example, were potential instruments for government; scientific values were taken to define modern culture and connect the past, present, and future of human civilization; and the unity of the scientific community was projected as a model for international relations.<sup>27</sup> This idea of science stood apart from the fascist view of the *disunity* of science across cultures. At the precipice of World War II, Needham and others elevated science into a universal movement that could unite people across national, cultural, and racial lines. Speaking across borders with shared principles and commitment to truth, Needham's characterization of the history of science as an international movement working across borders on a shared commitment to the truth, elevated science into a universal movement, and a model for international relations.

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<sup>26</sup> Ibid., 172.

<sup>27</sup> Harmke Kamminga and Geert Somsen, *Pursuing The Unity of Science: Ideology and Scientific Practice from the Great War to the Cold War* (London; New York: Routledge, Taylor & Francis Group, 2016), 3.

## Needham's Vision of Sino-Western Unity through Science

Needham may well have continued his career as an esteemed embryologist at Cambridge had not three Chinese graduate students arrived in his laboratory in the summer of 1937, Wang Ying Lai (王应睐, 1907-2001), Shen Shih-Chang (沈詩章, 1912-2002), and Lu Gwei-Djen (魯桂珍, 1904-91). The three students had excelled in the cosmopolitan educational environment that opened up during the Republican period of the 1920s and 1930s, studying biochemistry and English in Nanjing, Beijing, and Shanghai. They landed in London to pursue their PhD's in Needham's lab in July of 1937, the very moment that the Japanese army invaded Shanghai, beginning a two-year period of rapid expansion and slaughter through much of Eastern China. These students, especially Lu Gwei-Djen, brought into focus for Needham both the unity of science and the scientific community across cultures, and the dire threat Chinese scientists faced with the Japanese invasion.

The story of how one of these students, Lu Gwei-Djen, developed a life-long intellectual and romantic relationship with Needham, is well known.<sup>28</sup> Lu was Needham's first Chinese tutor, collaborated with him in the writing of many of his histories of Chinese science, and became an influential historian of Chinese medicine in her own right.<sup>29</sup> The surviving materials describing

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<sup>28</sup> This is the focus of much of Winchester, *The Man Who Loved China*. Lu and Needham married in 1989, two years after the death of his first wife, Dorothy, in 1987.

<sup>29</sup> According to the draft notes for *SCC* housed in the Needham Institute Lu took part in much of the writing of his work, but is only listed as a co-writer in two volumes. Her published works include: *Celestial Lancets: A History and Rationale of Acupuncture and Moxa* (Cambridge; New York: Cambridge University Press, 1980); With Joseph Needham, *Science and Civilisation in China Volume 4 Physics and Physical Technology Part III: Civil Engineering and Nautics* (Cambridge: University Press, 1971); With Joseph Needham, *Science and Civilisation in China Vol. 5*,

their relationship in the 1930s and 1940s is entirely composed of Needham's journals and publications, so her impact on him is filtered through his eyes.<sup>30</sup> However, her biography and Needham's writings together give the impression that Lu shared with Needham a view, archetypal of the late Republican era, that the West had underestimated Chinese pre-modern science and technology.

The daughter of a Nanjing apothecary, Lu had excelled in the new educational opportunities available for women in the Western missionary schools of urban China, attending Ginling College in 1926-1930, and lecturing in the medical school of St. John's University in Shanghai.<sup>31</sup> During these years, the Kuomintang came to power, and enacted sweeping changes in missionary schools like Lu's that transformed them from foreign-led enclaves, into Chinese led schools integrated into the national education system. While this experience traumatized many foreign administrators and teachers at Ginling College, it was also empowering for many of Lu's Chinese teachers and students.<sup>32</sup> Lu thus came of age seeing Chinese increasingly assert themselves in previously Western-dominated educational institutions. Although Lu studied

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*Chemistry and Chemical Technology: Pt. V: Spagyric discovery and invention: physiological alchemy* (Cambridge: Cambridge University Press, 1983); "A contribution to the history of Chinese dietetics," in *The Hall of Heavenly Records: Korean Astronomical Instruments and Clocks, 1380-1780*, (Cambridge: Cambridge University Press, 1951).

<sup>30</sup> My research on this topic is limited now to secondary sources. The Needham Institute contains Needham's letters of correspondence, and manuscript drafts, and journals that may shed greater light on the question of Lu's influence on his conception of the history of Chinese science in this period.

<sup>31</sup> Lily XiaoHong Lee, ed. *Biographical Dictionary of Chinese Women: The Twentieth Century, 1912-2000* (Armonk, New York: M.E. Sharpe, 2003), 382.

<sup>32</sup> Jin Feng, *The Making of a Family Saga: Ginling College* (Albany: SUNY Press, 2009).

modern biology and medicine, her father continually reminded her to pay heed to traditional Chinese knowledge, despite being dismissed by Westerners. This double engagement in modern science and traditional Chinese medicine as a matter of national pride was also the hallmark of the great inventions narrative of the late 1920s and 1930s.

Lu convinced Needham that China offered something fundamental to all human history, and deserved recognition. Needham dedicated the first volume of *Science and Civilization in China* (1954) to Lu and her father, citing precisely this narrative. He wrote that Lu could, “appreciate and understand modern, science, but at the same time with the belief that the ancient and medieval practitioners and artisans of China had known what they were doing much better than most sinologists are usually prepared to believe.” She had taught him that, “techniques fundamental in human history had grown from that soil, certain things yet valuable might be found there if it were dug into, and at the least, the whole history of science and techniques in China would be an essential element in any comprehensive history of world achievement.”<sup>33</sup> As I show in Chapter 2, this narrative was in fact very widespread in 1930s Republican China as a proof of national and racial scientific ability. While Chinese nationalists had advanced this argument domestically to bolster confidence and patriotism, to Needham's ears it was also a challenge to the chauvinism and racism endemic in western views of the history of science.

In the 1930s and 1940s, Needham's interest in Chinese history was secondary to his work in promoting Sino-British relations. In the 1930s, he joined the Anglo-Chinese Intellectual

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<sup>33</sup> Joseph Needham, *Science and Civilization in China*, Vol. 1 (Cambridge: Cambridge University Press, 1954), 10.

Cooperation Committee and the Sino-British Cultural Association which promoted cross-cultural understanding.<sup>34</sup> He also marched in support of state condemnation of the Japanese occupation of China, a position the British government avoided lest they provoke a Nazi-Japanese alliance (which did not actually happen until September 27, 1940). Influenced by the Chinese scholar Chung Shu Lo, he was also alerted to the Japanese attack on Chinese universities and scientific laboratories. His 1940 lecture at Cornell University, printed as the article “The Nazi Attack on International Science,” pointed toward the Japanese invasion of China as parallel with the Nazis in Europe, with equally dire effects on science:

The Chinese – our international allies: The struggle of China against Japanese aggression is basically identical with that of western democratic fight against nazi-fascism. Chinese civilization, which owes its unique qualities to its wonderful combination of the romantic and the rational, is based on the sincerely philanthropic rationalism of Confucius (overlaid though this was in later ages by Buddhist pessimism and Taoist magic). The Chinese are defending the rationality of man against a mythical racial-national spirit quite akin to the spirit of nazism but equipped with a special religious system of indigenous origin.”<sup>35</sup>

Reflecting several years of intense study of Chinese language, philosophy and history under Lu Gwei-Djen and other faculty at Cambridge, Needham casts China as an ideological, cultural ally to Britain and the United States – a scientific, democratic nation, fighting an anti-scientific, fascist enemy. In China, May Fourth reformers had championed science and democracy *against* Confucianism, which they saw as holding people back from political, social and educational progress. The KMT regime opposed this iconoclastic view, and began a Confucian revival in the

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<sup>34</sup> Mougey, "Needham at the crossroads," 91.

<sup>35</sup> Joseph Needham, *The Nazi Attack on International Science* (London: Watts & Co., 1941); first delivered as the Schiff Lecture at Cornell University, 1940.

1930s under the New Life Movement, seeing it not as the basis of rationality and science, but as an ethical system that would be the basis of sociopolitical life. Needham was entirely removed from these movements in China, and echoed an older European view of Confucianism as a rational philosophy that went back to Enlightenment philosophers like Leibniz, Voltaire, and Diderot, Rousseau. He saw the influence of Confucian thought on Europe as fundamental to the rise of Enlightenment science and philosophy.<sup>36</sup> In his appeal to the British public, Confucianism represents an underlying “rationality of man,” a historic and moral connection, that Chinese and Western democracies must defend together. The threat of fascism toward rationality and science is a theme he would write about often. It framed the war as a universal struggle of values that transcended nations entirely. It is also the beginning of his public efforts to describe China as culturally and historically linked with the West, uniquely positioned to contribute to the development of modern science and world evolution toward communism.

Needham would take a direct role in the British diplomatic effort to aid the Chinese scientific community through the Sino-British Scientific Cooperation Office (SBSCO). In 1939, a group of Oxford and Cambridge faculty, concerned over the recent attacks by Japan on Chinese universities, asked Joseph Needham to go there to investigate and offer support. The British Council, the cultural arm of the British Foreign Office, would take charge of the mission. Not until Japan attacked the US and UK at Pearl Harbor, Hong Kong, and Singapore in December

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<sup>36</sup> Needham wrote his most detailed history of the influence of Chinese philosophy on the west in Joseph Needham and Ling Wang, *Science and Civilisation in China: History of Scientific Thought*, vol. 2 (Cambridge: Cambridge University Press, 1956).

1941 did Britain forthrightly offer aid to China. Even then, Winston Churchill was hesitant to offer aid to Nationalist China, as Chiang Kai-shek sought to establish China as an anti-colonial model for Asia. In Chiang's visit to New Delhi to strengthen the Sino-Indian war alliance in 1942, he infuriated Churchill when he met with the Jawaharlal Nehru and Mahatma Gandhi, leaders of the Congress Party who sought to liberate India.<sup>37</sup> With the US supporting Chiang and expanding their own influence in the region, the scientific mission of the SBSCO was a low-cost, high-visibility way to maintain influence in Asia, whatever the fate of its colonial holdings in the post-war period. The project would be not be prepared to launch until Spring of 1942. The Foreign Office tasked Needham with the mission to find out what was needed by the Chinese schools and laboratories, and make sure they got it. "I was to do everything in my power to renew and extend the cultural bonds between the British and Chinese peoples," Needham told a London newspaper. He was going to China as a diplomat, the head of a new body to be called the SBSCO, which was attached to the British embassy in Chongqing.

### **Unity in the Present, Unity in History**

To incorporate China into the fight to save science in the present, Needham incorporated China into the history of science. Needham would show that China was more than the "sick man of Asia," more than a backward agricultural country that was the weakest of the Allied nations. Rather, anecdotal evidence suggested to Needham that China had many successes in science and technology in the ancient past. If his compatriots in the west understood that China had played a

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<sup>37</sup> Rana Mitter, *Forgotten Ally: China's World War II, 1937-1945* (Boston and New York: Houghton Mifflin Harcourt, 2013) 245-249.

pivotal role in the birth of modern humanism, science and technology, might this change the relationship of the two civilizations in the present? Before his departure to China, Needham contemplated studying China's history of science and technology, and discussed it with Lu Gwei-Djen. He began articulating his “grand question”, later known as the “Needham question,” in his private writing: despite its early achievements, why had modern science not developed in China?<sup>38</sup> Needham would not directly answer this question until *The Grand Titration* (1969), in which he suggested that the lack of a merchant class in China, whose equivalent in Europe had united scientific theory and the mechanical practice in the pursuit of wealth, impeded the growth of modern science there.<sup>39</sup> However, as Nathan Sivin has pointed out, this counter-factual question was not actually answerable, and its true value only lay in that it launched a vast study of what China, and the non-West in general, had accomplished in science and technology.<sup>40</sup> As Needham began studying China's history of scientific achievement, he also developed an argument of historical unity between China and the West. Needham adamantly did not want to compare “Chinese science” with “European science,” which would only reproduce the Spenglerian view that civilizations are the key subject of history, and develop their own incommensurable arts, sciences, and cultures. Rather, because mankind shared one common environment in nature, their attempt to understand nature was ultimately a shared endeavor, what

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<sup>38</sup> Winchester, *The Man Who Loved China*, 2008.

<sup>39</sup> Needham did offer at least one answer to his "grand question" in *The Grand Titration: Science and Society in East and West* (London: Allen & Unwin, and Toronto: Univ. of Toronto Press, 1969).

<sup>40</sup> Nathan Sivin, “Why the Scientific Revolution Did Not Take Place in China—or Didn’t It?” *Chinese Science* 5 (1982): 45–66.

Needham called “the fundamental continuity and universality of all science.”<sup>41</sup> Thus, biology, physics, chemistry, and mathematics, etc., were not Europe's alone, but universal endeavors that could be found in Chinese history. While he always asserted that modern science – the translation of knowledge into the language of mathematics – was a European achievement, he suspected that Europe in fact owed a great debt to China. The past contribution of Chinese philosophy, science and technology to Western culture underlined the present mission to join Europe and Asia in international cooperation as historic and ideological allies.

As Needham departed for China in 1942, he made it clear in “The Chinese Contribution to Scientific Humanism” that his work with SBSCO was in service of a dream that the West and China would eventually join in political and intellectual communion. Here, Needham asserts that modern science originated in Europe, but that Chinese philosophy made a significant impact on its development. He sees science as a universal movement uniting Chinese and Western history, and a means for their evolution into one great society through world government:

No doubt the greatest effect of modern science on human civilization has been to unify the whole world's surface. Among the tasks of integration which humanity is now facing in the progress towards higher forms of order and union, none can well be thought larger than the confluence of the Euro-American and Chinese civilizations. The more one studies the two, the more do they seem, I feel, like two different symphonies by two different composers using identical fundamental melodies.<sup>42</sup>

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<sup>41</sup> Joseph Needham, *Science and Civilization*, Part 2 (1974), xxii; Part 3 (1976), xxiv-xxv; Part 4 (1980), xxxvii.

<sup>42</sup> Joseph Needham, “The Chinese Contribution to Scientific Humanism,” in *Within the Four Seas: Dialogue of East and West* (London: George Allen & Unwin, 1969; first published in *Free World*, 1942), 97.

Here Needham asks, might the unifying turn in the history of science be a model for the East-West socio-political integration? For Needham, the history of science had shown that once knowledge was expressed in the language of mathematics, scientists worked together across cultural, racial, religious, and political boundaries, and integrated their findings into one universal body of knowledge. Nonetheless, before this integration Chinese science was philosophy still was playing the “identical fundamental melodies” as in the West, suggesting to Needham deep philosophical and historic connections that might facilitate present-day integration. The values of the Enlightenment of humanism and rational thought, Needham argued, were coproduced through and interaction of China and the West, predisposing China to integration with a democratic, scientific west in the present. Needham's conception of modern science as a European product that was also universal required a somewhat paradoxical reading of history. He went on:

If modern science originated and developed wholly in the West, it was due very largely to the existence of favorable social and economic conditions there, conditions which did not exist in China. Conditions in China were, indeed, definitely inhibitory to the growth of modern science and its associated technologies. But now for many years since the impact of Western civilization through the Chinese eastern coast, China has exerted herself to catch up with these developments, and today, of course, there are a large number of first-rate Chinese scientists and technologists in all fields.<sup>43</sup>

Needham repeats the long-held consensus of Orientalist European historians of the 19<sup>th</sup> and early 20<sup>th</sup> centuries that China had become historically stagnant, unable to progress along Western

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<sup>43</sup> Needham, “The Chinese Contribution to Scientific Humanism,” 97.

lines. At this point, Needham believed China's "bureaucratic feudal" imperial system prevented the rise of a merchant class that he thought gave rise to modern science in Europe. He often remarked that this was merely the result of geography – that the "continental character of China" led to a large, centralized state, while the "peninsular structure of Europe" led to the rise of the mercantile city-state, in which merchants had the power and money to finance research in order to develop new forms of production and trade."<sup>44</sup> Like his contemporary, the influential American historian John K. Fairbank, he sees "the impact of Western civilization" as having ushered China into the modern world.

And yet, elevating China's past scientific greatness was a way to temper the sense by Westerners that modern science "was born with us," and that modernization meant Westernization. Rather, he argued that the birth of modern science had depended on Chinese input. Raising China's status in history also suggested they deserved higher status in their wartime alliance in the Big Four with the US, UK and USSR. China was more than a weak but convenient geopolitical ally. Needham suggested that it shared a deep moral and historic bond with European democracy and science, and may yet provide a unique combination of ethical and scientific governance that was the key to the future international order. He continued:

If our personal duty in our day and age is to ally ourselves with all such forces as we may find at work in the world making towards higher levels of social integration, this generally means political action of one kind or another. One of its

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<sup>44</sup> Joseph Needham, "The Chinese Contribution to Science and Technology,' in *Clerks and Craftsmen in China and the West: Lectures and Addresses on the History of Science and Technology* (Cambridge: University Press, 1970). Adapted from a lecture delivered at the opening session of UNESCO at the Sorbonne, Paris, November 1946; tr. From French "Conferences de l'UNESCO', Fontaine, Paris, 1947.

forms today is the promotion of all possible machinery of international cooperation.

Scientific humanism is at least as old as the pre-Socratic philosophers in Greece and the Chinese philosophers of the time of the Warring States in China. But its universal triumphs were reserved for the last few centuries, and its greatest are yet to come.<sup>45</sup>

The history of science here legitimized his work to merge the Chinese and Western scientific communities, and more than that, humanity itself. In 1942, what “higher levels of social integration” and the “machinery of international cooperation” might look like was still an open question. Furthermore, how would Western nations treat China in that new order? Needham suggested scientific humanism as a universally shared, rational, scientific basis for a new world order.

As Director of the SBSCO he went to China to nurture relationships between Chinese scientists and British institutions exactly along these lines, seeing science as a language and a culture that united them all. He would pursue a shared history, emphasizing that the triumphs of Western culture – modern science and technology – were a product of global effort, sending the message to his Euro-American audience that as the Allied nations sought to salvage control of the world order, they ought to include China as an equal member. History was the means by which Needham was pushing England and the West to abandon its imperialistic, arrogant attitude

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<sup>45</sup> Needham, “*The Chinese Contribution to Scientific Humanism*,” 97.

toward China and Asia in general, pushing them to recognize value in each other. Scientists themselves would be the vanguard of the new international relations.

Though Needham entered China in 1943 as a British agent in service of the Republican government, he left he left in 1946 an ally of the Chinese Communist Party. These were pivotal years of struggle between the Communist and Nationalist regimes, and to both Needham offered a connection to the Western scientific community. He arrived in the war-torn capital of Republican China, Chongqing, in March 1943, and took up an office and a small staff at the British Consulate. As the Director of the SBSCO, he was charged with the mission to assess and aid the scientific community in “Free China.” Needham secretly hoped that the Chinese Communist Party would eventually lead China, but as a representative of the British Government, he officially served as Chiang Kai-shek’s Scientific Counsellor. The two met in the Summer of 1943, and Chiang asked him to research and report on what the government needed to do to build up science in China.<sup>46</sup> Needham was one of a new set of “China hands” that included sinologists and scholarly experts pursuing scientific, cultural and intelligence gathering missions, such as the American historian John King Fairbank. Though his mission was supported by the Nationalist Government, Needham resented the corruption of KMT officials and the vast inequality he witnessed in Chongqing, which he wrote about it letters home.<sup>47</sup> He blended into the politically heterodox scene of intellectuals in Chongqing, who had arrived from throughout

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<sup>46</sup> Joseph Needham, “Wartime Report to Chiang Kai-Shek: The Position and Prospects of Science and Technology in China” (Chongqing, Winter 1945), 4.

<sup>47</sup> Winchester, *The Man Who Loved China*, 2008.

China and the world to support the Chinese struggle against Japan.<sup>48</sup> In Chongqing he met with many Communist historians, scientists, and political figures who would later reach the highest positions of influence in the PRC, including Guo Moruo, Zhu Kezhen, and Zhou Enlai.<sup>49</sup> Especially important was his meeting with Zhou Enlai, who spent the war in Chongqing attempting to maintain the Chinese Communist Party's United Front with the KMT, while simultaneously expanding the Party's underground intelligence network. Zhou became the premier of the PRC in 1949, and would usher Needham into a life-long relationship with the Chinese Communist Party at the highest levels.

Needham's official task was to establish the SBSCO as a scientific post-office of exchange between Western and Chinese scientists, and he facilitated the inflow of much needed laboratory instruments, Western academic journals, and other resources from British India.<sup>50</sup> He spent most of his time away from the intrigue of politics of Chongqing, and in the laboratories the displaced Chinese scientific community. He travelled by truck and donkey through Szechuan, Yunnan and Guizhou, giving both "moral and material help." In his report on his first year in China, he framed these efforts as true to the principle that "free communication...is of the essence of international science." European scientists had maintained contact with each other

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<sup>48</sup> Vincent K.L. Chang and Yong Zhou, "Redefining Wartime Chongqing: International Capital of a Global Power in the Making, 1938–46," *Modern Asian Studies* 51, no. 3 (2017): 577–621.

<sup>49</sup> Needham kept a list of all the people he met in China from 1943-1946. These are available online through the Needham Research Institute: [http://www.nri.cam.ac.uk/JN\\_wartime.htm](http://www.nri.cam.ac.uk/JN_wartime.htm) Accessed 3/27/2019.

<sup>50</sup> Joseph Needham, "Report of the First Year's Working of the Sino-British Science Co-operation Bureau," British Council Cultural Scientific Office in China, 1944, 2.

through centuries of war and division. The SBSCO was working to ensure that despite the efforts of “Feudal-Imperialist Japan,” Chinese scientists feel “no longer isolated from the main body of humanity united in the scientific quest.”

Just as Needham was ordering books, tools, apparatus, and chemical reagents onto Royal Air Force airplanes and into the labs of Nationalist China, he was also strengthening the diplomatic relationship by introducing Chinese scientists to their Western counterparts. From September 1942 to 1946, Needham published reports on the state of science and technology in different parts of China in the foremost scientific journal, *Nature*.<sup>51</sup> These articles gave western readers the impression of a developed and dedicated scientific community soldiering under dire circumstances in the hinterlands of “Free China”. Needham describes the Chinese scientists as connected to Western sciences both in their common research. As science by this time was understood to be a fundamental part of national defense, the Chinese thus made up “science’s ‘front line’” among the United Nations.<sup>52</sup> The series was furthermore punctuated by contributions from Chinese scientists<sup>53</sup> and even Chiang Kai-shek himself with his speech “The Way and Spirit of Science,” which Needham saw posted in every workshop and laboratory of Chongqing and translated himself.<sup>54</sup> These articles affirmed the important place of science in

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<sup>51</sup> Also see the book of photographs taken during his time in China, Joseph Needham and Dorothy Needham, *Chinese Science* (London: Pilot Press, 1945).

<sup>52</sup> Joseph Needham, “Science in Chungking,” *Nature* 152, 66 (July 17, 1943).

<sup>53</sup> Such as Tseng Chao-Lun, “Messages from Chinese Men of Science,” *Nature* 151 (May 29, 1943), 612.

<sup>54</sup> Chiang Kkai-shek, “The Way and Spirit of Science” (Abridgement of an address by CKS given in 1942, tr. by Huang Hsing-Tsung and Joseph Needham), *Nature* 152, (August 14, 1943), 180-182.

Nationalist China, and showed it to be an important and common bond between the Allied nations and China in the war effort.

Needham delivered his “Position and Prospects of Chinese Science and Technology” to Chiang Kai-shek in the Winter of 1945, suggesting his government invest more resources in science, and what he saw as the Chinese state's fundamental misunderstanding of the nature of scientific and technological progress. In his report, Needham describes the fine work being done by the scientists he met in China, but also the ways in which during the war science had deteriorated, how labs were turned into barracks, foreign-trained scientists were held in suspicion, and technology was under-utilized and mismanaged. He urged Chiang to increase funding of science and science education, send Chinese students abroad, increase foreign language study, and hand political power to scientists and engineers. The principle problem in the thinking of Chinese administrators, he writes, is that they valued only “applied science” – meaning useful technologies - and not “pure science” – meaning the regular investment in scientific research for the pursuit of knowledge, not just material benefit or human welfare. He writes that “Government must absolutely avoid the 'miraculous' attitude towards science, in which science is regarded as something magic which can produce miracles.” Rather than starve scientific institutions of funds, and then demand them to produce useful things like synthetic rubber or an atomic bomb, it is essential “that no distinction should be made between pure and applied science. The former is the life-blood of the latter.”<sup>55</sup> Needham argues that this misguided

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<sup>55</sup> Needham, Joseph. “Wartime Report to Chiang Kai-Shek: The Position and Prospects of Science and Technology in China.” Chungqing, Winter 1945, 8.

policy was the result of a ruling class with little knowledge or interest in science, who believed “that perhaps they can use ‘western science’ as the mythology accompanying a useful set of techniques, without affecting in any way their own way of life or their world outlook. This is an illusion.” Rather, Chiang ought to recognize that modern science flourished in the West because it was embedded in “the social setting of European civilization,” including Greek philosophy, Roman law, the Enlightenment, the rise of capitalism, and the French Revolution.<sup>56</sup> Contrary to the beliefs of conservative Chinese reformers since the Self-Strengthening Movement of the late Qing, science could not be separated from civilization. Needham states, however, that he hopes it not necessary “for China to retrace all the steps in the weary road of the development of capitalism in Western Europe.”<sup>57</sup> Rather he suggests state support for science and industrialization, and state pressure on capitalists to invest in light industry, as a way to overcome the historical and psychological factors that had held China back in the past.

At the same time, Needham emphasized that science was not merely a product of the West, but was a universal project in Chinese people could, and were already, legitimately and authentically participating. The three great inventions of ancient China were historical evidence of their equality with the West, and furthermore, he wrote:

I dislike nothing more than the expression “western science” sometimes heard, for there is no such thing as western or eastern science, but only one universal human science, of which the Chinese are the inheritors equally with the west, it being but a historical accident (as I think can be proved) that modern science originated in

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<sup>56</sup> Ibid., 41.

<sup>57</sup> Needham, “Wartime Report,” 20.

Western Europe, China herself having previously contributed many fundamental discoveries to world civilization...

To fail to see this is to make just as big a mistake as the Westerners who firmly believe that China's purely agricultural civilization was a product of the people rather than the environment, and that Chinese never made, indeed were incapable of making, any contributions to the history of human discovery and invention. How absurd this is, the facts of the discovery of gunpowder, printing, and the compass may show. These three discoveries were most appealed to at the time of the Renaissance in support for the developing idea of Progress, of the view that the Moderns were better than the Ancients. Yet these three discoveries were all Chinese, not European...

The fact is that despite all narrow nationalism mankind forms one family...Far from trying to use modern science as a tool without regard for the social setting in which it grew up, the Government should encourage Chinese students to acquaint themselves as fully as they can with the whole history of thought in the West.<sup>58</sup>

At home in Britain, Needham used the great inventions narrative to disabuse his countrymen of the notion that "civilization was born with us", the racist and imperialist arrogance that held that all that was good in science, culture and philosophy was Europe's alone. Writing to Chiang Kai-shek, he marshalled the same history of Chinese achievement to argue that science and technology was as much theirs as it was the west's. This was not merely a matter of correcting the historical record, but of both China and the West overcoming their "narrow nationalism" to engage in collective pursuit of science. Needham suggested that the Nationalist Government created scientific awards based on Chinese history, such as the "Tribute of Yu" for engineers, "Order of Shen Nung" for agricultural science, and the "Order of the Dream Pool" (taken from Shen Kua's *Dream Pool Essays*) for scientists in general. The Chinese government should also promote Sinology in the West, "in order that knowledge of Chinese achievements in the history

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<sup>58</sup> Ibid., 41-43.

of thought may be more widespread.” At home, students of modern science should also “acquaint themselves as fully as they can with the whole history of thought in the West.” The great inventions in Needham’s grand narrative was an early example of mutual achievement in East and West that underlined the universal bonds of humanity, not the singular achievements of one nation. His practical suggestions to Sinify scientific institutions and awards supported the belief that “All peoples of the earth have the right to participate in the whole human heritage.”<sup>59</sup>

### **International Unity, on Whose Terms?**

In his portrayal of the Allied Nations as a united democratic front against fascism, Needham was perhaps knowingly eliding the intense strategic and philosophical conflicts between great powers, few of whom shared his dream of evolution toward a unified humanity. The Allied Powers had originally been the United States and the United Kingdom, but President Franklin Roosevelt had pulled in first the USSR and then China to comprise the four “great powers” that would ensure world peace. Roosevelt hoped to avoid the weakness of the League of Nations by imbuing the US, UK, USSR, and China sole military power after the conclusion of the war, to serve as the world’s “four policemen” that would secure world peace. Stalin scoffed at the notion of China as a world power, and furthermore hoped to avoid entering the Pacific war until the European front was closed. Churchill was keen to maintain the British empire, against the dreams of the other three members. Chiang Kai-shek held the Pan-Asianist dream that Asians could collectively liberate themselves from Japanese and Western imperialism, and enter into the

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<sup>59</sup> Needham, “Wartime Report,” 42.

family of nations on equal terms. As the “great powers” entered talks in 1944-1945 to build institutions and alliances that could survive these conflicting dreams, science, history, and the history of science rose as important elements outside of the military and security issues that could hold them together.

While the other three powers were focused on military issues first and foremost, as the weakest of the four powers, the Chinese delegation enthusiastically supported cultural and scientific exchange as part of the United Nations mission. Stalin scoffed at the notion of China as a great power, and hoped to avoid any role in the Pacific War until the European front was closed. Once China was included, he pulled the Soviet Union out of the earliest three-power conference that established the UN at Dumbarton Oaks in Washington D.C. September to October 1944. China entered Dumbarton Oaks as a weaker member with little leverage. From the beginning, the Chinese ambassador Wellington Koo (1888-1985), urged the new institution to include cultural and scientific exchange as part of its mission. A veteran diplomat who had previously represented China at the League of Nations, Koo saw Chinese in international legal institutions with the West as the best means to achieve equality in the family of nations. Like Needham, he believed that universal values of democracy and science could be the basis of international relations that might transcend geopolitics and actually deliver world peace.

Filling in the USSR's seat as a weaker member, China had little leverage to affect the terms of the UN. However, Koo did put forward the Chinese point of view, including a proposal for a cultural and scientific branch of the UN:

With the continuous revelation of the wonders of science and the unending achievements of technology, a systematic interchange of ideas and knowledge will be invaluable in the promotion of the social and economic welfare of the peoples of the world. Similarly common effort should be made to advance

international understanding and to uproot the causes of distrust and suspicion among nations by means of educational cultural collaboration.<sup>60</sup>

Koo here was suggesting two priorities that the United Nations would set as they sought to pull in newly de-colonized and war-ravaged nations into alliance with the Great Powers of the UK, but especially the United States. First was the immediate task of supporting developmental projects. Koo asks that the “wonders of science” and technology be transferred to the member states in need, addressing the immediate needs of the “smaller powers” in the wake of World War II. Second was long-term alliance building. Member states should facilitate cultural exchange and educational reform to build “international understanding” amongst the public that would ensure the endurance of the alliance. Koo suggested the establishment of an International Social Welfare Office to facilitate economic and scientific cooperation. He also proposed an International Cultural Relations Office that would prepare “publications and school texts calculated to promote international understanding and friendship,” “to encourage international peace movements,” “to remove possible causes of international ill-feeling in the fields of radio broadcasts, films, theatre and literature,” “to establish international research organizations,” and “to do everything possible to increase the exchange of information among the various nations.” Later at the San Francisco Conference of the UN (April 25-June 26, 1945), which expanded to 50 member states in attendance, Koo re-emphasized cultural and educational cooperation as an important aspect of the UN.

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<sup>60</sup> Lura Gertrude Camery, *American Backgrounds of the United Nations Educational, Scientific and Cultural Organization*, (Ph.D. Thesis, Stanford University, 1949).

These conferences in 1944-45 led to the founding of the United Nations Educational and Cultural Organization (UNESCO) on July 31, 1945. The organization took education as its primary concern, pursuing the immediate aim of building up the institutional infrastructure of war-torn countries, but also the long-term project of building encouraging popular support for the UN between national populations through educational reform. The declaration proclaimed in the San Francisco Conference as a result of the Chinese proposal stated that: 1. Peace among nations must be founded on comprehension and mutual understanding; 2. That the United Nations have a duty to see that culture is made accessible to all men; 3. That it is the duty of the United Nations to facilitate the exchange and dissemination of knowledge about national (educational and cultural) activities. Building “mutual understanding” signaled the rolling back of the nationalism, racism and xenophobia that had permeated education in many places during the war. And yet, it also opened the door to wildly divergent perspectives by member states on how exactly to talk about world history, the mission of world peace, and how it should be achieved.

As an influential member of one of the Great Powers with a powerful network of friends at UNESCO, Joseph Needham gained a powerful voice in the organization to insert his views. His most lasting impact was to successfully insert science into the UNESCO charter, turning the organization in to a vehicle for the international scientific collaboration along the lines of his work in the SBSCO. In his final *Nature* article capping his series on science in China in 1944, Needham wrote “An International Science Co-operation Service”, proposing an institution that

would expand the work he was doing with the SBSCO to a global scale.<sup>61</sup> All sides of World War II accepted that science and technology had been essential in the war effort, and there was widespread public sentiment supporting increased governance of science. Needham opened his article with the words of Winston Churchill, “Science has given to this generation the means of unlimited disaster or of unlimited progress. When this War is won we shall have averted disaster. There will remain the greater task of directing knowledge lastingly towards the purposes of peace and human good.” When Churchill spoke those words in 1944, the “unlimited disaster” he referred to, was the possible loss of the war to the Axis powers. After the dropping of the atomic bombs on Hiroshima and Nagasaki in August of 1945, the sentiment was even more pressing amongst delegates to the UN. Needham saw the wartime activities of the SBSCO, as well as other similar efforts between the UK and its colonies in Asia and Africa, and between the United States, UK and USSR, as a model. In 1945, Needham’s urged his friend and head of UNESCO, Julian Huxley, to incorporate science into their new institution. A member of one of the most famous scientific and literary families in England, Huxley was a fellow scientist who shared Needham’s internationalist vision of evolution toward a unified world society and government. Together they would attempt to insert this view of history and international relations into the core activities and mission of UNESCO.

During the first General Meeting in London, November 1-16, 1945, the member nations, including the Chinese led by Hu Shih, accepted this proposal by the UK delegation to add

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<sup>61</sup> Joseph Needham, “An International Science Cooperation Service,” *Nature*, vol. 154, no. 3917 (November 25, 1944): 657-60.

“science” to the charter, and renamed the institution UNESCO. The US had dropped nuclear bombs on Hiroshima and Nagasaki only the month before, making the stakes of global cooperation and oversight of science painfully clear. The British delegate, Minister of Education Ellen Wilkinson (1891-1947) called on scientists and those in the humanities to take greater responsibility for the effect of science on society in her opening statement:

In these days, when we are all wondering, perhaps apprehensively, what the scientists will do to us next, it is important that they should be linked closely with the humanities and should feel they have a responsibility to mankind for the result of their labours. I do not believe that any scientists will have survived the world catastrophe, who will still say that they are utterly uninterested in the social implications of their discoveries.<sup>62</sup>

She was tapping into a fundamental shift in how publics and governments around the world thought about the relationship between science and society. While in the prewar period intellectuals like J.D. Bernal and Joseph Needham fought to persuade the state and the public to embrace central planning of science and technology, it now appeared irresponsible and immoral for any government to ignore it. Hu Shih was the lead delegate at this meeting, and also proposed to add science to the name and charter of UNESCO.<sup>63</sup> He pointed to the 60-year history of Chinese students being sent abroad to the United States and Europe as a precedent to the efforts at fostering mutual understanding that UNESCO could carry out. However, in a later talk in January 11, 1946, Hu expressed some of the doubts, saying that the UNESCO Constitution

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<sup>62</sup> Fernando Valderrama, *A History of UNESCO* (Vendome, France: UNESCO Publishing, 1995), 22-23.

<sup>63</sup> United Nations Conference for the Establishment of an Educational, Scientific and Cultural Organization, *[Proceedings of the] Conference for the Establishment of the United Nations Educational, Scientific and Cultural Organisation, London, Nov. 1-16, 1945* (London: Preparatory Commission UNESCO, 1945), 29.

“admittedly contains some of the most beautiful and high-sounding words and phrases to be found in the English language,” but that he and some of the delegates “began to feel that perhaps we had set for ourselves not only a high but a useless task.”<sup>64</sup> Nevertheless, with the participation of forty-four member states, the UNESCO Constitution was signed in November 16, 1945.

## **Diversity versus Unity in World History**

In the early days of its establishment, UNESCO members agreed that reforming history education would be essential as part of its mission to raise “mutual understanding” between nations, how history ought to be written was a source of unending conflict. UNESCO’s attempt to reform history education around the world was nothing new. Peace movements had focused on reforming history education since the 19<sup>th</sup> century, with particularly high activity in interwar Europe to remove nationalistic bias and glorification of violence and war. However, UNESCO was the first attempt to write global history that was also globally produced. Never had so many nations come together to pursue an intellectual project. The USSR refused to enter UNESCO initially, but it did bring in the formerly colonized and colonizer, the victims and victors of World War II together. But, as Hu Shih remarked, many could not see through the “high-sounding words and phrases” to understand what UNESCO might actually do. As British journalist Kenneth Lindsay reported in the Daily Mail at the opening of UNESCO’s first

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<sup>64</sup> Hu Shih, “The UNESCO Conference: A Chinese Delegate’s Point of View,” *Pi Lambda Theta Journal*, Vol. 24, No. 3, Education and the Peace (March, 1946), 109-111.

conference in 1946: “What is UNESCO? In recent and sample conversations I have heard it described as a tooth-paste, a new Rumanian Minister, and by an eminent Civil Servant as ‘the worst collection of jargon ever generated by the human mind.’”<sup>65</sup>

In these early years, Julian Huxley and Joseph Needham allied together to promote mankind’s evolution toward unity as UNESCO’s mission. In March 1946, Julian Huxley was named the Director-General of UNESCO. Julian was the grandson of Thomas H. Huxley, who earned the moniker “Darwin’s Bulldog” for being the foremost defender and popularizer of the theory of evolution.<sup>66</sup> A renowned scientist in his own right who synthesized the science of genetics with the theory of evolution, Julian appealed to the technocratic leanings of the British Government by promising to pull the scientific community on board with UNESCO.<sup>67</sup> At President Truman’s direction the American delegation opposed Huxley’s nomination, and managed to reduce his six-year tenure down to two.<sup>68</sup> A close friend who similarly hoped to use UNESCO as a vehicle for the internationalization of science, Needham was named Senior Counsellor and Head of the Natural Sciences Section. However, their attempt to assert those views into the mission of UNESCO would become a political boondoggle, as they came the

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<sup>65</sup> Lindsay, Kenneth. "Keep an Eye on Unesco." *Daily Mail* [London, England] (Nov. 19, 1946: 2), *Daily Mail Historical Archive*, Web. Accessed April 2, 2019.

<sup>66</sup> Thomas Huxley, *Evolution: The Modern Synthesis* (London: Allen & Unwin, 1942).

<sup>67</sup> John Toye and Richard Toye, “One World, Two Cultures? Alfred Zimmern, Julian Huxley and the Ideological Origins of UNESCO,” *History*, Vol. 95, No. 3 (July 2010), 330.

<sup>68</sup> W.H.G. Armytage, “The First Director General of UNESCO,” in *Evolutionary Studies: A Centenary Celebration of the Life of Julian Huxley: Proceedings of the twenty-fourth annual symposium of the Eugenics Society, London, 1987*, edited by Milo Keynes, G. Ainsworth Harrison (London: Macmillan, 1989), 188.

differing world-views of fellow academics in the organization, and the competing agendas of their member states.

Julian Huxley's first gambit in asserting the philosophy of evolution toward global unity was the publication in September 15, 1946 of *UNESCO: Its Purpose and Philosophy*.<sup>69</sup> Huxley stated that UNESCO must "be based on some form of humanism," that needed to be "scientific but not materialistic", and furthermore, "must be an evolutionary as opposed to a static or ideal humanism." Like Needham, Huxley saw biological and social evolution as similar, the former working through natural selection, the latter a process of cumulative tradition that was decidedly subjective. "Cumulative tradition, like all other distinctively human activities, is largely based on conscious processes-on knowledge, on purpose, on conscious feeling, and on conscious choice. Thus the struggle for existence that underlies natural selection is increasingly replaced by conscious selection, a struggle between ideas and values in consciousness." (9) Man, he wrote, had not evolved significantly biologically since ancient history. But "it is in social organization, in machines, and in ideas that human evolution is mostly made manifest." (10) As a eugenicist, Huxley believed both in encouraging biological traits in the population, and similarly, saw UNESCO as shepherding the evolution of world society. "From the evolutionary point of view, the destiny of man may be summed up very simply: it is to realize the maximum progress in the minimum time. That is why the philosophy of UNESCO must have an evolutionary background, and why the concept of progress cannot but occupy a central position in that philosophy." (12)

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<sup>69</sup>Julian Huxley, *UNESCO: Its Purpose and Its Philosophy* (London: Preparatory Commission of the United Nations Educational, Scientific and Cultural Organisation, 1946).

Two corollaries followed from this: that uniting man's tradition would be beneficial to human progress; and that social unification necessitated political unification. (13) UNESCO's aim was to stress this necessity through education, to "lay the foundations on which world political unity can later be built. It can help the peoples of the world to mutual understanding and to a realization of the common humanity and common tasks which they share, as opposed to the nationalisms which too often tend to isolate and separate them." (13) Although unification may be a distant dream, Huxley proposed ways UNESCO could pave the way in the fields of education, natural and social science, culture and the arts, and even in the promotion of population control through eugenics.

Huxley's pamphlet proved enormously controversial. When the his 60-page handbook was distributed at the first General Conference of UNESCO in Paris, 1946, a slip of paper was inserted into it saying that it reflected Huxley's "personal attitude," and that "it is in no way an official expression of the views of the Preparatory Commission."<sup>70</sup> Laying down moral principles and policies derived from the science of evolution was an attempt to transcend cultural differences. But to UNESCO's most powerful and paranoid member state, the United States, Huxley's "humanism" looked like a façade covering up an atheist, communist ideology. Furthermore, the notion of uniting all humanity socially and politically, flew in the face of the real inequalities which UNESCO member nations still hoped to preserve. The United States still preserved a Jim Crow system of racial oppression, and hoped to preserve for military power in

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<sup>70</sup> Toye and Toye, "One World, Two Cultures?" 328.

the hands of the “Big Four;” Churchill and many political and intellectual elites in the United Kingdom wanted to preserve Western Civilization as UNESCO’s core identity, and preserve their colonial holdings; for colonized nations, they wanted national independence and equality, not to be subsumed back into a Western dominated political and moral system. In fact, Chiang Kai-shek had sought to make China the leader of the colonized world amongst the Big Four.<sup>71</sup> While the United Nations enshrined the integrity of nation-states in a diplomatic-security apparatus, Huxley’s wanted to build a UNESCO that would undermine the centrality of the nation-state in the long-run.

As UNESCO turned toward its primary mission of education, and especially of reforming history education, this conflict developed into two divergent visions of world history and how to build world peace: one of the universalizing vision of Huxley and Needham, the other a view of diversity – nation-states influencing each other, but ultimately maintaining their integrity and unique identity. These two views of world history produced two different accounts of the great inventions narrative during the Cold War.

This conflict played out most dramatically and publicly in the creation of UNESCO’s *History of Mankind*. Needham suggested to Huxley that UNESCO write a history of mankind stressing cultural interchange as an antidote to the military and political focus of most national histories based on biases and preconceptions. The UNESCO books could be used as a source for classroom textbooks for schools in all countries and could contribute to UNESCO’s mission of

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<sup>71</sup> Klaus Muhlhahn, *Making China Modern: From the Great Qing to Xi Jinping* (Cambridge, Mass.: The Belknap Press, 2019), 339.

education for peace.<sup>72</sup> Huxley and Needham led the initial discussions of the project in 1946-1947, and it was adopted at the 1947 General Meeting of UNESCO. They passed a resolution welcoming the idea of producing a history of mankind that would focus on an “understanding of the scientific and cultural aspects of the history of mankind, of the mutual inter-dependence of peoples and cultures and of their contributions to the common heritage.”<sup>73</sup> However, before the project could get off the ground it faced a major problem. The CIA had long suspected that UNESCO was a cover for espionage, and warned President Truman that it was infiltrated by Communists. Joseph Needham was especially suspect, as a scientist who identified as a communist. This was not entirely unreasonable, as UNESCO was involved in the debate over sharing atomic energy, a cause that Needham supported; they feared he might send secret information of even uranium samples to the USSR.<sup>74</sup> Because of these suspicions, the United States forced Needham out of UNESCO in 1948. He headed back to his post at Cambridge April 20, 1948, and set to work on his own history of science.

### **The Great Inventions in *SCC* and *The History of Mankind***

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<sup>72</sup> Julian Huxley, *Memories* (New York: Harper and Row, 1970).

<sup>73</sup> UNESCO, *Records of the General Conference of the United Nations Educational and Cultural Organization, Second Session, Mexico 1947* (Paris: UNESCO, 1947), resolution 5.7.

<sup>74</sup> CIA, “Evaluation of Communist Infiltration of UNESCO. Report. Central Intelligence Agency. Top Secret,”

Declassified Documents Reference System, Ohio University (February 7, 1947).

During the 1950s and 1960s, Needham and UNESCO both produced their own world histories that ultimately failed to achieve the initial lofty goals of uniting all humanity. Needham, Huxley, and a myriad of other educators, scientists, and political figures had elevated science as a unifying force in international relations. More than the strategic, legal institution of the United Nations, they hoped to unify humanity along values of science that superseded nation, race, and political ideology. But in the immediate crush of Cold War tensions in the late 1940s, that dream was quickly squashed. In 1949, a year after Needham was booted out of UNESCO as a suspected communist, the Chinese Communist Party took Beijing and the Nationalist Government fled to Taiwan. This led to a crisis in UNESCO over whether the newly founded People's Republic of China, or the Republic of China (now based in Taiwan) would hold membership. While many in UNESCO sought Communist participation to fulfil the organizations universal goals, American pressure combined with Soviet suspicion of the organization foreclosed this possibility. On May 30, 1950 UNESCO declared it would back the Nationalists. In response, Czechoslovakia and Hungary, which had both become communist states under the sway of the USSR since in the years since joining, left UNESCO in protest over the decision. The Republic of China representative Wen Yuanning condemned the two countries to burn in an “inferno reserved for the soulless.”<sup>75</sup> With the Soviet Union and now all Eastern Bloc countries absent, the United States pushed, though not entirely successfully, to turn UNESCO into a Cold War propaganda

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<sup>75</sup> Kathleen Teltsch, “UNESCO Parley Puts Off Chinese Decision; Formosa Delegate Pillories Soviet Group,” *The New York Times* (May 26, 1950), 5.  
<http://search.proquest.com.ezproxy.library.wisc.edu/docview/111710466?accountid=465>.

instrument much like Voice of America.<sup>76</sup> Far from unifying humanity, UNESCO was quickly becoming a battleground between member states pursuing opposing agendas in the early Cold War.

Ousted from UNESCO, Needham would dedicate the rest of his life to producing *Science and Civilization in China*, and defending the Chinese revolution. By the publication of the first volume of *SCC*, what began as a history outlining science and technology as a unifying force in world history, became a project to give greater credit to one nation – China – for its past achievements. Needham's support of the PRC courted controversy that threatened to overshadow his work on *SCC*. And yet, in both his support of the PRC and his attack of Eurocentrism in history, Needham was consistent in criticizing Western chauvinism and disregard for Asia that was rising again in the early Cold War, despite the brief dream of world peace that UNESCO had promoted.

Before *SCC* could be published, Needham nearly lost his reputation entirely defending the PRC. Back in England, Needham became an important international ally to the PRC and a conduit to the West during extremely vulnerable years. In 1949, Needham arranged the first visit of a PRC delegation to the UK. According to British State Dept. documents, he frustrated them no end by guarding the delegation from any contact with British government officials, as he took them on speaking tours of England and Scotland. He also launched and served as president of the Britain-China Friendship Association, which lobbied for warmer relations between Britain and

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<sup>76</sup> "Unesco Called on to Counter Soviet." *New York Times* (Jun 7, 1950), 5.  
<http://search.proquest.com.ezproxy.library.wisc.edu/docview/111642771?accountid=465>.

the PRC, and eventually in 1955 for recognition of the PRC rather than the Republic of China in the United Nations.<sup>77</sup> These actions made Needham one of the PRC's most important public advocates in England, and a means to shift public opinion in the West toward supporting the PRC against ROC's claim as the true China, and against the US role in the Korean war.

The true test of Needham's commitment to the PRC came in 1952, when he was asked by Guo Moruo to join the International Scientific Commission to investigate the possible use of biological weapons by the USA in the Korean War. For Zhou Enlai and Mao Zedong, the event was meant to garner international sympathy for China and Korea and enhance its own international prestige. Using foreigners to echo their claims raised their legitimacy. Led by Zhou Enlai and Guo Moruo, the delegation asked Needham to join the International Scientific Commission. Not only was Needham eager to lend his authority to limit the use of science for such destructive ends, he was also motivated by his bitter experience at UNESCO to curb US aggression in Asia and help the PRC however he could. He was convinced that Westerners had little regard for Asian lives, and he trusted the word of his Chinese scientist friends, who he thought had been unfairly dismissed. Furthermore, by agreeing to join the investigation he also cemented his relationship with the Chinese Academy of Sciences, and access to research materials for SCC, an opportunity which few other academics would enjoy until the late 1970s. To further convince him, the Chinese authorities mobilized his scientist friends from his wartime travels, like Zhu Kezhen and others, all now well-established in the CAS, and fervently

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<sup>77</sup> Later, the group fell under Soviet control in the Sino-Soviet split, and in 1965 Needham began a pro-PRC group called Society for Anglo-Chinese Understanding.

convinced of the use of germ warfare by the US.<sup>78</sup> Needham produced the 700 page *Report of the International Scientific Commission for the Investigation of the Facts Concerning Bacterial Warfare in Korea and China*. In response he faced withering attacks from British parliament, as well as his colleagues in the scientific community.<sup>79</sup> However, he did secure access to Chinese research materials that would support his production of SCC for the next decades. Subsequent research into the state archives of the PRC, South Korea and the former USSR, have revealed that this indeed was doctored by the PRC with help of the Soviets.<sup>80</sup> Nonetheless, Needham stuck to his assertion until the end of his life.

Whatever the truth of the case over biological weapons in the Korean War, Needham and his critics were also arguing over a larger question of the place of Asia and the West in the post-war era. Needham saw Western ignorance and racism leading them to ignore the outcry of Chinese scientists and treat Asian lives as disposable, just as the US had done when it dropped two nuclear bombs on Japan. Needham viewed historians as similarly dismissing Asians in the past who had made great achievements that profoundly impacted the West. In *Science and Civilization, Volume 1*, he announced a grand project to correct this deliberate lacuna in the historiography. More than that, Needham also attacked what he saw as the racist, imperialist mindset that had produced this lacuna in the first place. While at UNESCO, he had envisioned

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<sup>79</sup> Joseph Needham , et. al., *Report of the International Scientific Commission for the Investigation of the Facts Concerning Bacterial Warfare in Korea and China* (World Council of Peace, 1952).

<sup>80</sup> Chen Shiwei, "History of Three Mobilizations: A Reexamination of the Chinese Biological Warfare Allegations against the United States in the Korean War," *Journal of American-East Asian Relations* 16, no. 3 (2009): 213-47.

*The History of Mankind* as an evolutionary history emphasizing the increasing interconnectedness of civilizations, a history that would support the present mission of establishing world government. But in *SCC*, East and West are reified as entirely separate subject, whose interconnectedness is extremely limited.

Interconnectedness of East and West becomes important to Needham in that it proves that China's past science and technology did not just benefit itself, but also were "great contributions" to the West. This comes through immediately in the preface, in which he asserts the important contributions of Chinese philosophy, science and technology to the West:

Still today the contribution of the Far East, and especially of its oldest and most central civilization, that of the Chinese, to science, scientific thought and technology, remains unrecognized and clouded in obscurity. The very term 'Far East', which I shall not use again in this book, but which springs spontaneously to the written page, exemplifies that fundamental insularity of outlook which it is so difficult for Europeans, even those who have the best intentions, to discard. The scientific contribution of Asia, and in particular of the 'Central Country', China, is the theme of this work. What exactly did the Chinese contribute, in the various historical periods, ancient and medieval, to the development of Science, Scientific Thought and Technology?<sup>81</sup>

While Needham criticizes the notion of the "Far East" as implying "insularity" of East and West in history, he nonetheless returns to Asia and the nation-state of China as the basic unit of analysis. He then uses the verb "contribution" to describe China's great inventions, emphasizing that their value is in that they spread to other places. After all, if a discovery is made in China and never leaves her borders, can it be called a "contribution"? He then frames the central task, which would override all others as *SCC* continued into new volumes – "what exactly did the

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<sup>81</sup> Needham, *SCC*, Vol. 1, 1954, 3.

Chinese contribute... to the development of Science, Scientific Thought, and Technology?" He doubles down on this later, emphasizing that this corrective history will undermine the support for Eurocentrism in history:

Today, though the 'white man' may have put down his 'burden' and even forgotten about it, are not Europeans, viewing the effects of modern science and technology in the complete transformation of the habitable globe, tempted too often to say to themselves that after all, this began in Europe with Galileo and Vesalius, and to conclude that Wisdom was born with us? A salutary correction of perspective is necessary. There *was* a Chinese contribution to man's understanding of Nature, and his control over it, and it was a great one... Their achievements should be mutually recognized and freely celebrated with the joined hands of universal brotherhood."<sup>82</sup>

Here Needham equate the "white man's burden," the idea that it was the duty of British empire to spread civilization to the inferior races of the world, with the contemporary faith in modern science as the marker of Western superiority. Recognizing Chinese accomplishments that had contributed to modern science might undermine Western chauvinism, and contribute to the "mutual comprehension" of East and West necessary to join in "universal brotherhood." At the very least, he hopes that it will correct the view, established during the Enlightenment and repeated by historians like Arnold Toynbee (1889-1975), that saw Western civilization as rational and mechanically inclined, and the East as irrational but spiritual.

But in the main text of the volume, qualifying what counts as a "contribution" becomes the most important aspect of the interconnectedness of China and the West. Section 7 of Volume 1, "Conditions of Travel of Scientific Ideas and Techniques between China and Europe," lays out

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<sup>82</sup> Ibid., 9.

a taxonomy of inventions. He begins by addressing the phenomenon of parallelisms – the occurrence of similar scientific ideas or technologies in different places. This can be described three ways: First, as simultaneous invention – different people produce the same inventions independently in different places and times. As civilizations came to share similar principles and theories in history, these kinds of simultaneous discoveries became more and more common. Second, diffusion of invention – the spread of an invention from one place to another. Though Needham is able to establish here a survey of the historical links between China and the West, flowing through the Silk Road, the Mongolian Empire, and the Spice Trade, proving the travel of an invention from East to West is still a matter of conjecture and probabilities, and rarely is there textual evidence making an iron-clad case. Third, Needham introduces a lower bar to prove the connection, “stimulus diffusion” – this means that just the idea that something has been produced elsewhere may stimulate its invention somewhere else. Beyond asserting greater connectedness between China and the West before the 18<sup>th</sup> century, Needham is reluctant to parse exactly if or how Chinese inventions spread to the West, or determine who had priority in each case.

Nevertheless, Needham presents a list of 26 inventions “which reached Europe and other regions at times varying between the +1<sup>st</sup> and the +18<sup>th</sup> centuries, running from a to z. All of these appear in China before the West, which is accentuated in the table. However, “we must not suppose that the last word has been said on any of these developments, nor, the adequate evidence exists in all cases to prove conclusively that the later European uses were derived from

the earlier Chinese practice.” This long list is comically contrasted with a list of only four mechanical techniques transmitted from the West to China<sup>83</sup>:

Table 8. *Transmission of mechanical and other techniques from China to the West*

	Approximate lag in centuries
(a) Square-pallet chain-pump	15
(b) Edge-runner mill	13
(c) Edge-runner mill with application of water-power	9
(d) Metallurgical blowing-engines, water-power	11
(e) Rotary fan and rotary winnowing machine	14
(f) Piston-bellows	c. 14
(g) Draw-loom	4
(h) Silk-handling machinery (a form of flyer for laying thread evenly on reels appears in the +11th century, and water-power is applied to spinning mills in the +14th)	3-13
(i) Wheelbarrow	9-10
(j) Sailing-carriage	11
(k) Wagon-mill	12
(l) Efficient harness for draught-animals: Breast-strap (position) Collar	8 6
(m) Cross-bow (as an individual arm)	13
(n) Kite	c. 12
(o) Helicopter top (span by cord)	14
(p) Zoetrope (moved by ascending hot-air current)	c. 10
(q) Deep drilling	11
(r) Cast iron	10-12
(s) 'Cardan' suspension	8-9
(t) Segmental arch bridge	7
(u) Iron-chain suspension-bridge	10-13
(v) Canal lock-gates	7-17
(w) Nautical construction principles	> 10
(x) Stern-post rudder	c. 4
(y) Gunpowder	5-6
(z) Gunpowder used as a war technique	4
(aa) Magnetic compass (lodestone spoon)	11
(ab) Magnetic compass with needle	4
(ac) Magnetic compass used for navigation	2
(ad) Paper	10
(ae) Printing (block)	6
(af) Printing (movable type)	4
(ag) Printing (metal movable type)	1
(ah) Porcelain	11-13

Table 9. *Transmission of mechanical techniques from the West to China*

	Approximate lag in centuries
(a) Screw	14
(b) Force-pump for liquids	18
(c) Crankshaft	3
(d) Clockwork	3

This table of 26 inventions transmitted from China to the West on the left, and the 4 significant inventions transferred from the West to China before 1800. The right column indicates the lag in centuries between the appearance of the invention in one place and the other.

In the text of the chapter, Needham steps back from making a blanket assertion that just because an invention was made in China first, it must have diffused to the West. But in the tables, that

<sup>83</sup> Ibid., 242-3.

distinction disappears, and all the inventions are said to have “transmitted from China to the West.”

Chief among them are the four great inventions of paper, printing, gunpowder, and the compass, which Needham returns to repeatedly in Volume 1 to exemplify the failure of Western historians to recognize their Asian origin. For example, he criticizes J.B. Bury’s *The Idea of Progress*, published first in 1920 but republished many times over. Bury quotes Francis Bacon’s remarks on the three great inventions, but fails even in a footnote to mention their Chinese origin. Though Needham saves the details of the inventions for future volumes, the question of what exactly was or was not diffused from China to the West is set aside, and the fact of their early appearance in China is most important to the claim that these were great “contributions.” The point is to assign credit, to enhance the prestige of China in world history, not to write a world history that might show increasing interconnectedness through time. Over the many volumes of *SCC*, the “Needham Question” of why China had not created modern science, how Chinese inventions spread, or the interrelatedness of China and the West in the past, is set aside in favor of what Needham would later call his “grand titration” – a metaphor taken from chemistry, meaning to measure the “great civilizations against one another, to find out and give credit where credit is due...”<sup>84</sup> Why was such an exercise necessary for Needham? I argue that his early bitter experiences in the Cold War led him to believe that Western chauvinism and racism had not died with the fascists in World War II, but was still alive and well. *SCC* did not

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<sup>84</sup> Needham, *The Grand Titration*, 1969.

ultimately provide a history of all mankind triumphing through the sharing of knowledge. Rather, it became a history of one nation-state's achievements.

While Needham helmed a team of researchers that published volume after volume from his post in Cambridge, at UNESCO, the *History of Mankind* dragged on for decades. Beset by Cold War politics within the organization, the writing of history into a never-ending negotiation between academics representing national and ideological positions that were inexorably at odds. With Huxley and Needham out of the picture, and the new director of UNESCO the Brazilian Jaime Torres Bodet decidedly uninterested in producing a history epic, the US delegation successfully nominated American historian Ralph E. Turner to head *The History of Mankind* project. Though Turner bought into the vision of human evolution toward unity, he lacked the power to wrangle the project through the mire of Cold War divisions and ideological disagreements that plagued UNESCO in the 1950s, which only escalated when the USSR under Nikita Khrushchev's leadership joined in 1954.<sup>85</sup> The first volume did not appear until 1963.

Examining the coverage of the great inventions in UNESCO's *The History of Mankind* shows how the earlier ideals of a human evolution toward unity gave way to a narrative of discrete nation-states all making their own discrete contributions. This was a result of the process of negotiation between UNESCO member states over the content of the history. The volume in

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<sup>85</sup>Gilbert Allardyce, "Toward World History: American Historians and the Coming of the World History Course," *Journal of World History* 1, no. 1 (1990).

which the great inventions appear, *Volume IV: The Foundations of the Modern World*,<sup>86</sup> has been made famous by Gilbert Allardyce's account of its creation by American historian Louis Gottschalk.<sup>87</sup> It took Gottschalk twelve years to complete the volume, exceeding the deadline by eight years. On the day he submitted the manuscript, he had a heart attack. At first, Gottschalk planned to call the volume "The European Age, 1300-1775," which was rejected by the commission president Pablo E DeBaerredo Carneiro, who said that "no age can be called European."<sup>88</sup> Attempting to avoid the Eurocentric model, Gottschalk brought on other specialists, at his own expense. Over 12 years, he sent his work over 12 years to 350 advisors around the world, including Soviet experts whose Marxist methodology was entirely at odds with the emphasis on peaceful exchange and unification that suffused the entire project. They sent their complaints to him in a package weighing thirty-six pounds.<sup>89</sup> Despairing, Gottschalk said, "Every time I tried to satisfy one critic, I would dissatisfy another. So I plead incompetence." He concluded that "I have found the task of preparing a volume that will satisfy me on world history from 1300 to 1775 beyond my capacity, and I believe the task of preparing one that will satisfy all the critics an impossible one."<sup>90</sup> As Gottschalk attempted to weigh conflicting critiques

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<sup>86</sup> Louis Gottschalk, Loren C. MacKinney, and Earl H. Pritchard, *History of Mankind: Cultural and Scientific Development. Vol. 4. The Foundations of the Modern World* (New York: Harper and Row Publishers, 1969).

<sup>87</sup> Allardyce, "Toward World History".

<sup>88</sup> *Ibid.*, 32.

<sup>89</sup> *Ibid.*, 34.

<sup>90</sup> Allardyce, "Toward World History," 34-35.

against one another, the volume lost the overall narrative of increasing unity and became a negotiation between competing national interests, in which everyone received a share of the past.

The great inventions appear in the section “Science and Technology between 1300 and 1530,” which begins with the age old assertion that “Before 1300, the level of Christendom's scientific and technological achievements in many respects was lower than that of the great civilizations of China, India, and the Islamic world. In those civilizations science had flourished during the so-called 'Dark-Ages' of the West.”<sup>91</sup> Despite indicating that the main action lie elsewhere, the narrative here focuses on the “disappointing” slow development of science in Europe, and casts the Middle East and Asia as supporting civilizations that influenced its development.

Thus, the non-West only takes center stage in the sub-section “Science and technology outside Europe.” Echoing the preference of the book towards interactions between civilizations rather than discrete developments, the author notes that only science and technology that “entered the stream of world culture” need be considered. What this amounts to is a catalogue of non-Western places that effected Europe. Islamic science and technology is given a large sub-section here, two smaller sections for India and China, and a paragraph-long section on Japanese medicine. The two-page passage on Chinese science and technology is almost entirely drawn from Needham's *SCC*, *Vol. I* (1954) and *III* (1959). It reproduces the great inventions narrative as Needham had written it, of how China had the compass, gunpowder, and printing

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<sup>91</sup> Gottschalk, et. al., *History of Mankind*, 789.

before Europe, and how they were brought there through the Mongols. It also includes the quote by Francis Bacon Needham had used in *SCC Vol. I*, that “these three have changed the whole face and state of things throughout the world.” The text adds, “If [Bacon] was right, it is to Chinese technology that the world owes this debt.”<sup>92</sup>

And yet, when the history of printing, navigation, and military technology are considered on their own in greater detail, European and Chinese narrative run in parallel rather than in connection, and even the notion of the Chinese origin of the great inventions is sidelined. In the history of printing, the issue of its invention in Europe is sidestepped by the sentence:

The “invention” of printing in the West required more than the use of movable type...These needs were only slowly satisfied in the fifteenth century.<sup>93</sup>

By putting the word “invention” in quotation marks, and using the passive voice, the author basically does not assign credit for the invention of printing at all. Likewise, the invention of gunpowder is declared “still somewhat a mystery,” and only its use in Europe is described.<sup>94</sup> The use of the magnetic compass is barely discussed in the many sections dealing with the rise of global travel, in which other instruments like the astrolabe, the stern-post rudder, and advances in astronomy are given greater attention. Again, transmission of the compass from China to the West is sidestepped, when the author writes:

The Chinese are supposed to have long known that a freely suspended magnet will point north and south, but only around the year 1100 did this fact become

<sup>92</sup> Gottschalk, et. al., *History of Mankind*, 815.

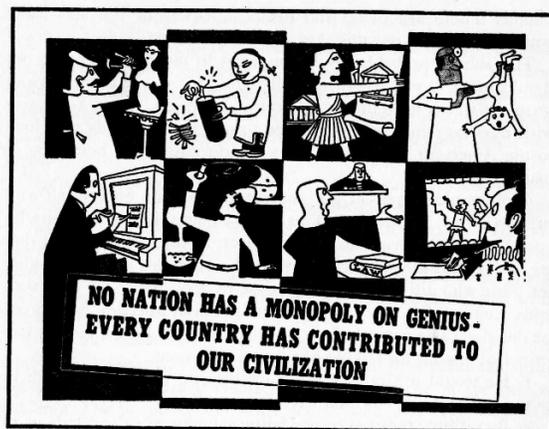
<sup>93</sup> *Ibid.*, 555.

<sup>94</sup> *Ibid.*, 946-951.

known in the West. About that time magnetic compasses were first mentioned in Europe...<sup>95</sup>

Rather than suggest that Europeans learned about the compass from the Chinese, he uses the passive voice to leave the origin of the compass ambiguous, and instead seaways into its development in Europe. In sum, *The History of Mankind* depicts civilizations as developing science and technology in parallel rather than in interchange, leaving the thorny issue of primacy aside. Europe remains center-stage, while the Middle-East, South and East Asia dominate the rest of the material as important side-players. As civilizations are usually discussed on their own as chapters are broken into sub-sections by area, every civilization gets to be the hero of its own story.

## Conclusion



Returning to the image opening the chapter, what can we make of it now? For a brief moment in the late 1940s, a major constituency of educators, intellectuals, and political leaders bought into

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<sup>95</sup> Ibid., 806.

the idea that mankind might be ready for world governance, and even more radically, evolution into a unified human community that transcended the nation-state. The text here promotes those values of equality and human rights that undergirded this political project with its message that “no nation has a monopoly on genius.” Furthermore, it suggests that “our civilization” expands beyond the West, and includes China. Joseph Needham and others advanced science as a universal language that might serve as a model for international relations, and the history of science as evidence of mankind's ability to learn from one another and work toward common goals. This new emphasis away from politics and war, and onto science, art and culture, is also reflected in this image depicting Greek architecture, French sculpture, and the Chinese invention of gunpowder.

However, this image also represents the failure of historians to fulfill the dream of one world unity and world peace. Rather than a united humanity, each nation-state has its own box in this image, with its own stereotypical national garb and achievement that it “contributed” to the world. As Cold War tensions grew in the late 1940s, the dream of overcoming national identity was abandoned. For Needham and UNESCO, writing world history became less about promoting the dream of unity and peace, and more about reassigning credit for past accomplishments. As the People’s Republic of China was denied entrance to the United Nations, the great inventions became a useful vehicle to claim China’s prestige in the face of persistent Western attitudes of racism and Eurocentrism. In this tumultuous geopolitical context, it was not Chinese historians who nominated the great inventions as their nation’s proudest achievements, but Needham. Legible to a Western audience, Needham brought the great inventions to new prominence as China’s “great contributions” to world history. Recognizing the international cache of the great inventions narrative, the Chinese Communist Party would soon follow his lead.

## Chapter 4: The Great Inventions in the Mao Era

In the early years of the PRC, the great inventions narrative provided a historical answer to the quintessential question of the nuclear age – how can science a force for good and not evil? As the Chinese Communist Party, with the direction and material aid of the USSR, began a program of rapid industrialization after 1949, so too did popular magazines seek to popularize the study of science as a national and moral imperative. A children’s magazine that would publish frequently on the great inventions, *Progressive Youth* (*Jinbu Qingnian* - 进步青年, formerly *Zhong Xuesheng* 中学生), posed this dilemma in its first issue in the PRC period (December 1949). Entitled “Why do so many people despise science?,” the editor explained that it was “because Hitler used it for evil,” and now American and English imperialists – “second generation Hitlers” – use science “in the shady business of robbing and killing.” But the author then asked, “are the calamities that accompanied the coming of science unavoidable? Can science be made harmless, into a type of thing ‘with 100 benefits and not one disadvantage’?” He advanced an argument that would be crucial in promoting the study of science and technology in China:

Science itself is innocent, scientists themselves are also innocent, the only guilty ones are those who use science; it is due to having a subset of people who misused science, exploit science to do misdeeds. Science itself is the number one weapon. It can be compared to the latest type of fast-loading rifle, grasped in the hands of KMT spy it can kill people and rob property, grasped in the hands of the People's Army, then it can protect the country...

Therefore, the urgent duty before us is to take this sharp weapon down, it is to disarm the imperialist's science! Only when the imperialist's science has been disarmed, after science is handed back to the hands of the peace-loving people, can world peace be guaranteed, can all humanity's happy days truly arrive. Not

until that day, can science be a thing “with one hundred benefits and not one disadvantage;” until that day, who can still fear it, not trust it?<sup>1</sup>

Couched in the recent experience of the Second World War and the ongoing battle with the KMT now based in Taiwan, science here is presented as neutral. In the hands of fascists like Hitler, the treacherous Chiang Kai-shek, and Western imperialists, it can do incredible harm. These dangers were not at all abstract in December 1949, when the fight to unify China under the CCP had not even fully ended. But science, the editor argued, was like a rifle that anyone could use. In the hands of the “peace-loving people” – the Chinese Communist Party and larger Communist Bloc – it could create world peace. The article thus called on its middle-school student audience to study science in support of the noble cause of world peace and anti-imperialism.

This argument had a parallel in the historical narrative of the four great inventions – that modern science and technology, and modernity itself, was not a Western invention used to humiliate China, but was in part a product of the Chinese laboring people themselves.<sup>2</sup> During 1950-1954, a flood of articles and books appeared in children’s magazines including *Progressive Youth*, as well as widely available paperback books and newspaper articles. The entry of the PRC into the Korean War (known in China as the “Resist America, Aid Korea War” *kangmei*

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<sup>1</sup> Chen Xinqian 陈新谦, “Weishenme you henduo ren zenghen kexue?” 为什么有很多人憎恨科学? [Why do so many people despise science?], *Jinbu Qingnian* 进步青年 [Progressive Youth] 218 (December 1949).

<sup>2</sup> The position I am describing here is not the same as the “Chinese roots of modernity” advanced by the Kyoto School of historians in 1930’s Japan, who argued that that Song Dynasty China, not Europe was the first modern civilization. This theory supplied imperialist Japan with a civilizational lineage confined to East Asia. Rather, the great inventions narrative allowed these Chinese authors to *confirm* that modernity had sprung from the West (central to a Marxist view of history), while only claiming that it would not have been possible without Chinese contributions. There is no “alternative modernity” here, only a Chinese preface.

*yuanchao zhanzheng* 抗美援朝战争) in November 1950 prompted a wave of publications promoting patriotism in which the great inventions narrative became a prominent subject. From 1951, authors increasingly wrote of the great inventions as proof that Chinese had only used science to make “great contributions to world civilization,” and that China was capable of standing up to “imperialist America and her running dogs.” In these publications, authors uncovered a “forgotten” history of early scientific and technological achievement that held forth a vision of China as the most advanced civilization on earth, and heralding the potential of New China to unlock the creative genius of the Chinese laboring people. This chapter will examine the popular literature – magazines, newspapers, and cheap paperbacks – that established a great inventions narrative for the Mao over 1950-1954.

### **Mao’s Great Inventions Narrative, 1939**

The popularity of the great inventions in the early PRC popular literature would not likely have occurred without Mao Zedong’s own brief reference to them in his historical treatise, *The Chinese Revolution and the Chinese Communist Party*. Written in the midst of the Chinese Civil War in December 1939, the book is much better remembered as Mao's first attempt to reshape the Marxist theorization of Chinese history. Here, Mao presented a radical alternative to one imposed by Stalin, that China was only prepared for a bourgeois revolution and required the co-leadership of the Chinese Communists and the Kuomintang in a United Front. Mao asserted that on the contrary, China was ready for socialism immediately, and the Chinese Communist Party

alone was the rightful leader of the revolution.<sup>3</sup> Mao also departed from Karl Marx's original analysis of China, which he with India as examples of "Asiatic bureaucratism," a system separate from Europe which served as the model of normal historical development. Mao eschewed this theory entirely, and classified nearly all Chinese imperial history – from the Zhou (1046-256 BC) and Qin (221-206 BC) Dynasties until the Opium War (1840 AD) – as the "feudal" stage of China's history, similar to the West's. Mao saw this age as defined by the conflict between rebellious peasant and exploitative landlords, and the incursions of foreign capitalism, dynamics of class conflict which form the drivers of historical progress. He describes the CCP as leading China out of a dark feudal past.

Nevertheless, in the first few pages of the book Mao points out the "renown" and "high level of development" of Chinese agriculture and handicrafts in the feudal period, her possession of "many great thinkers, scientists, inventors, statesmen, soldiers, men of letters and artists," and of the inventions of the compass, gunpowder, paper, and printing. What work were the great inventions in particular doing for Mao in his retelling of Chinese history? Mao wrote:

Developing along the same lines as many other nations of the world, the Chinese people (here we refer mainly to the Hans) went through many thousands of years of life in classless primitive communes. Some 4,000 years have gone by since the collapse of these primitive communes and the transition to class society, which took the form first of slave and then of feudal society. Throughout the history of Chinese civilization its agriculture and handicrafts have been renowned for their high level of development; there have been many great thinkers, scientists, inventors, statesmen, soldiers, men of letters and artists, and we have a rich store

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<sup>3</sup> Stalin determined that China had only experienced a "democratic bourgeois revolution," entering the capitalist stage, and therefore supported Nationalist-communist co-rule, rather than supporting the Chinese Communists outright. Mao, however, wrote that China had experienced a "new democratic revolution" (*xin minzhuzhuyi geming*), which the Chinese Communist Party should lead. Huaiyin Li, *Reinventing China: Imagination and Authenticity in Chinese Historical Writing* (Honolulu: University of Hawaii Press, 2013), 102.

of classical works. The compass was invented in China very long ago. The art of paper-making was discovered as early as 1,800 years ago. Block-printing was invented 1,300 years ago. In addition, moveable types were invented 800 years ago. Gunpowder was also used in China earlier than in Europe. Thus China has one of the oldest civilizations in the world; she has a recorded history of nearly 4,000 years.<sup>4</sup>

This short passage is one of the few in *The Chinese Revolution* to describe the glories of China during its "feudal" age, and the great inventions stand out for receiving the most attention. I argue that Mao utilized the great inventions narrative here to, 1) prove that "feudal" China developed similarly to the West, and 2) that the China's laboring class had made great achievements in science and technology, despite the impediments of feudalism.

First, the great inventions and other achievements of the imperial past show that China developed "along the same lines as many other nations of the world," with its own great statesmen and scientists. As Joseph Levenson has remarked, one appeal of Marxism to Chinese revolutionaries was that it allowed them to incorporate China into a world history that didn't leave them at a permanent disadvantage. This was because Marx theorized a further stage of history, socialism, which the West had not yet reached.<sup>5</sup> But while Marx had set China (along with India and other parts of Asia) apart from the development of the West with his theory of "Asiatic despotism," in *The Chinese Revolution and the Chinese Communist Party*, Mao completely ignored this theory, and saw imperial China as much in line with the development of

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<sup>4</sup> Mao Zedong, *The Chinese Revolution and the Chinese Communist Party* (Beijing: Foreign Languages Press, 1968). First published in Chinese language in *Gongchangdang Ren* 共产党人 [*Chinese Communists*], Iss. 4 & 5 (Spring, 1940), and republished after the establishment of the PRC in *Mao Zedong Xuanji* 毛泽东选集 [The selected works of Mao Zedong], Vol. 2.

<sup>5</sup> Joseph Levenson, *Confucian China and Its Modern Fate* (Berkeley: University of California Press, 1964), 134ff.

other advanced nations. While Westerners and many Chinese reformers had declared that China “had no science” in its imperial past, Mao breezily declares that China had many “great thinkers, scientists, inventors...” and heaps special praise on the great inventions. Mao uses the inventions to signal that China had not developed outside of world history, but was firmly within it.

Second, Mao implicitly credits the great inventions to China's "peasant and handicraft workers," the heroes of his brand of Chinese history. As practical technologies utilized by artisans and soldiers, the great inventions lent themselves to the idea that the working class were the source of everything good in China's past. In *The Chinese Revolution*, Mao wrote clearly that "the principal contradiction in feudal society was between the peasantry and the landlord class. The peasants and the handicraft workers were the basic classes which created the wealth and culture of this society."<sup>6</sup> While other Chinese sciences such as astronomy or geometry were the domain of the imperial literati alone, the technologies of printing, paper, gunpowder and the compass were products of artisans and workers, and thus a more suitable subject of Mao's contained praise of the feudal past. While Mao is most concerned with class conflict in the “feudal” past, highlighting the great inventions signaled that the Chinese laboring people possessed irrepressible talent, and had impacted world history despite the corruption of feudal society.

The schema of Chinese history laid out in *The Chinese Revolution and the Chinese Communist Party* would become dogma in history writing under the PRC. The inclusion of the great inventions here would lead to expanded research and publishing on the topic in the 1950s

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<sup>6</sup> Mao Zedong, *The Chinese Revolution and the Chinese Communist Party*.

and 1960s, when they became the most popular topic in the history of Chinese science and technology. As popular and children's writers, educators, academic historians, and even opera and comic book writers mined the imperial past for stories that might serve the new China, Mao's short passage here certified the inventions as a politically correct subject to celebrate. While the great inventions were already included in many history textbooks in the Republican period, under the expanded and centrally controlled education and media system of the PRC, they would be enshrined into popular consciousness like never before.

### **The Great Inventions in the Popular Press, 1950-1954**

Between 1950 and 1954, the Chinese inventions of printing, paper, gunpowder, and the compass became the subject of many articles and books in the popular press. Pivotal to this flood of writing on the inventions was China's entrance into the Korean War in October 1950, propelled the publications that would enhance patriotism more widely, and led writers to see the great inventions as an allegory for China's benevolent role in the world, compared with the imperialist West. No singular, authoritative account emerged in this period – indeed, the historians of science who might have written one were busily engaged in the total reorganization of the education system along Soviet lines until 1954. Rather, a number of scientists, children's writers, journalists, and professional historians wrote on the great inventions in popular and children's literature, cumulatively rewriting the narrative for the politics of the PRC era. First, they argued that the great inventions lent China a claim to the advent of modern science and technology, and modernity itself. Second, they gave credit to laboring class for the great inventions, bringing the narrative in line with Maoist historiography. Third, they used the narrative to illustrate the Maoist principle of “patriotism and internationalism,” by showing that

making achievements in science and technology not only strengthened the nation, but was also a “great contribution to world civilization.” Constantly reprinting Mao’s earlier 1939 excerpt, these publications established the great inventions as a subject of patriotic celebration of China’s feudal past – a rarity in the PRC era.

The first series of articles on the great inventions to appear in the PRC era was “The Story of the Book,” which appeared in *Progressive Youth* published over April to June of 1950, and established the narrative of Chinese ownership of modernity. Written by Xu Tiaofu (徐调孚 1900-1981), a prolific translator of classical Chinese literature who became director of China Youth Publishing House (*Qingnian Chubanshe* 青年出版社) in 1949. Perhaps coincidentally, the title of this two part article was identical to a children’s book by the Soviet writer Mihail Il’in, whose short world history of the book was re-published in China in the same year.<sup>7</sup> While Il’in’s story centered on the ancient Mediterranean world with the Chinese invention of paper as an honorable mention, Xu asserted that the book, a critical component of modernity, was derived from the Chinese inventions of paper and printing. Xu wrote:

For nearly one-hundred years, The Chinese people have been deeply influenced by the poison of imperialist culture, and believe that all modern civilization is passed down from Euro-America. Once upon a time, a group of people said that everything in China was “as it was in ancient times.” This is not true. Furthermore, the idea that everything is derived from Euro-America is equally mistaken. We should seek truth from facts, find the actual truth, and only then make an argument. The technology of paper making in ancient China was already completed. After the 4<sup>th</sup> and 5<sup>th</sup> centuries AD, the progress was already enough to

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<sup>7</sup> Yilin 伊林 (Il’in, Mihail), *Shu de gushi* 书的故事 [The story of the book], Ying Li (Beijing: Xinzhi sanlian shudian, 1950). This was a republication of a 1936 Chinese translation from the Russian original, which was published in the USSR in 1928.

use a variety of plant fibers to create beautiful papers of different sizes and colors.<sup>8</sup>

Xu here used the Chinese invention of paper and printing to counter the idea that modernity was solely the product of the West, and that China had never been technologically advanced. The “story of the book,” he writes, shows that China has was a critical contributor to “modern civilization,” a fact that a century of imperialism had led Chinese people to forget. The idea that “everything in China was ‘as it was in ancient times,’” was actually a key component of earlier writing about the great inventions in the nineteenth and early twentieth centuries, as Westerners and Chinese alike bemoaned that despite discovering these technologies in ancient times, only Westerners developed them. In fact, Xu wrote, the “modern technology” of papermaking was “perfected” in ancient China, long before the West began using it.

And yet, Xu contrasts this strong claim of China’s part in creating modern civilization with his explanation of how she had fallen behind in modern times:

In the end of the 18<sup>th</sup> century, each European country invented mechanical technology, thereupon leading to the success of the Industrial Revolution, and capitalist society took shape. Consequently, every product was produced in large quantity, one by one they were sold to foreign markets....China’s invention of paper making technology from beginning to end stopped at the stage of handicraft, it did not have a single step of development, but Europe’s paper-making industry was mechanized, it progressed by leaps and bounds. Can handiwork compete with machines? Because in the last half century, China’s use of printed book paper is practically dependent on supply from Sweden, Norway, Finland, Canada and Japan, everyone has already forgotten who it was that invented paper.<sup>9</sup>

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<sup>8</sup> Xu Tiaofu 徐调孚, “Zhi de faming (shu de gushi)” 纸的发明 (书的故事) [The invention of paper (the story of the book)], *Jinbu Qingnian* 进步青年, Vol. 222 (April 1950).

<sup>9</sup> Xu Tiaofu, “Zhi de faming (shu de gushi).”

While much of the article dealt with the early history of papermaking in China, this passage points out how China had continued to produce paper by hand, while the European imperialists produced it by machine and consequently flooded the Chinese market. The long history of Chinese superiority is broken by Western industrialism and imperialism. Despite the author's call to remember that the Chinese invented papermaking, reviving this history was not to advocate a literal return to the past, but to inspire a sense of national ownership over the modern papermaking industry, rather than seeing it as solely a product of the West. To modernize the paper industry, therefore, would not be to imitate the West, but to revive China's past mastery and status.

When China entered the Korean War in October 1950, writing on the great inventions shifted toward emphasizing how they represented a “great contribution to world civilization,” and were thus an illustration of the Maoist principle of “patriotism and internationalism.” This turn began with a January 1, 1951 editorial in the *People's Daily* entitled “Strengthen our great motherland under the banner of patriotism.” Sharing the front page with a portrait of Mao and reports on the battle in Korea, the article contrasted the “narrow nationalism” of China's imperialist enemies with the combined “patriotism and internationalism” of the PRC.<sup>10</sup> The principle of “patriotism and internationalism” suffused Maoist thought and writing, most famously described in his 1938 tribute to Norman Bethune, the Canadian doctor who died

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<sup>10</sup> Editorial, “Zai weida aiguo zhuyi qizhi xia gongguo women de weida zuguo” 在伟大爱国主义旗帜下巩固我们的伟大祖国 [Strengthen our great motherland under the banner of patriotism], *Renmin Ribao* 人民日报, January 1, 1951.

fighting with the CCP. In that letter, later reproduced in the “little red book” of quotations, Mao explained that the defeat of imperialists at home was both a patriotic defense of the nation, and also made possible the international communist revolution.<sup>11</sup> In November 1948, Liu Shaoqi (刘少奇) also expounded on this principle in a *People’s Daily* article, “Discussion of Internationalism and Nationalism,” which compared the “bourgeois nationalism” of capitalist countries and the KMT to the “proletarian internationalism” of communist countries.<sup>12</sup> Now a mere year after its founding, the PRC looked to its Soviet ally for material assistance and leadership in national reconstruction, and at the same time was embroiled in a costly war in Korea for which it was ill prepared. Connecting internationalism and nationalism was not just an abstract commitment to global revolution, but a political principle that enmeshed China in a web of Cold War commitments and alliances.

The editorial also reprinted Mao’s quote on China’s illustrious history and great inventions from his 1939 *The Chinese Revolution and the Chinese Communist Party*, and called on readers to see China’s history as a model for the principle of internationalism and patriotism. The editorial prefaced Mao’s quote with an argument that the imperialists were not only attempting to destroy China, but also its status in world history:

The imperialists and their running dogs have arrogantly attempted to obliterate the status of the Chinese people in the world, who account for about a quarter of all humanity, and then to obliterate the status of Chinese history in world history. But

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<sup>11</sup> Mao Zedong, “In Memory of Norman Bethune” (December 21, 1939), in *Selected Works*, Vol. II, 337, <https://www.marxists.org/reference/archive/mao/works/red-book/ch18.htm>.

<sup>12</sup> Liu Shaoqi 刘少奇, “Lun guoji zhuyi yu minzu zhuyi” 论国际主义与民族主义 [Discussion of Internationalism and Nationalism], *Renmin Ribao* 人民日报, Nov. 7, 1948. Translated into English in: Liu Shaoqi, *Internationalism and Nationalism* (New York, N.Y.: Committee for a Democratic Far Eastern Policy, 1948).

this is futile. We oppose nationalists who refuse to study foreign nations and despise other ethnic groups.

The claim that Westerners had attempted to “obliterate the status of China history in world history” was not unfounded. In the wake of World War II, many leaders around the world agreed that Eurocentrism and racism in history education had contributed to the rise of fascism, and UNESCO (the cultural branch of the United Nations) made history education reform its first priority.<sup>13</sup> As the Korean War drew China into open conflict with its previous ally against fascism, the editors at the *People’s Daily* now identified the American “imperialists and their running dogs” (referring to Cold War client states like the Republic of South Korea) as harboring the same bigoted ideology as the Nazis. The editors continued by explaining the benevolent, outward-looking nationalism that Chinese should practice:

We oppose ridiculous self-importance, but we also oppose being unduly humble. According to objective facts, China’s long history and culture not only united 475 million people into a great country, but also is the center of the long history and culture of East Asia. It has once and continues to make its important contributions that influence the whole world (*zhongyao gongxian yinxiong quanshijie* 重要贡献影响全世界). Does anyone have the right to discredit objective facts?

The editors contrasted the racism and “ridiculous self-importance” of American and Nazi nationalism to Chinese patriotism that is based in the “objective facts” of its long and illustrious history. Mao Zedong’s original 1939 passage, quoted in this article, declared that China and the West had “developed along similar lines.” But now in 1951, the editors at the *People’s Daily* framed Chinese history and the great inventions as an “important contribution that influenced the

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<sup>13</sup> This effort is detailed in Chapter 2 of this dissertation, which shows how the Cambridge biochemist and historian of science Joseph Needham worked within UNESCO to reform history writing, which he hoped would advance the evolution of the humanity into a unified community transcending racial and national divisions.

world.” Rather than emphasizing the class conflict of China’s feudal past as Mao had done in the 1930s, a new rhetoric emerged during the Korean War of honoring “our ancestors” (*women zuxian* 我们祖先).

Most importantly for the great inventions narrative, this article introduced a catchphrase that has followed the inventions in Chinese writing up to today, calling them China’s “contribution” (*gongxian* 贡献) to world civilization. This contrasted China with its imperialist enemies, who only sought to invade, kill, and rob other countries. But the “contribution” framework was also narrow, in that it established a narrative of influence in one direction between two discrete subjects – from China to the world. In subsequent writing on the great inventions, both popular and academic, Chinese authors used this catchphrase, describing them as a “great contribution” (*weida gongxian* 伟大贡献) to world civilization. This historical framework brought the world into view only so much as it demonstrated China’s long-held supremacy and influence.

Over the course of 1951, numerous publications appeared on the great inventions using the “great contribution” framework, and expounding on the principle of “patriotism and internationalism” in the context of the Korean War. The first of these was a six-part series by Mao Zuoben (茅左本) entitled “The Inventions of Our Ancestors,” appearing in monthly popular science magazine *Science Pictorial* (*Kexue Huabao* 科学画报) between January and June

1951.<sup>14</sup> Across these articles, Mao called on the reader to draw on the history of China's scientific past to renew its civilization in the new era. China's deep history would give it strength in the face of the "thief imperialist America, which hasn't looked up our history, dreams to spread chaos everywhere, and blindly seeks death!" Mao writes that while America only has a brief history of 175 years, China has five thousand:

Many 'firsts' in the world should be counted to us, in the world many inventions were first created by us. We are the world's most ancient and long lasting civilization, we are the people who forged the path of world civilization... Speaking of our inventions, our compass, our gunpowder, our paper, our printing, everyone knows are the four great inventions, that spread to the West, truly advancing their civilization by a great step.<sup>15</sup>

While the US may have been better armed than Chinese troops in Korea, Mao Zuoben used a survey of China's long history of discoveries, punctuated by testimony from Western scientists and historians like Joseph Needham and Frederick W. Lanchester, to give the impression of China's long-held and inevitable superiority. With its many "world firsts," Mao told his readers that "we are the people who forged the path of world civilization." The article included a Song Dynasty illustration of an iron plow taken from the *Tiangong Kaiwu* (天工开物), a twelfth century encyclopedia that included descriptions of contemporary inventions and agricultural tools. The caption read "At the time when the West used wooden plows to till the fields, we

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<sup>14</sup> Mao Zuoben 茅左本, "Women Zuxian de chuangzao faming" 我们祖先的创造发明 [The Inventions of Our Ancestors], *Kexue Huabao* 科学画报, (January – June 1951). These articles were collected into the book: Mao Zuoben (茅左本), *Wo men zu xian de chuang zao fa ming: Shi si hui* 我们祖先的创造发明 [The Inventions of Our Ancestors] (Shanghai: Lao dong chu ban she 劳动出版社, 1951).

<sup>15</sup> Mao Zuoben 茅左本, "Women zuxian de chuangzao faming" 我们祖先的创造发明 [The inventions of our ancestors], *Kexue Huabao* 科学画报, 17 (January 1951): 2–6.

already at that early point used iron plows.” A table of major inventions titled “My country’s important inventions timeline,” begins with the “south pointing cart” in 2600 BC and continues to iron movable type in 1488 AD dominates another page, depicting a long history of continuous discovery. Above it the passage again refers to the depth and glory of China’s history:

We have 5,000 years of glorious scientific history, in the future we shall have even more glorious science than in the past 5,000 years. Only in the era of Mao Zedong, are we finally able to without limit express our scientific talent, we shall use our inventions to brighten the brilliant light of the Mao Zedong era, and produce yet more brilliant light.

	年代	朝代	創造發明
紀	2600	黃帝	黃帝發明指南車 螺祖發明蠶絲
	2357	堯	天文氣象學開始
	2250	夏	陶器
元	1122	周	發現磁石 發明鐵器
	221	秦	長城造成 李冰造都江堰水利工程 蒙恬發明筆
前	132	漢	張衡造地動儀
	105	漢	蔡倫發明造紙
紀	605	隋	大運河完成 火藥開始做爆竹
	948	五代	馮道發明刻板印刷
元	1061	宋	畢昇發明活字版印刷
	1131	宋	戚允文用火藥造霹靂砲 指南針應用於航海
後	1488	明	華燧安國發明銅活字版

Mao here is careful to point out that the achievements of the “feudal” past will pale in comparison to those possible in the era of Mao Zedong. He goes on to explain that China’s past inventions were made *despite* the fact that “the ruling class were unable to see the talent for producing inventions of the laboring people, compared to other sciences it was more ravaged by feudalistic society.” Mao’s analysis shows the difficulty of drawing on the “feudal” past for succor in the PRC era. Mao simultaneously praises the past accomplishments of Chinese

inventors, while at the same time arguing that these were achieved *despite* the “ravages of feudalistic society.” Cataloguing the great inventions of the dynastic past was thus framed as a prelude to the limitless progress to come now that China was liberated. Only now in a socialist society could the talent for technological invention of the Chinese laboring people be fully expressed. *Science Pictorial* was a magazine devoted to popularizing science and technology in the present, full of images of smiling farmers on new tractors and young scientists at work in their labs. Published within these pages, Mao’s “Inventions of our Ancestors” series confirmed new China’s potential for rapid progress.

As the series progressed across the four great inventions as well as astronomy and traditional Chinese medicine, Mao also tackled the contested issue of Chinese priority in inventing these before the West. The assigning credit for the inventions is inherently controversial, both factually and theoretically. To begin with, the historical facts around the origins of the inventions has been in dispute for centuries – depending on our reading of the textual and archeological evidence, one might reach very different conclusions about where, when, and who first invented each technology. This problem is compounded by the reality that most of the inventions are not entirely original, but are improvements upon previous technologies, or iterations of them. For instance, the south pointing cart, an invention dating to the third century AD that used mechanical gears to point direction, is always referred to in these sources as a precursor the magnetic compass. The great inventions narrative, however, always put the emphasis on those inventions that had influenced Europe – but even here, the claim that it was Chinese inventions that spread to Europe, rather than Europeans inventing them independently, was always difficult to prove. Mao Zuoben used the argument here that priority equated to influence – meaning that as the first discoverer of an invention, Chinese deserve credit

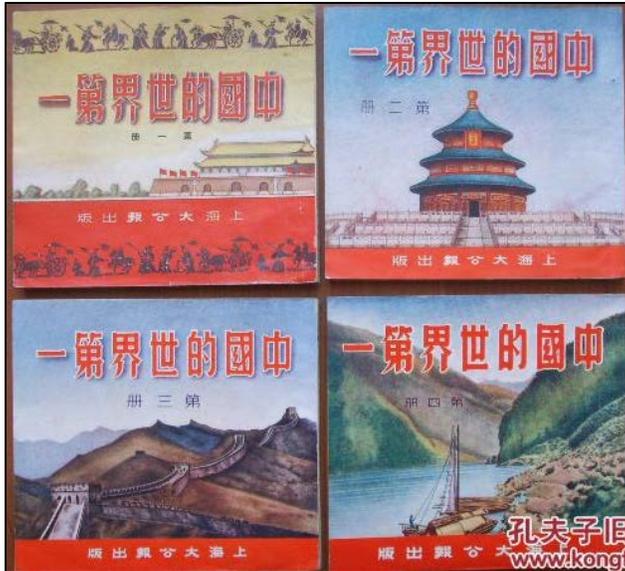
for influence, whether or not it can be proved that the Chinese invention was actually transmitted abroad. He thus declared the compass “not only a great event in the cultural history of my country, but also in the cultural history of the world.”<sup>16</sup> Mao declared that gunpowder “absolutely is one great inventions of my country that influenced the world.”<sup>17</sup> He smashes down arguments by “imperialists” and “fascists” who suggested that Europeans discovered the great inventions on their own, for example that the English monk Roger Bacon independently discovered gunpowder in the 13<sup>th</sup> century, or that Johannes Gutenberg invented the printing press in 15<sup>th</sup> century Mainz (a city in modern Germany). These doubts of Chinese influence in history, Mao wrote, mirrored the racism of Americans in the present, who believed that the “black and yellow races are not intelligent and incapable of understanding modern science.”<sup>18</sup> Equating doubts of Chinese influence in the past with American racism and imperialism in the present effectively closed the debate.

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<sup>16</sup> Mao Zuoben 茅左本, “Women zuxian de chuangzao faming” 我们祖先的创造发明 [The inventions of our ancestors], *Kexue Huabao* 科学画报, 17 (February 1951): 44–45, 62.

<sup>17</sup> Mao Zuoben 茅左本, “Women zuxian de chuangzao faming,” 17 (March 1951): 82-83.

<sup>18</sup> Mao Zuoben 茅左本, “Women zuxian de chuangzao faming” 我们祖先的创造发明 [The inventions of our ancestors], *Kexue Huabao* 科学画报 [Science Pictorial], 17 (April, 1951): 120–123.



Cover images of *China's World Firsts* (1951) featuring famous landmarks.

A month later in February 1951, the book series *China's World Firsts* appeared, an illustrated children's book that epitomized the kind of nationalist world history suggested in the January 1<sup>st</sup> *People's Daily* editorial. In Mao's 1939 *The Chinese Revolution and the Chinese Communist Party*, he had written that "China is one of the largest countries in the world," that China had a population "almost a quarter of the world total," and that she "has one of the oldest civilizations in the world." This authors of *China's World Firsts* translated these lines into an entire approach to history, presenting an catalogue of the "biggest, most numerous, earliest" (最大, 最多, 最先) episodes, natural landmarks, artifacts, and achievements from the Chinese past, spanning from China's population of 500 million (the largest in the world), to the Great Wall (the longest in the world), to the inventions of paper, printing, gunpowder, and the compass, and many

more.<sup>19</sup> The individual accounts of the four great inventions followed a familiar pattern, defending Chinese priority of invention, pointing out how much earlier China possessed the inventions before Europe, and asserting that they had contributed to “modern civilization.” The historical approach laid out in the introduction to the series explains how this type of history contributed the larger project of promoting “patriotism and internationalism” in the PRC:

China is lovable, and the people’s China is especially lovable. China has a large territory, a large population, rich and colorful products, and a long and profound history and culture, so it has many "world firsts."

The standard by which we chose the "China's World Firsts," is measured by China's largest, earliest, most numerous, best, and most unique. We praise "China's world firsts," which is intended to show China's contribution to humanity and to the world, to prove that China is lovable, and to encourage us Chinese people to work harder on this basis to strive harder to create, to humanity, to the world, make yet more and yet greater contributions.

Our **new patriotism** is combined with **internationalism**, and it is by no means advocates a **narrow-minded nationalism, and cannot be abused**.

Dear readers, we read this volume of "China's World Firsts," to guide China's lovable-ness, we all are energetic, everyone works hard, the heart of the people's new China will carry forward the masses, the future is boundless!

This introduction distills many of the conventions of history writing in the early PRC period, which made the great inventions such a popular topic. First, this history is meant to “prove that China is lovable,” meaning it inspires patriotism – love of country (*aiguo* 爱国). The reference to China’s “large territory, large population, rich and colorful products, and long and profound

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<sup>19</sup> Dagongbao chuban she weiyuanhui 大公报出版社委员会 [Da Gong Bao Press Committee], *Zhongguo de shijie diyi* 中国的世界第一 [China’s world firsts] (Shanghai: Da Gong Bao Chubanshe, February 1951).

history and culture,” is taken directly from Mao’s 1939 *The Chinese Revolution*, pointing toward a pastiche of China’s historical episodes and features, rather than a narrative. Second, this patriotism is combined with internationalism, contrasted with “narrow-minded nationalism” (a reference to the fascist, imperialist regimes of the Japanese Empire, Nazis, and the United States). Thus, the editors focus on China’s “world firsts,” and its “contribution to humanity and the world.” In this nationalist world history, China’s “biggest, most numerous, and earliest” qualities and achievements - not just the great inventions, but also possessing the largest population, the longest wall, the tallest mountain, and the longest canal – are also suggested to be “contributions” to the entire world. The lesson to readers is to see the national project of communist revolution in the PRC as also a global one, a new “contribution to humanity.” Nothing epitomizes this patriotic internationalism more than the great inventions, which gain their significance not through their history within China, but only within the global context as a “world’s first.”

The following month, in March 1951, the book *China's Ancient Ten Great Inventions* appeared, also responding to the call to look to history as a source of patriotic pride.<sup>20</sup> Over the previous several months, the author, Yan Yu (燕羽), had published the self-explanatory *Look, This is America!* (1950), and *Why is Imperialist America Destined to Lose?* (January 1951),

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<sup>20</sup> Yan Yu 燕羽, *Zhongguo Gudai Shidafaming* 中国古代十大发明 [China's Ancient Ten Great Inventions] (Shanghai: Qunlian chubanshe 群联出版社, March 1951, republished 1952).

before turning to the topic of the history of science. In his preface, he reflected the call of the 1951 New Year's *People's Daily* editorial to study China's glorious past:

As a modern Chinese person, to truly be familiar with all the glorious deeds of our motherland is a duty; with respect to the great inventions of ancient China, even more so they are the first things to be familiar with. The ten great inventions presented in this little book, their place of interest is that these practical inventions all gave rise to the development of society and human livelihood; moreover, their influence is global in character...

This book's responsibility is only to select the ten most important inventions, giving the study of patriotism a little resource to put into practice. Naturally, to act as a modern Chinese person, when it comes to the ancient great inventions of our ancestors, at least one must possess simple general knowledge.

Yan Yu was by no means an expert in Chinese history, but rather a popular writer of short paperbacks on relevant political topics. His preface reflects the status that the great inventions (here expanded from four to ten) were attaining as required knowledge during war-time. Like in *China's World Firsts*, the historical narrative was less important than a general knowledge of the "glorious deeds of our motherland." Yan Yu went on to explain why the history of science and technology was a particularly important part of a patriotic education:

In the aspect of science and technology China has fallen behind, it is only a circumstance of the recent one-hundred some years, this is the result of the invasion of imperialism, and the corruption of the feudal military clique's rule, it is simply not the result of the Chinese people having some mental deficit, everyone concedes this fact.

Now China has already established a people's regime with unprecedented strength, at the same time the whole country is advancing by leaps and bounds, in the boost to morale of the love of our great ancestors, the Chinese people are certainly inheriting the good of past traditions, renewing the creativity of our glorious history in the modern day.

Yan Yu here explains that China fell behind the West in science and technology only due to the assault of imperialism and corruption, not any "mental deficit." With the leadership of the new

regime, Chinese could “inherit the good of past traditions,” and renew its tradition of scientific and technological progress.

Important scientists and historians also published popular articles on the great inventions, using the narrative to frame their own fields in the context the present struggle against imperialism. In March 1951, the famous physicist and applied mathematician Qian Weichang (钱伟长 1912-1980) published an article in *China Youth and People’s Weekly* entitled “Ancient China’s Three Great Inventions.” As Dean of Studies and Vice President of Tsinghua University, not to mention the nephew of famous Chinese historian Qian Mu (1895-1990), Qian Weichang was in a powerful position from which to frame the importance of science and technology in the new era. Qian wrote that he was inspired by the January 1<sup>st</sup> *People’s Daily* editorial that to study “our ancestor’s great and glorious discoveries,” and thereby “create more scientific discoveries, and bring wealth and prosperity to human life.”<sup>21</sup> Qian emphasized that the Chinese people had not used the great inventions to subjugate others, like the “imperialists and their running dogs” had, but shared them with all humanity:

Our ancestors and my country’s people did not take these brilliant inventions and discoveries only for themselves, to keep as secret, or as capital for outward aggression. On the contrary, our ancestors have undoubtedly contributed these inventions to all mankind, laying a necessary foundation for all modern-day civilization.<sup>22</sup>

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<sup>21</sup> Qian Weizhang 钱伟长, “Zhongguo gudai de san da faming” 中国古代的三大发明 [The three great inventions of ancient china], *Zhongguo Qingnian* 中国青年 (March 27, 1951): 10–13, 61.

<sup>22</sup> Ibid.

Qian used the example of the great inventions to contrast “our ancestors’ great contribution to world culture,” with the self-serving West, concluding that this glorious history ought to give the Chinese people self-confidence in their struggle against imperialism.

In May 1951, historian Zhou Yiliang (周一良, 1913-2001), then chair of the Peking University History Department, published an article in the journal *History Education* that outlined how to advance “patriotic history education,” with specific advice on the great inventions.<sup>23</sup> Zhou called the great inventions the “richest content” for patriotic education, that was sure to “produce a very big result.” He emphasized three points historians and educators should pay attention to when discussing them. The first, perhaps reflecting the fact that most accounts of the great inventions were produced by children’s writers and journalists rather than historians, was to “seek truth from facts,” to rely on “close textual research” and to “not minimize, but also not exaggerate.” Second, Zhou repeated the narrative, earlier embraced by Sun Yat-sen, that used the inventions to assert racial ability. Writers on the inventions should assert that the “Chinese people’s intelligence and wisdom is not less than that of people of other nation, and in the last several thousand years we have always stood in the front,” and to “inherit and make full use of three-thousand years of glorious tradition!” Zhou’s third point, however, emphasized the internationalist argument suggested by the *People’s Daily* editorial, that the great inventions could be framed as China’s “great contribution” to world civilization.

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<sup>23</sup> Zhou Yiliang 周一良, “Tuijin aiguo zhuyi lishi jiaoyu de ji ge juti wenti” 推進愛國主義歷史教育的幾個具體問題 [Several Specific Issues in advancing patriotic history education], *Lishi Jiaoxue* 历史教学 5 (May 1951). *Lishi Jiaoxue* [History education] was began in 1950, it was the earliest journal on history and history education to be published in the PRC era and is still in print today. Zhou Yiliang regularly published articles in this journal in its early years.

In the same month, Zhou published an article that illustrated this methodology in action, entitled “Paper and Printing – China’s Great Contribution to World Civilization.”<sup>24</sup> A serious scholar, Zhou’s account of the history of printing and paper in China was much more detailed than his contemporaries’, drawing on the latest historical and archeological evidence from Western and Chinese researchers. In his introduction, he framed this history within the “great contribution” framework, giving credit to the laboring people for the inventions, finally calling it all a legacy that China could renew by turning back imperialism in the present war:

From technological discoveries and inventions, it is more and more clear to see the results of the intelligence and wisdom of the Chinese laboring people. Silk, paper, printing, movable type, porcelain, etc., not only enriched us but was also a great contribution to the whole world. ... Now Chinese people stand up! We will turn back the invasion of imperialists, wash clean 100 years of humiliation, and at the same time also inherit and renew our 3000 years of glorious tradition!<sup>25</sup>

Zhou’s history of paper and printing emphasized how they spread throughout Asia and Europe, giving evidence to the notion of them as “great contributions.” Furthermore, backed up the idea that the “Chinese laboring people” were responsible for the inventions with an argument at least partially based in the historical evidence. Zhou wrote that paper and printing were used to expand popular culture to “the masses,” allowing the dissemination of literature beyond the Classics. He extended this into a general argument about the effects of printing and paper everywhere. Concerning the production of the inventions themselves, Zhou emphasized what he called the “close relationship between the Chinese masses and early technology.” He speculated,

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<sup>24</sup> Zhou, Yiliang, *Just a Scholar: Memoirs of Zhou Yiliang (1913-2001)* (Leiden: BRILL, 2013).

<sup>25</sup> Zhou Yiliang 周一良, “Zhi yu yinshuashu – Zhongguo duiyu shijie wenming de wei da gongxian” 纸与印刷术 - 中国对世界文明的伟大贡献 [Paper and printing - China’s great contribution to world civilization], *Xinhua Yuebao* 新华月报 4:1 (May 25, 1951), 186–190.

for instance, that it was probably peasant women who first discovered papermaking by collecting the scum of plant and fishing nets on the riverbanks, and drying it into cheap and durable paper. Zhou also made much of the inventor of movable type, Bi Sheng (毕昇 990-1051AD), who is referred to as a “commoner” (布衣) in the *Dream Pool Essays* (*Mengxi Bitan* 梦溪笔谈, 1088 AD). Furthermore, Zhou emphasized that the inventions were examples of “patriotism and internationalism,” which he wrote were “at their root are two sides of one issue. Our ancestor’s inventions and discoveries all helped the people of other nations, this also is precisely a valuable resource from which to study the combination of patriotism and internationalism.”<sup>26</sup> Despite the conflicts of feudal society that he writes stymied the development of these inventions, Zhou nonetheless depicts them as a “glorious tradition” in comparison to the “100 years of humiliation” at the hands of imperialists. He concludes by calling on the reader to “cherish the motherland that has this type of history.”

Also in May 1951, *Progressive Youth* magazine began a monthly series written by Sui Shusen (随树森 1906-1989) titled “Our ancestor’s four great inventions” (*women zuxian de si da faming* 我們祖先的四大發明). Published in four installments, the articles collectively established Chinese credit for their contribution to modern “world culture.” Written for an audience of middle schoolers, these brief histories illustrated the prestige of the Chinese people on the world stage, and the importance of studying science and technology for the good of the nation.

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<sup>26</sup> Zhou Yiliang, “Zhi yu yinshuashu...,” 186-190.

Establishing credit to China and the Chinese people as the true inventors of paper, printing, gunpowder, and the compass, is the first task of these articles. However, the series leaves some room for debate. In his article on printing, Sui writes:

Western printing history compared to China's is very late.... Even if China's movable type did not directly influence Western movable type, nonetheless credit (荣誉) for the world's earliest invention of movable type, certainly is still given to my countrymen.<sup>27</sup>

Here Sui points to the priority of the Chinese invention of movable type in the eleventh century, three centuries before Gutenberg created his own printing press in the fifteenth century, as enough evidence to give credit to China. This makes the whole issue of the possible transfer of printing from China to Europe, not to mention the use of movable type in subsequent Chinese history, totally irrelevant. But surprisingly, in the very next month's issue of *Jinbu Qingnian*, a follow-up article appeared by Xue Zhen (薛真 1924-2011), an editor and propagandist in the People's Liberation Army, that walked back this extreme position. Providing much more detail on the history of movable type printing than Sui Shusen's previous article, Xue Zhen concludes that:

You can't say that Bi Sheng's invention of movable type isn't an important event in Chinese history. But according to *Mengxi Bitan*, at that time it was not widespread.<sup>28</sup>

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<sup>27</sup> Sui Shusen 随树森, "Yinshua (Women Zuxian de sidafaming zhi yi)" 印刷 (我们祖先的四大发明之一) [Printing: the first of our ancestors four great inventions], *Jinbu Qingnian* 进步青年 235 (May 1951), 12-13. In the 1960's, the principle of "internationalism and patriotism" formed a chapter of Mao Zedong's *Book of Quotations* – the ubiquitous "little red book."

<sup>28</sup> Xue Zhen 薛真, "Guanyu 'Yinshua'" 关于《印刷》 [Concerning "Printing"], *Jinbu Qingnian* 进步青年 236 (June 1951), 20-21.

Once the history of Chinese printing is embedded in the larger narrative of “the great inventions” that had sparked modernity in Europe, establishing Chinese credit for movable type becomes paramount, despite the fact that it plays a very minor role in the history of Chinese printing. This pattern is repeated in Sui’s article about the compass, in which he raises many questions about the early knowledge of the compass and magnetism in China which he says are unanswerable. Rather than discuss how the compass was used in ancient China, he instead lays out evidence for China’s claim to credit, concluding that that, “My country used the compass earlier than Arabia and Europe, therefore we can prove that the compass was invented by my country.”<sup>29</sup> In this way, the desire to claim “credit” leads these histories to focus on priority, rather than the use, or even the flourishing of the technology. The artistic achievements of Chinese print culture, the feats of Chinese navigators, and the victories won with Chinese gunpowder weapons become secondary to the task of claiming credit for those inventions deemed significant in a “world history” context – functionally meaning, those inventions deemed important by Westerners. Thus, strangely, movable type in these accounts appears as the most important achievement of Chinese printing, even though it was hardly used at all in China.

The inevitable controversies that plague the claiming of “credit” are washed away in the larger framework of the inventions as a “great contribution” to world civilization. In a typical example, Sui wrote:

The invention of printing and paper are a contribution [贡献] to modern culture, they are the greatest, because the spread of culture depends on printed books. The

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<sup>29</sup> Sui Shusen 随树森, “Zhinanzhen (women zuxian de sidafaming zhi san)” 指南针 (我们祖先的四大发明之三) [Compass: The third of our ancestors four great inventions], *Jinbu Qingnian* 进步青年 238 (August 1951), 19.

completion of books cannot begin without printing and paper.... Movable type printing compared to common printing is more convenient, it is an even greater contribution to the establishment of culture.<sup>30</sup>

Here Sui established the relationship of Chinese people to “modern culture,” elsewhere referred to as “world culture.” In the global context, printing and paper are not just elements of traditional Chinese cultural heritage, but a “contribution” to the advent of modernity itself. The great inventions gave PRC historians a legitimate way to insert China into the narrative, shared by Marxist theory, that Europe was the center of world history and that China had declined in modern times. In his article on paper, Sui explains that papermaking is one of the few inventions that Westerners did not improve on – the exception that proves the rule:

The credit for the invention of paper in all the world belongs to the ancient Chinese people. Paper is an extremely great contribution to world culture. From a country's rate of paper consumption, you gauge that country's level of culture. Before the 12th century, European people still didn't know how to use paper, but in China, in the 1st century BC, at this early time they already invented the technology of paper. But other types of inventions, although they were found by my country, after they enter into the West, they are brought to a greater height of development. Papermaking technology is unique, in that in my country's most ancient times it had already reached the peak of development. The thin paper that European people use today (Western name India Paper) and Chao paper (Western name papier-mâché) also all in the 19th century went from my country into theirs.<sup>31</sup>

By establishing the amount of paper used by a country as the “gauge” of a country’s “level of culture,” Sui adapts technology into a marker of status. It is worth noting how out of step this is

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<sup>30</sup> Sui Shusen 随树森, “Yinshua...,” 12–13.

<sup>31</sup> Sui Shusen 随树森, “Zhi (Women zuxian de sidafaming zhi yi)” 纸 (我们祖先的四大发明之二) [Paper: the second of our ancestors four great inventions], *Jinbu Qingnian* 进步青年 236 (June 1951), 18–19.

with the contemporary historiography, Marxist or otherwise, which looked for the presence of a nation-state, capitalism, urbanization, and industrialization as markers of modernity. But within the “great contribution” framework, the eventual development of modernity can happen anywhere. In the global perspective, it is China’s influence on other places is ultimately most important. In this passage, Sui points out that the modern paper used by Westerners were derived from China. Discussing printing, gunpowder, and the compass as well, Sui always points to the great influence that China had on Japan, Korea, India, and the West vis-à-vis the spread of these inventions.



Cover of *China's Four Great Inventions* (1951, 1953, 1955), featuring an image of the “south pointing cart,” an early mechanical compass.

This paradigm was repeated in children’s book on the great inventions appearing from 1951-1954. These included *China’s Ancient Three Great Inventions* (May 1951),<sup>32</sup> *China’s Four*

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<sup>32</sup> Ying Li 应力, *Zhongguo gudai de san da faming* 中国古代的三大发明 [China's ancient three great inventions] (Beijing: Qingnian chubanshe 青年出版社, May 1951). Part of the “Great Motherland” (Weida Zuguo 伟大祖国) book series.

*Great Inventions* (October 1951, reprinted in 1953 and 1955),<sup>33</sup> and *China's Ancient Four Great Inventions* (December 1952, republished 1954 and 1962).<sup>34</sup> Short, cheap paperbacks for a young audience, these books were printed in large numbers and made available throughout the country. All of these replicated the conventions established in 1951, using the “great contribution to civilization” framework, establishing Chinese priority and credit for the inventions, highlighting the role of the laboring peoples in the inventions, and using them as an example of “patriotism and internationalism” in action. Most notable is Huang Ning’s *China’s Four Great Inventions*, which quotes both Mao Zedong’s 1939 *The Chinese Revolution*, and Qian Weichang’s recent article in *China Youth*. Huang begins:

Our great ancestors, in history have countless brilliant scientific discoveries and inventions, among these great inventions, those that made the greatest contribution and had the widest influence are paper, printing technology, the compass and gunpowder, we call these China’s four great inventions.

In each chapter, Huang runs through the history of the inventions from their origins, through their development over different dynastic periods, culminating with their spread to Europe. The narrative is centered on the inventions themselves, while the human actors are almost invariably “our ancestors,” or “our hard-working ancestors” (*women laodong zuxian* 我们劳动祖先), whose intelligence is proven through their “scientific” discoveries of the inventions.

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<sup>33</sup> Huang Ning 黄宁, *Zhongguo si da fa ming* 中国四大发明 [China's four great inventions] (Shanghai: Shangwu yinshuguan 商务印书馆, October 1951). Reprinted 1953 and 1955 by Shaonian ertong chubanshe 少年儿童出版社.

<sup>34</sup> Zhang Hui 章回, *Zhongguo gudai de si sa faming* 中国古代的四大发明 [*China's ancient four great inventions*] (Shanghai: Hua dong renmin chubanshe 华东人民出版社, December 1952; reprinted in 1954). Republished in 1962 by Zhongguo qingnian chubanshe 中国青年出版社.

In these passages, Huang centers “our ancestors” and “the laboring people” as the main actors in the history of the inventions, affirming the Maoist vision of the working class as the central subject of Chinese history and transcending the chronology of dynasties and regional differences. Young readers may take the abundant availability of paper for granted, but Huang reminds them that this is due to the great effort of their ancestors:

Today, there is seemingly nothing fantastic about paper, our own factories daily produce white newsprint, white writing paper, kraft paper, and also our calligraphy paper made of bamboo, cotton paper, as well as clean, white, beautiful fine writing paper, continuously supplying our use. But, at the time of beginning to invent it, it was not easy! Our ancestors spent who knows how much effort, until we were able to enjoy this type of pleasure today.<sup>35</sup>

In the case of printing, he is able to identify the Chinese the “laboring people” (*laodong renmin* 劳动人民) and the “ordinary people” (*laobaixing* 老百姓), the heroic protagonist of Maoist historiography, as the inventors of printing:

In approximately the late 8th century, our ancestors...invented the world’s earliest printing. This thing is the invention of the great laboring people, it came into popular use amongst the ordinary people.<sup>36</sup>

Discussing the compass, Huang connects it to the Chinese land itself, and to the intelligence of the Chinese people:

Our motherland is a vast territory with boundless resources, Northeast China, North China, East China, over the land of many regions, all contains a great amount of natural magnet. Therefore, when our ancestors worked, they very easily uncovered this type of magnet, and by means of their intelligence, in not

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<sup>35</sup> Huang Ning 黄宁, *Zhongguo si da faming*, 1.

<sup>36</sup> *Ibid.*, 13.

long discovered the special character of magnets, and knew it was capable of attracting metal, and pointing in a direction.<sup>37</sup>

Discussing gunpowder, he reminds the reader that his inventions became the “foundation stone of modern national defense,” not just in China but everywhere:

Our outstanding ancestors, not only invented paper, printing, and the compass; amongst the greatest contributions of all cultural endeavor, they also invented gunpowder, which became the foundation stone of modern national defense.<sup>38</sup>

Complete with quiz questions at the end of each chapter, the book was ready for use in the schools. Huang Ning followed the book up with the similarly themed *The Story of the Invention of Printing* (1952).<sup>39</sup> With their wide distribution and many reprintings over the 1950s, popular paperback like these spread this version of the great inventions narrative widely amongst Chinese youth.

## **The Four Great Inventions in PRC Academia**

It was not until 1952 that historians of science were able to turn back to active publishing, at which point the importance of the great inventions within the rubric of patriotic history, and the main tenets of its narrative, was already established. In the first decade of Communist rule, the history of science expanded significantly as a research field within the reorganized scientific and educational institutions, and these historians took on the great inventions as a premier

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<sup>37</sup> Ibid., 24.

<sup>38</sup> Ibid., 31.

<sup>39</sup> Huang, Ning 黄宁, *Yin shua shu de fa ming gu shi* 印刷术的发明故事 [The story of the invention of printing] (Shanghai: Da Zhongguo tushuju, November 1953).

subject of study. During the Republican period, there were only about fifty Chinese scholars engaged in the history of science and technology, and all were primarily focused on other activities.<sup>40</sup> After the establishment of the PRC in 1949, the Communist regime established new institutions that bolstered the history of science, and drew it in closely to the priorities of the state. In November 1950, the Chinese Academy of Sciences (CAS) was established, with its first president Guo Moruo 郭沫若 (1892 – 1978), a well-known Marxist historian and archaeologist. Many of the amateur researchers of the Republican period rose to prominence in the new institutions of the PRC. Two of the major programs of the CAS were to “(1) to collect and start out the reference materials about the history of Chinese science and technology; (2) to introduce, translate and publish the works of modern science from advanced countries. This started the process of institutionalization of history of science in China.

In 1954, the National Commission of History of Natural Science was set up by the CAS. It was chaired by Zhu Kezhen 竺可桢 (1890 – 1974) , a historian of meteorology and now Vice-President of the CAS. The other committee members were also those historians of science who rose to prominence in the 1930s and 1940s. Contrasting two articles by Zhu in 1946 and in 1954 shows how his vision for the history of science in China changed under the new regime.

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<sup>40</sup> Liu Dun, “A Brief Introduction to the Studies on History of Science in the People’s Republic of China,” <http://www1.ihns.ac.cn/members/liu/doc/chinese.htm>. (accessed 8/31/2019)

In 1946, Zhu Kezhen published an article "Why Ancient China did not have natural science" in the journal *Kexue – Science*<sup>41</sup> that joined in the discussion of Joseph Needham, Karl Wittfogel, and Chinese scholars like Chen Li, and Qian Baocong over China's failure to develop modern science despite being far ahead of the West in many other respects. Then, Zhu wrote that China's institutions and scholarly class were not enough to make modern science, that China was at its heart an agricultural nation, and it ought to embrace "Western learning" – meaning modern science – and create a bright new era in Chinese science. But Zhu Kezhen's answer to this question evolved after the establishment of the PRC. In his new position within the CAS, he published an article in 1954 that signaled the beginning of widespread efforts to study Chinese history of science, entitled "Why should we study the history of Chinese science?" It appeared in *People's Daily*, the foremost national newspaper, and thus prepared public opinion for the institutionalization of the history of science in the new China. While in the 1940s Zhu had joined in the debate over why China had *failed* to develop modern science, this article redirected attention toward cataloguing what science China *did* have. In this turn, Zhu was actually following his friend Joseph Needham's lead – he also side-stepped a direct answer to his own question by launching a massive research effort at cataloguing nearly every aspect of China's history of science, the first volume of which appeared in that same year.

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<sup>41</sup> Zhu Kezhen 竺可桢, "Weishenme zhongguo gudai meiyou cansheng ziran kexue" 为什么中国古代没有产生自然科学 [Why ancient China did not have natural science], *Kexue* 科学 Vol. 67, Issue 3 (May 2015). Republication of original in *Kexue* 科学 Vol. 28, Issue 3 (1946).

Zhu begins his article instead with the argument from a previous generation, that "China had no science." Many Chinese intellectuals of the Republican period adopted this position in support of a larger agenda of radical political and education reform. They were reacting against a conservative notion stemming back to the mid-19<sup>th</sup> century that Western science could be adapted without fundamentally changing Chinese Confucian education and governance. New Culture intellectuals in particular led the charge against this idea. But now in the 1950s, when no faction in China sought to prevent the adoption of modern science and the historian's first job was to promote patriotism, this approach no longer fit with the times. With the political forces of conservatism in China thoroughly disposed of, defending ancient China's record on science became more a matter of national pride, particularly it was important to argue for China's equivalence with the West in world history.

Zhu Kezhen thus begins his article with a quote from a Western philosopher and mathematician – Alfred Whitehead – establishing a straw man argument to frame his article:

The more we know of Chinese art, of Chinese literature, and of the Chinese philosophy of life, the more we admire the heights to which that civilization attained. For thousands of years, there have been in China acute and learned men patiently devoting their lives to study. Having regard to the span of time, and to the population concerned, China forms the largest volume of civilization which the world has seen. There is no reason to doubt the intrinsic capacity of individual Chinamen for the pursuit of science. And yet Chinese science is practically negligible. There is no reason to believe that China if left to itself would have ever produced any progress in science.<sup>42</sup>

This quote echoes centuries of European writing on China (and India for that matter), that depicted it as advanced in moral philosophy and art, but hopelessly backwards in logic and

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<sup>42</sup> Alfred Whitehead, *Science and the Modern World: Lowell Lectures, 1925* (Cambridge: Cambridge University Press, 1926), 7.

science. By recognizing the "intrinsic capacity of individual Chinamen," Whitehead's statement does not reach the level of racial animus that many similar takes on China's backwardness had in the past. In his 1946 article, Zhu Kezhen basically agreed with Whitehead's argument, and investigated the many reasons why it might be true. But now in 1954, he takes the opposite turn, attributing Whitehead's position to his prejudice against China:

Were the achievements in natural science of ancient China really insignificant? This kind of prejudicial, subjective conclusion of Whitehead's is obviously incorrect. Indeed, this question can only be answered after studying the specific facts of history.

Zhu leaves no room for debate over China's failure to develop modern science here – instead, he begins with the stronger claim that China *had no science at all*, a position he identifies as a product of Western prejudice. But before launching into historical evidence of China's ancient accomplishments in the history of science, Zhu Kezhen appeals to Soviet philosopher and Stalin protégé Pavel Yudin, whose interpretation of Marxism proved that China *must* have had science:

Dr. Pavel Yudin of the Soviet Union concluded from Stalin's genius book "Marxism and Linguistics" that "all areas of social consciousness, including natural science, art, literature, political economy and history, etc., their development is caused by the need for material production, and their development depends on the production of material goods necessary for society." The production of material goods in ancient China was enough to give rise to art, literature, and history up to a certain level, then why would there be no impact on the natural sciences alone?

While in 1946, Zhu had weighed China's climate, its social system, its institutions and bureaucracy as potential inhibiting factors to the development of science, here Zhu adopts a simplistic theory that ancient China's high level of material production must have meant it developed a high level of natural science. This is not exactly derived from Marxist theory itself – which, like Whitehead, held China and India apart from the normal pattern of historical

development of the West. But it foreshadows the way in which Zhu here frames the entire field of Chinese history of science in contemporary political terms.

Zhu presents three reasons to study ancient Chinese history of science, writing that it is useful for the present goals of industrialization, internationalism, and patriotism. Zhu takes the USSR as a model for the PRC in how to tie the history of science to the betterment of the proletariat, repeating the maxim that historians of science should “study the knowledge of the peasants,” meaning to research how China’s astronomy, mechanical inventions, and agricultural technology were actually products of peasants. The study of history, he writes, can contribute to the Five-Year Plan, the ambitious set of national production goals set by the state for the years 1953-1957. “To progress, the proletariat must reflect on history, and use it to develop new culture.” Recovering past records of comets, earthquakes, and agricultural techniques, he writes, can be useful in the present.

Second, Zhu writes that the history of science contributes to internationalism, an important effort in the 1950s when the PRC was trying to accrue allies in the international environment and before the isolation of the Cultural Revolution. Here he writes that the great inventions of paper, the compass, and gunpowder were proof that China had influenced the world. “In the past they had an enormous impact, research of them is a big help to the history of world culture. There are still many inventions we do not know.” Zhu also references Joseph Needham, who had just published his first volume of *Science and Civilization in China (SCC)*, and had already indicated 20 more “great inventions” originating from ancient China that had spread to the West. “Research is essential.” Zhu writes. “Our history of science contains treasured information, we cannot wait, we should throw out the bad and keep the good from our history.” Following Needham's own methodology, Zhu sees the history of science as the

uncovering of more and more "great inventions." Recognizing these achievements does not alter the narrative of Chinese or world history at all, but expands the volume of China's "contributions" to the world.

Zhu concludes by returning to the opening challenge presented by the "prejudiced" Western philosopher, who ignored China's past accomplishments. No longer would China be dismissed in this manner on the world stage:

Our ancient natural science is very rich, and we cannot ignore it, and let it be buried in piles of old books. The history of natural science is one part of the history of culture, world histories published by capitalist countries in the past overflowed with all of the fascist ideas embraced by those "excellent" Western nations, and had very little to say about the history of Chinese culture. Today peaceful countries of the world grow stronger by the day, internationalism (*guocheng zhuyi* 国际主义) has become the leading ideology in world history... My country's field of the history of ancient natural science is like a desolate field, but it is full of treasures, whether from patriotism or from internationalism, our historians and scientists all have the responsibility to open up the grass.

This indictment of a fascist West looking down its nose at China's great history actually resonated with the internationalist movement of the 1950s. The United Nations and UNESCO led the way in global efforts (without the participation of Communist states) to remove racist, nationalistic, and prejudicial material from history textbooks. Joseph Needham himself had an early leading role in UNESCO, and promoted the history of Chinese science in the West towards these ends. Zhu was totally aware of these efforts, and here proposes that researching Chinese history of science was a way to participate in that community.

Between the reorganization of educational institutions in 1952 and the Anti-rightist campaign of 1957, many academic publications were published in the PRC about the great inventions. The popular narrative of the great inventions advanced in popular publications during 1951-1952 emphasized them as China's "great contribution" to world civilization. Academic

historians, drawing on archeological and textual evidence, focused on building up a detailed account of the inventions' development, and making an iron-clad case of their origin in China.

During the 1950s, several scholars focusing on the histories of paper, printing, gunpowder, and the compass gained important positions in the new institutions of the PRC, and published important works. Xiang Da (向達 1900-1966) coined the term “four great inventions” (*si da faming* 四大发明) in Chinese in 1930, and translated the influential *The Invention of Printing and its Spread to the West* (Columbia University: 1925) by Thomas Francis Carter into Chinese. In the PRC, he became Chief Librarian of Peking University Library, where he continued publishing on the art and artifacts of the Dun Huang caves, including early printing. As a young man, Zhang Xiumin (張秀民 1908-2006) read Xiang Da's translation of *The Invention of Printing*, and later remarked that “since printing is a defining invention of ancient Chinese craftsmen, I felt it was a great shame that no Chinese writer had undertaken this task and was therefore determined to start writing *The History of Chinese Printing and its Influence*.”<sup>43</sup> His epic on the history of printing during was first published in 1958, and translated into Japanese in 1960, and remains authoritative today.<sup>44</sup> Historian Feng Jiasheng (冯家昇 1904-1970) was prompted by Joseph Needham to write a history of gunpowder, which he similarly

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<sup>43</sup> Zhang Xiumin 张秀民 and Han Qi 韩琦, *Zhongguo yinshuashu de faming ji qi yingxiang* 中国印刷术的发明及其影响 [The history of Chinese printing and its influence] (Shanghai: Shanghai renmin chubanshe, 2009), xviii. First formally published 1989; this preface was written in 1984.

<sup>44</sup> Zhang Xiumin, *Zhongguo yinshuashu de faming ji qi yingxiang* 中国印刷术的发明及其影响 [The invention of printing in China and its influence] (Beijing: Renmin chubanshe, 1958). Translated to Japanese 1960; republished in 1978 and 2009.

title “The Invention of Gunpowder and its Westward Spread.” Feng wrote that he wanted to prove once and for all the Chinese origin of gunpowder, and disproving the many theories of its European origin dominant up to then.<sup>45</sup> Wang Zhenduo (王振铎 1911-1992) continued to research the history of the compass, south pointing cart, and other ancient inventions. After the establishment of the PRC he assumed the role of curator of science and technology in the National Museum in Beijing, where he made reproductions of Chinese inventions such as the south pointing cart, the south-pointing spoon, and the seismograph that became iconic images of ancient Chinese technology (this will be discussed more in chapter 5).

The work of these scholars in the 1950s collectively advanced knowledge about the great inventions, but did so within a narrative framework that was established by the 1950-1952 spate of popular publications. They all use the “great contribution” framework, that sees the inventions as China’s contribution to the external and separate “world civilization.” Unlike those previous popular accounts, these historians were able to mount more evidence in defense of Chinese priority of invention, which remained a primary concern for Chinese historians of science. While these historians enjoyed a period of productivity during the 1950s, nearly all of the above named were targeted by the many campaigns in the Mao era. Xiang Da was persecuted in the Anti-Rightist campaign of 1957, and was named one of the top rightists in academia. Persecuted and attacked repeatedly over the ensuing years, he died prematurely in 1966. During the Cultural Revolution, Zhang Xiumin was forced to abandon his studies, and his reference materials were

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<sup>45</sup> Feng Jiasheng 馮家昇, *Huoyao de faming he xi chuan* 火藥的發明和西傳 [The invention of gunpowder and its spread west] (Shanghai: Shanghai renmin chubanshe 上海人民出版社, 1954). Republished 1956, 1962, 1978.

sold as scrap.<sup>46</sup> This generation of scholars came of age in the 1920s and 1930s, when Western missionary scholars and academics like Thomas F. Carter were the leading experts on the history of Chinese science and technology. While many of them studied in Western universities, they also thought, like Zhang Xiumin, that Chinese people themselves should become the experts of their own history. And yet, as the Anti-Rightist Campaign (1957) and later the Cultural Revolution (1966-1976) brought academic research and publishing on the history of science to a definitive halt, it would ironically be the British scholar Joseph Needham who remained the foremost scholar on the history of science and technology in China. Within the PRC, the great inventions would primarily still be best known from popular literature such as that discussed here, and the small but significant quote in Mao Zedong's *The Chinese Revolution and the Chinese Communist Party* (1939).

## Conclusion

The PRC was born into an unstable world order. Only a year after the Chinese Communist Party took Beijing and began national reconstruction, it was again engaged in a costly war in Korea for which it was unprepared. In this context, the CCP leadership called for Chinese to look to the “glorious history of their ancestors” for inspiration in the fight against imperialism. As writers and publishers from many backgrounds – journalists, historians, scientists, and children’s writers – answered this call, they turned to the great inventions of ancient China. Over 1950 to 1954, the inventions appeared in newspaper articles, magazines,

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<sup>46</sup> Zhang Xiumin 张秀民 and Han Qi 韩琦, *Zhongguo yinshuashu de faming ji qi yingxiang*.

children's literature, and paperback books. According to one author, for a modern Chinese person, "one must at least possess simple general knowledge" of the great inventions. While Mao Zedong himself had commented on papermaking, printing, gunpowder, and the compass in his 1939 *The Chinese Revolution and the Chinese Communist Party*, these writers developed a fuller version of the narrative befitting the ideals, politics, and priorities of the PRC in the 1950s. Much like Sun Yat-sen's earlier interpretation of the narrative, they asserted that the inventions proved the "intelligence and wisdom" of the Chinese people, showing that Chinese they were not only capable of mastering modern science and technology, but had done so long before Europeans. Now in the PRC era, these authors added to the narrative that these achievements were made by the "laboring people" *in spite* of the corruption of "feudal" society, meaning that the revolution would now unleash even greater technological creativity. Finally and most importantly, these authors used the great inventions to depict a world in which China was a scientific superpower. Unlike the imperialistic West, they wrote, China had used shared the great inventions with the world, making a "great contribution to world civilization" that improved daily life and culture for all humanity. As the Korean War intensified, authors associated the inventions with the Maoist principle of "patriotism and internationalism," showing that achievements in science and technology at home also connected China to the rest of the world. The topic of the great inventions would recede from public view during the Cultural Revolution (1966-1976). But as the PRC stepped back into the world in the 1970s, the image established in these 1950-1954 publications of China as a scientific superpower benevolently sharing its knowledge with all humanity, would make a powerful return.

## Chapter 5: The Great Inventions in Reform Era China

The death of Mao Zedong in 1976 and the subsequent rise to power of Deng Xiaoping ushered in a sea change in science and technology in the PRC, bringing the great inventions narrative to prominence again. During the 1950s science and technology had enjoyed heavy investment as a key component of national security, but this period was cut short by the 1958 Anti-Rightist Campaign and later the Cultural Revolution (1966-1976), which targeted intellectuals as impediments to social and political progress who needed to be re-educated and controlled. Deng Xiaoping intended to reverse this situation. In 1978, Deng delivered an address at the National Science Conference that would pivot China from a focus on social progress toward material progress, and return intellectuals, and scientists in particular, to the vanguard of national leadership. In laying out his vision for China's future, he raised the narrative of the great inventions. Printing, paper, gunpowder, and the compass, he said, "played a major role in advancing world civilization. We should not rest on our ancestors' achievements; rather, such achievements should strengthen our resolve to catch up with and surpass the countries that are most advanced in science and technology."

Just as in the early 1950s Chinese media had taken clues from Mao about how to discuss the inventions, Deng's speech also led to a flurry of academic and popular writing, museum exhibits, and public art that connected them to his policies of "Reform and Opening Up," and the "Four Modernizations." However, this was not entirely a top-down affair. Empowered by the restoration of their institutions and a sense of intellectual freedom, historians of science produced many novel takes on the great inventions narrative during the 1980s, two of which I will examine here. First, I will examine historians of science who produced a revivalist great inventions

narrative, that used them as evidence of China's past glory and power that would be renewed in the Reform Era. Having gained the full support of Deng Xiaoping and the CCP by 1978, the Chinese Association for Science and Technology (CAST) adopted this narrative, and wrote it into an exhibit of ancient Chinese science and technology that travelled Canada and the US, titled *China: 7000 Years of Discovery*. Formed in collaboration with the Ontario Science Center, the exhibit used the great inventions as both lucrative "edutainment," and as an act of cultural diplomacy that might thaw lingering Cold-War tensions. The second is an anti-authoritarian narrative. While their colleagues at CAST celebrated the great inventions as China's national pride, leftist intellectuals returned to the "Needham Question" – why had China failed to develop modern science, despite her early lead ahead of Europe? Historians Jin Guantao (金观涛, b. 1947) and Liu Qingfeng (刘青峰) concluded that the inventions of gunpowder, printing, paper and the compass had not been actually been "technologies of control," which ultimately empowered imperial elites to maintain an "ultra-stable" Chinese society that squashed scientific progress going back to the Qin Dynasty (221-206 BC). This narrative spilled from niche intellectual circles into popular culture when it was included in the hit TV mini-series *River Elegy* in 1988. Ultimately, Jin, Liu, and the *River Elegy* series were associated with the 1989 Tiananmen Square Democracy Movement, leading to their exile and the suppression of this great inventions narrative in the aftermath of the massacre. Meanwhile the revivalist great inventions narrative, retold as patriotic "edutainment," was preserved and reproduced endlessly in the PRC up to the present.

## Deng Xiaoping's Great Inventions



Deng Xiaoping at the National Science Conference in Beijing, March 22, 1978. Xinhua.

On March 22, 1978, Vice Chairman Deng Xiaoping addressed the National Science Conference in Beijing with a speech that was a dramatic turning point in Chinese science policy. Addressing an audience of 6,000 of China's top leaders and scientists, Deng declared science a productive force, and that scientists were not intellectuals, but workers. Since the Chinese Communist Party had attained national power in 1949, there had been a struggle for power between so-called "Reds" – the peasant class that had successfully fought the War of Liberation against Japan, the Civil War against the Nationalists, and embodied the ideals of communist revolution – and "experts" – the pragmatic intellectual elite who were indispensable to the regime's bureaucratic capability and material development. As the CCP pursued an ambitious program of industrial and scientific development in the 1950s, they maintained a "Red-over-Expert" power structure, in which the largely illiterate peasant cadre class managed scientific institutions, overseeing the

work of a debilitated, but indispensable, scientific community.<sup>1</sup> However, this uneasy balance declined into outright persecution of intellectuals that devastated Chinese scientific institutions beginning with the Anti-Rightist Campaign of 1958, and reaching its apogee during the Cultural Revolution (1966-1976). This was undergirded by a class system that privileged members of the working and peasant class, while penalizing intellectuals, particularly those from a capitalist family background. By declaring that science was a productive force and that scientists were not intellectuals, but workers, Deng reversed the old hierarchy of “Red-over-Expert,” and launched intellectuals, and scientists in particular, to the vanguard of national leadership.

As Deng continued to lay out his case for the rejuvenation of Chinese science, he introduced new themes and principles that would supplant the older revolutionary ethos of the CCP. Rather than the social and political progress that Mao had focused all the nation’s energies on advancing, Deng now pivoted China toward the goal of material progress. He revived the theme of “backwardness” (*luo hou* 落后), emphasizing that China had fallen behind other countries in military, industrial, and economic strength. He was careful to blame the Gang of Four and the Cultural Revolution, not Mao Zedong directly, for this decline. His vision for China’s future was embodied in the “Four Modernizations” policy – the national mission to modernize agriculture, industry, national defense, and science and technology. Now under the banner of the “Four Modernizations,” the CCP would pursue a policy of “opening up to the

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<sup>1</sup> Joel Andreas, *The Rise of the Red Engineers* (Stanford: Stanford University Press, 2009), 18-19.

outside” (*dui wai kaifang* 对外开放) to learn foreign science, and allow scientists to focus on their professional work rather than politics. Of the four modernizations, Deng said that science and technology were “the key,” without which “there can be no rapid development of the economy.”

In this historic address, Deng conjured up the narrative of the great inventions as a high point in China’s past that revealed the depths of her current “backwardness”:

Comrade Mao Zedong often reminded us that China ought to make a greater contribution to humanity. In ancient times, China scored brilliant achievements in science and technology; its four great inventions [paper, printing, the compass and gunpowder] played a major role in advancing world civilization. We should not rest on our ancestors’ achievements; rather such achievements should strengthen our resolve to catch up with and surpass the countries that are most advanced in science and technology. Our present contributions in these fields are far from commensurate with the standing of a socialist country such as ours.<sup>2</sup>

Deng Xiaoping here recalled the old Maoist slogan that China should make a “great contribution to humanity,” a phrase frequently attached to the great inventions in the Mao era, and immortalized in a quotation from the “little red book” of *Quotations from Chairman Mao*. But we cannot take this at face value – Deng was a master at drawing on Mao’s words to advance policies that Mao himself had bitterly opposed when he was alive. For both Mao and Deng, the great inventions signaled a past golden age of Chinese technological superiority which should be reclaimed in modern times. In Mao’s narrative, the CCP would lead China out of the “century of

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<sup>2</sup> Deng Xiaoping 邓小平, “Speech at the National Science Conference” (March 22, 1978), in *Selected Works of Deng Xiaoping (1975-1982)* (Beijing: Foreign Language Press, 1983), 106. Also at <https://dengxiaopingworks.wordpress.com/2013/02/25/speech-at-the-opening-ceremony-of-the-national-conference-on-science/>

humiliation” at the hands of feudal rule and foreign imperialism by reviving the native talent for science and technology of the working people. In Deng’s narrative, he would lead China out of a disaster of their own making – the Cultural Revolution – by raising the political status of intellectuals and scientific work. Under Mao, intellectuals had to be both “red” and “expert,” balancing their political education with scientific research. Now, Deng declared that there was nothing more “red” than using one’s expertise to serve the nation. When Deng bemoaned that China’s “present contributions” in science and technology were “far from commensurate with the standing of a socialist country such as ours,” he placed the blame squarely on the shoulders of the Gang of Four and the Cultural Revolution for letting China “fall behind” in science and technology. Evoking the great inventions as a past golden age thus opened a space, albeit a limited one, for criticism of “ultra-leftists” within the CCP and the excesses of the Cultural Revolution.

Deng also departed from Mao’s great inventions narrative by using it to assert the principle of scientific openness and exchange with the world. Under Mao, the great inventions were conjured to assert a unique national scientific heritage independent from the West or the USSR. Rather than mutual exchange, writing on the inventions under Mao emphasized how China had made great “contributions to all humanity,” while Western nations had used their technology to dominate others. Now Deng used the history of the great inventions to assert just the opposite – that just as the West had once learned from China, now China should learn from the West. While Deng maintained that the Maoist principle of self-reliance was a good one, self-isolation in science and technology had only led to “backwardness”:

Backwardness must be recognized before it can be changed. One must learn from those who are more advanced before he can catch up with and surpass them. Of

course, in order to raise China's scientific and technological level, we must rely on our own efforts, develop our own creativity and persist in the policy of independence and self-reliance. But independence does not mean shutting the door on the world, nor does self-reliance mean blind opposition to everything foreign. Science and technology are part of the wealth created in common by all mankind. Every people or country should learn from the advanced science and technology of others. It is not just today, when we are scientifically backward, that we need to learn from others. Even after we catch up with the most advanced countries, we shall still have to learn from them in areas where they are particularly strong.<sup>3</sup>

Along with "reform" (*gaige* 改革), "opening up to the outside" soon became a central feature of Deng's plans for China. While in the 1950s the great inventions were written into a nationalistic world history that emphasized how much China had influenced the world, Deng now emphasized the principle of mutual exchange of science and technology. When Deng states that "science and technology are part of the wealth created in common by all mankind," he appeals to a spirit of scientific internationalism that had long been subsumed by Cold War rivalry.<sup>4</sup> Mao had already begun a reopening China to the West when he met with Nixon in 1972. Now Deng sought to make the case conclusively that China should learn from the West in science and technology.

Later on May 7, 1978, Deng again raised the great inventions to make this point in his talk "Realize the Four Modernizations, Never Seek Hegemony." He pointedly criticized the Gang of Four, saying that their downfall would finally allow China to "make use of all the advanced technologies and achievements from around the world." He returned to the example of the great inventions to justify this policy reversal:

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<sup>3</sup> Deng, "Speech at the National Science Conference," 107.

<sup>4</sup> See chapter 3 of this dissertation.

Science and technology have no class nature; capitalists make them serve capitalism, and socialist countries make them serve socialism. Ancient China had four great inventions (paper, printing, gunpowder and the compass — Tr.), which later found their way to countries around the world. Why then should we be hesitant about making use of advanced technologies and achievements from around the world? We should make advanced technologies and achievements the starting point for our development.<sup>5</sup>

Here Deng Xiaoping used the great inventions to assert the principle that science and technology are apolitical, and thus China would not compromise itself by learning them from the West.

Under the Cultural Revolution, the doors of international exchange – crucial to the training and flourishing of intellectuals in all fields – had been resolutely shut. Just as Deng Xiaoping had opened the door to market reforms ushering in the contradictions of “socialism with Chinese characteristics,” here he introduced similar contradictions in the field of science and technology.

The great inventions narrative helped him justify flinging China’s doors to the world open.

As the CCP directed their media organs toward promoting the policy of the Four Modernizations in 1978, they followed Deng’s cue by frequently evoking the great inventions. What emerged was the beginnings of a revivalist narrative that portrayed the threats of feudalism, imperialism, and the Gang of Four as neutralized, replaced the class politics of the Mao era with an ethno-nationalist politics, in which material rather than social development was most important. Many examples appeared that year in the *People’s Daily*, the official newspaper of the Chinese Communist Party. A lengthy article on CCP plans to rebuild Chinese science and

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<sup>5</sup> Deng Xiaoping, “Realize the Four Modernizations and Never Seek Hegemony” (May 7, 1978), <https://dengxiaopingworks.wordpress.com/2013/02/25/realize-the-four-modernizations-and-never-seek-hegemony/>. (accessed May 27, 2020)

technology used the great inventions to indicate that “China is one of the countries with the earliest advanced civilizations,” a position corroded by feudalism, imperialism, and the “severe interference and destruction of the Gang of Four.”<sup>6</sup> Similarly, the article “Facing backwardness before moving forward” used the inventions to derive the lesson that “it must be seen that our difficulties are difficulties we can pass through, and our backwardness is a temporary backwardness. China was the home of the four great inventions, the brains of Chinese people are not stupider than others.”<sup>7</sup> By raising the great inventions as a symbol of a past golden age, these articles eased the pain of self-criticism that Deng had prompted, and gave hope for rapid progress.

Other articles focused on the great inventions as a justification for the policy of “opening up,” and learning from Western science. A September *People’s Daily* editorial echoed Deng’s universalist view of science, stating that “science and technology are the wealth created by mankind, and are not restricted by ‘nationality.’” The authors compared the four great inventions to more recent examples of “the introduction of foreign advanced technologies to develop the domestic economy at high speed,” such as Japan’s importing of foreign technology and rapid economic development since the 1960s.<sup>8</sup> This point was echoed in the November 3 editorial,

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<sup>6</sup> Bai Gongda 柏恭大 and Ke Yan 柯妍, “Shixian kexue jishu xiandaihua” 实现科学技术现代化 [Realize the modernization of science and technology], *Renmin ribao* 人民日报, September 6, 1978.

<sup>7</sup> Liu Tingli 刘廷礼 and Xie Dianbin 谢殿斌, “Zhengshi luohou caineng qianjin” 正视落后才能前进 [Focus on backwardness to advance], *Renmin ribao* 人民日报, July 24, 1978.

<sup>8</sup> Xinhua News Agency 新华社, “Dadan yinjin jiakuai sudu” 大胆引进加快速度 [Boldly usher in accelerating speed], *Renmin ribao* 人民日报, September 17, 1978.

“Learn and use advanced foreign experience.” Here, the authors grouped paper, printing, gunpowder and the compass with New World crops like corn, potatoes, and tomatoes as knowledge that originated in one place but was been adopted all over the world. Mocking the Gang of Four’s suspicion of all things foreign, the authors wrote that “according to the logic of Lin Biao and the Gang of Four, is it not that only foreigners ride the train, and Chinese prefer to ride donkeys, foreigners use electronic computers, and Chinese prefer to use the abacus, in order to be ‘patriotic’?”<sup>9</sup> These passages used the great inventions to emphasize that adapting technology from abroad was natural, and all the great powers in history had done so. While Meiji and post-war Japan served as a recent example of an Asian country importing Western technology, the familiar story of how Westerners used the great inventions to spark their own rise to power showed that intellectual exchange went in both directions. It also framed modern adoption of Western technology as payback, which led to many half-joking references to Chinese “collecting on the debt” that Westerners owed them for taking the “intellectual property” of the great inventions centuries ago. Across all these references in the *People’s Daily*, the great inventions illustrated a core principle behind Deng Xiaoping’s “Reform and Opening Up” policy – that “opening up” to Western science and technology wouldn’t threaten Chinese national identity and status, but empower it.

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<sup>9</sup> “Xuexi he liyong guowai xianjin jingyan,” 学习和利用国外先进经验 [Learning and using the advanced experience of foreign countries], November 3, 1978.

## The Great Inventions as Diplomatic “Edutainment”

Not only would China learn from the world under Deng, but she would also step out into the world through cultural diplomacy; the great inventions became a useful subject to do so. Working within the context of the reestablishment of Sino-US relations, their exhibit rode on a tide of corporate, political, and public enthusiasm for reengagement, and a desire by many Americans to replace their image of China as a Cold War rival with something new. Scientists and historians in attendance at Deng’s speech at the National Science Conference in March 1978 saw an opportunity to build up the history of science in the PRC, and to connect with the global community after a long period of isolation. At the conference, the Chinese Association for Science and Technology (CAST) suggested the creation of a China Science and Technology Museum (*Zhongguo kexue jishu guan* 中国科学技术馆) in Beijing. In fact, such a museum had been approved for construction in 1958, but had never materialized. As Deng was leading a sweeping rejuvenation of educational and scientific institutions, the Association was able to win his approval for the project by April 29, only a month after the conference.<sup>10</sup> CAST formed the China Science and Technology Palace Preparatory Committee (CSTPPC), headed by Jia Gao, to accomplish the task.

The CSTPPC would usher in a new age in museum curation in the PRC. It is worth reviewing where they were starting from. The most important museum in the PRC from its

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<sup>10</sup> Liang Dan 梁丹 and Jian Wu 於坚, *Beijing bowuguan nianjian 1912-1987* 北京博物馆年鉴 1912-1987 [Yearbook of Beijing Museums, 1912-1987] (Beijing: Beijing yanshan chubanshe, 2000), 511.

opening in 1959 up to today is the Chinese History Museum (*Zhongguo lishi bowuguan* 中国历史博物馆), renamed the Chinese National Museum (*Zhongguo guojia bowuguan* 中国国家博物馆) in 2003. It prominently represented the history of science and technology in its *Chinese Narrative History Exhibit*, one of two permanent exhibits in the museum. The symbolic importance of this museum as a national symbol cannot be understated. During the first decade of communist rule, the CCP transformed Tiananmen Square into the symbolic center of the nation, with two symmetrical and identical looking structures on either end – the Chinese History Museum in the East, and the Great Hall of the People, housing the Chinese National Congress, in the West. Completed to great fanfare in 1958-1959, these represented the Chinese Communist Party's control over narratives of past and present.<sup>11</sup> Since its opening, the museum's permanent exhibits are divided in two – on the northern end is the Museum of Chinese History, and on the southern end, the Museum of the Chinese Revolution. The beginning of the First Opium War in 1839 marked the dividing line between the two, reflecting the CCP's emphasis on the war as a watershed between the premodern and modern eras. Until 1982, the Museum of Chinese History was organized chronologically according to Marxist stages of historical development: from primitive society (prehistory-2000 BC), to slave society (2000 BC – 475 BC), to feudalism (476 BC – 1840 CE).<sup>12</sup> The history of science and technology was well represented within the

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<sup>11</sup> Wu Hung, *Remaking Beijing: Tiananmen Square and the Creation of a Political Space* (Chicago: University of Chicago Press, 2005).

<sup>12</sup> *Zhongguo Lishi Bowuguan* 中国历史博物馆 [National Museum of Chinese History], *Zhongguo Lishi Bowuguan* 中国历史博物馆 [National Museum of Chinese History] (Beijing: Zhongguo lishi bowuguan, 1976).

permanent exhibit at the National History Museum, even more so in the Mao period than today. This exhibit thus set a standard for history of science and technology curation in the PRC.

The most prominent element of this older exhibit the CSTPPC drew on were its reproductions of pre-modern technology, which conformed to a Marxist view of Chinese history. These were produced by the curator in charge of the history of science and technology the Chinese National Museum, Wang Zhenduo (王振铎, 1911-1992). One of the most influential historians of technology in modern China, Wang made his name in late 1930s when built reconstructions of both Zhang Heng's seismometer from the 2<sup>nd</sup> century AD and the "south-pointing cart" (*zhinanche* 指南车), which possibly dated to the 3<sup>rd</sup> century AD. As no archeological evidence existed proving their existence, Wang drew from often vague textual sources to create his models, which he offered as proof that these inventions truly did exist in the ancient past.

When the Chinese Communist Party came to power and prepared the history exhibit for the National Museum over the 1950s, they pulled Wang in as curator to portray China's long history of scientific and technological achievement, which accorded with a Maoist view of Chinese history. This was a departure from past representations of Chinese national history. During the Republican era, the National Museum in Beijing housed the dynastic treasures of the

ancient past, divided according to artistic medium – porcelain, jade, painting, calligraphy, etc.<sup>13</sup> Following Mao’s interpretation of Marxist historiography, the exhibit asserted historical progress in all fields of society, from the distant past to the modern period – not only in fine art, but also in social, political, scientific and technological development.<sup>14</sup> Arranged according to Marxist period names – from prehistory, to slave and feudal society – the exhibit thus highlighted the achievements of China’s ancient artisans and working class, rather than only represent the treasures of a corrupt ruling class. As curator of science and technology, Wang produced many more famous reproductions of ancient Chinese technology and scientific instruments that filled the museum’s halls from its opening in 1959, representing the continual achievement of Chinese scientists and artisans. These included reproductions of the “four ingenious devices,” which included the ancient seismometer, an armillary sphere, the south-pointing spoon (*sinan* 司南 an early magnetic compass), and the south-pointing cart.<sup>15</sup> The exhibit also contained a Yuan dynasty cannon, the oldest such weapon in existence, as well as printing blocks, and a statue of

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<sup>13</sup> As the KMT fled China at the end of the Civil War, they brought the finest artifacts from this collection with them. They can now be viewed at the National Museum in Taipei, which is still curated according to the classical mediums of traditional Chinese art.

<sup>14</sup> Mao diverged from Marx’s own take on Chinese history, by arguing that China did have a history of science and technology in its feudal past. See Chapter 4 for my analysis of this argument.

<sup>15</sup> Besides the armillary sphere, there is no material evidence proving these inventions really existed in ancient China. Working from incredibly vague ancient texts, Wang created these reproductions proof that they *could have existed at all* in the ancient past. More recently, scholars in China have questioned the validity of Wang’s models, arguments which are laid out in Jiang Xiaoyuan 江晓原, *Zhongguo gu dai ji shu wen hua* 中国古代技术文化 [Chinese Ancient Technological Culture] (Beijing: Zhonghua shuju, 2017). I am convinced that the south-pointing spoon most likely never existed at all. And yet, existence of these ancient inventions is so firmly planted in Chinese popular culture that these debates as to their validity have not reached a broad audience.

the inventor of movable type, Bi Sheng. Examining a photograph of one exhibition hall from 1964 (below), the entire right side of the hall is filled with material on the history of science and technology, while the left side contains bronzes, pottery, and other fine art that would have formed the entirety of the old Palace Museum in the Republican Period.<sup>16</sup> This balance reflected the historiographical emphasis of the exhibit, which subsumed the artistic value of the artifacts, while emphasizing the development of science, technology, and the technical skills of China's artisan class. As the Cultural Revolution set in, archeologists had to go to lengths to explain the relevance of the fine art, jade, porcelain and bronze treasures to the present revolution. In comparison, the history of technology, largely the product of workers and artisans, more easily conformed to the political ethos of the Cultural Revolution. Wang's reproductions had already become iconic during the Mao era. They were featured on a stamp set in 1953, reproduced in other museums, public artwork, and reprinted in countless books and magazines. The CSTPPC reproduced many of these reproductions of ancient technology for their own new exhibit, but would strip away the Marxist historical narrative that they served in the Chinese National Museum.

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<sup>16</sup> All photographs here are from: Zhongguo Lishi Bowuguan 中国历史博物馆 [National museum of Chinese history], *Zhongguo Lishi Bowuguan* 中国历史博物馆 [National Museum of Chinese History] (Beijing: Zhongguo lishi bowuguan, 1964).



Clockwise from top left:

**A.** 1953 PRC stamp set of the “four ingenious inventions.”

**B.** Photograph of the Chinese History Museum Narrative Exhibit Hall, Feudal Society Wing, Song-Yuan Dynasty Section (1964).

**C.** Earliest existing cannon (Yuan Dynasty) (1964).

**D.** Statue of Bi Sheng, inventor of movable type (1964).

While the CSTPPC’s original mission was to construct a science museum within China, this quickly transformed into a mission of cultural diplomacy. In the spirit of “opening up to the outside,” the CSTPPC looked abroad for a model of a modern science museum they could reproduce in Beijing. They soon found one in the Ontario Science Centre in Toronto. The Centre was opened in 1969, and along with the Pacific Science Center in Seattle (opened 1962), and the Exploratorium in San Francisco (opened 1969), pioneered the interactive museum exhibition format. Unlike older science and natural history museums that were dominated by static dioramas (or the Chinese National Museum for that matter), these science centers used a hands-

on pedagogy, relying on interactive displays and live demonstrations to teach scientific principles. Science centers gained huge popularity in the 1970s. Over the decade the popularity of the interactive exhibit style led to the opening of other science centers around the world, and older science museums incorporated their interactive exhibit style to try to maintain their relevancy. The interactive style of science education also came to be seen by science educators as a new model of pedagogy.<sup>17</sup> By 1979, the Ontario Science Centre had capitalized on this phenomenon by launching a travelling exhibit, *Science Circus*, that the CSTPPC hoped to purchase as the foundation of their future museum in Beijing.

Another attraction of the Ontario Science Centre was the enthusiasm of director John Tuzo Wilson for the partnership with the PRC. A well-known geophysicist instrumental in originating plate tectonic theory, Wilson was a long-time advocate of international scientific cooperation. To that end, he had been one of the few Western scientists to travel to China under Mao, in 1958 and 1971. At that time, Wilson thought of himself as a modern-day Matteo Ricci – the Jesuit missionary who brought Western science to China in the 17<sup>th</sup> century.<sup>18</sup> Wilson had such a passion for China and Chinese culture that he sailed his own junk, a traditional Chinese

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<sup>17</sup> Karen A. Rader and Victoria E. M. Cain, *Life on Display: Revolutionizing U.S. Museums of Science and Natural History in the Twentieth Century* (Chicago: The University of Chicago Press, 2014).

<sup>18</sup> Wilson wrote about his 1958 trip in: J. Tuzo Wilson, *One Chinese Moon* (London: Travel Book Club, 1960).

sail boat, around the lakes of Ontario.<sup>19</sup> Now as the PRC sent her own emissary's abroad to learn how to establish a modern science museum, Wilson was eager to receive them.

Wilson and the CSTPPC worked together for three years, from 1979 to 1982, to negotiate a deal that would send exhibits in both directions. First, the Chinese side would send an exhibit of ancient Chinese science and technology to the Ontario Science Centre, entitled *China: 7000 Years of Discovery*. Springing from this initial exhibition, the team would pitch the exhibit to other museums for an extended North American tour. For the Chinese side, the narrow goal of the deal was to raise funds for the construction of a science museum in Beijing. As negotiations later unfolded in the 1980s between the CSTPPC and other North American museums, this priority became clear.<sup>20</sup> Besides the paying the CSRPPC for staging the exhibit, the Ontario Science Centre would also export their own *Science Circus* exhibit to Beijing. In return, the Science Center would host an exhibit that might not only prove profitable, but would stand to significantly raise their international profile. This truly met the spirit of the Reform Era to learn from foreigners, and establish trade deals that would also secure intellectual property from abroad. At least in the early 1980s, this was just as true in academia and museology as it was in the industrial and scientific sectors.

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<sup>19</sup> G. D. Garland, "John Tuzo Wilson. 24 October 1908-15 April 1993," in *Biographical Memoirs of Fellows of the Royal Society* 41 (1995): 535-52.

<sup>20</sup> My analysis is based on the correspondence between the CSTPPC and the Chicago Museum of Science and Industry from their archive.

While the financial side of the deal was a key sticking point in negotiations between Chinese and Western curators, the exhibit was also significant as an act of cultural diplomacy during a period of thawing Sino-American relations. *China: 7000 Years of Discovery* would be the third such Chinese exhibit to tour the West since Nixon's visit to Beijing in 1972. Reviewing the history of these previous exchanges provides a critical context for understanding how museums became a politically important and highly visible space for cultural diplomacy. The first two of these exchanges were in the field of archeology and art history. Several US delegations travelled to Beijing in the wake of Nixon's visit, but the sole academic exchange was made by art historians and archeologists in 1973.<sup>21</sup> Many archeological discoveries had been made in the PRC since 1949, and this area thus proved a way for the CCP restart cultural diplomatic relations with the US while putting its best foot forward.

The fruits of this exchange were the 1973-1975 *Exhibition of Archaeological Finds of the People's Republic of China*, and the 1980-1981 *The Great Bronze Age of China*. The contrast between these two landmark events illustrate the evolution of China's cultural diplomacy from the Mao to the Deng era. They also illuminate the arrival of the "blockbuster" phenomenon in the museum world, which would have deep and long influence on China's presentation of its own history of science and technology.

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<sup>21</sup> This includes the author's grandfather, the art historian and specialist in ancient Chinese bronzes, University of Minnesota professor Robert Poor.

The 1973-1975 *Exhibition of Archaeological Finds of the People's Republic of China* was a hit in the West, but was nearly a disaster from the perspective of Chinese curators. The exhibit included a collection of 385 bronzes, pottery, and textiles from prehistory to the 14<sup>th</sup> century AD that toured eight museums across Europe, Canada, and the US between May 1973 and August 1975.<sup>22</sup> It was the first exhibit to leave China since 1949, and contradicted Western impressions that ancient relics and archeology in general had been devastated under the Cultural Revolution. In fact, the exhibit showed, many discoveries had been made. However, as the exhibit travelled from Europe to the United States, the “Anti-Lin Biao, Anti-Confucius Campaign” began, leading to last minute revisions of the catalogue, and tense negotiations with the Western museums. Western curators sought to attract public interest by emphasizing the exhibit’s incredible array of fine art objects as representative of a long continuous and splendid history of Chinese culture. As the pressure of what would be the last political campaign of the Cultural Revolution mounted, the Chinese curators increasingly stressed that Western museumgoers must learn the present political dimensions of the exhibit. The amazing full-jade burial suit, or the iconic bronze “flying horse” were not to be gawked at as beautiful works of art from a glorious past, but as evidence of the decadence of the feudal elite, the talent of the working class, and how the Communist Party had now brought China to its peak of cultural and social development. While in London the British curators had titled the exhibit *The Genius of China*, as it moved to North America the Chinese curators demanded this title be scrapped, as the word was associated with intellectual

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<sup>22</sup> National Gallery of Art, “The Exhibition of Archaeological Finds of the People's Republic of China,” [https://www.nga.gov/exhibitions/1974/china\\_archaeology.html](https://www.nga.gov/exhibitions/1974/china_archaeology.html). (accessed May 27, 2020)

elitism and now Lin Biao. They even subtitled the exhibit with the Maoist dictum: “Let the past serve the present!” making their intentions plain to the Western audience. Under the pressure of intense political scrutiny, Chinese curators took as much control as possible over the terms and presentation of this cultural exchange. Nonetheless, public curiosity to see the exhibit of Chinese artifacts, the first to leave the country since 1949, brought hundreds of thousands of visitors across the world.<sup>23</sup>

By the time of *The Great Bronze Age of China* exhibit in 1980-1981, much had changed in the museum world, and in the PRC. In the West the age of the “blockbuster” exhibit was underway, exemplified by the 1976-1979 *Treasures of Tutankhamun* exhibit. Travelling to six American cities, the “King Tut” drew more than eight million visitors, who lined up for up to seven hours to gain entrance. The exhibit became a national sensation, and a model of high-budget, high-grossing curation that proved irresistible to museum directors reckoning with declining public funding since the late 1970s. Dubbed by contemporary critics as “edutainment,” the King Tut exhibit presented a commercially motivated blend of education and entertainment that soon spread from the world of natural history museums to art and science museums.<sup>24</sup> *Treasures of Tutankhamun* was also model of cultural diplomacy that must have been more attractive than the earlier PRC exhibit. The “King Tut” exhibit also originated as a diplomatic

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<sup>23</sup> Mary Jo Michelle Hague, “Cultural Diplomacy, Canada-China a Case Study: The Exhibition of Archaeological Finds of the People’s Republic of China held at the Royal Ontario Museum from 8 August-November 16, 1974” (Ph.D. diss., University of Alberta, Canada, 1986).

<sup>24</sup> Karen A. Rader and Victoria E. M. Cain, *Life on Display*, 248.

gesture, when the Nixon administration signed a bilateral agreement with Anwar Sadat, the president of Egypt, in June 1974. Just as Nixon had re-established relations with the PRC to isolate the USSR in 1972, his re-establishment of relations with Egypt in 1974 achieved the same ends. Buried in the agreement was a clause devoted to culture – Egypt would send the *Treasures of Tutankhamun*, then on tour in the USSR, to the US, who would in turn fund the reconstruction of Cairo’s opera house. The Nixon administration hoped this would lead Americans to associate Egypt with more than oil and war. Ultimately, the exhibit raised \$9 million for the Egyptian government, proving a success for both parties.<sup>25</sup> It also indicated to curators that Americans had a large appetite for exotic treasures from abroad.

Arriving at the Metropolitan Museum in 1980, *The Great Bronze Age of China* came in on the heels of *Treasures of Tutankhamun* and imitated its blockbuster model. Like the Egyptian exhibit, *The Great Bronze Age* showcased hundreds of archeological treasures never seen outside of their home country before. One highlight was the life-size terra-cotta warriors, discovered only six years earlier in Xi-An. The Anti-Lin Biao, Anti-Confucius campaign had created a dangerous political atmosphere within China that led nervous curators to carefully control the political messaging of the earlier 1973-5 exhibit. Now in the early Reform Era they operated under much less scrutiny, collaboratively producing rather than dictating a catalogue with their American counterparts. Rather than tense back-room negotiations and last-minute dictations, the

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<sup>25</sup> Meredith Hindley, “King Tut: A Classic Blockbuster Museum Exhibition That Began as a Diplomatic Gesture,” *Humanities: The Magazine of the National Endowment for the Humanities* 36(5) (September/October 2015).

PRC and American historians wrote their disagreements over history into the catalogue itself; none of these came close to the ideological gulf that separated curators five years earlier.<sup>26</sup> Even the title of the exhibit was a concession – according to Marxist historiography, the years 2000 BC – 500 BC was the “slave society,” not a “Bronze Age.”<sup>27</sup> While the Chinese art historians still applied Marxist class analysis to the history of the bronzes, this history of conflict between the laboring and ruling class was smoothed over by a grander narrative of millennia of continuity. Chinese and American historians converged here around an “appreciation of the accomplishments of ancient Chinese civilization,” which was unified by the artistic and technological culture of bronze-making. A history of conflicting social forces and dynastic change was thus replaced by an ethno-nationalist one, that identified the People’s Republic of China as the inheritors of a continuous and glorious Chinese civilization.

Most illustrative of the radically new political context was the funding of the exhibit. The primary sponsor was the Coca-Cola Company, whose chairman J. Paul Austin had pursued a long campaign to enter the PRC market after a 30-year ban under Mao. Austin was so successful that he struck a deal with the Deng Xiaoping administration to sell Coke in China on December 13, 1978, two days *before* the Carter administration formally re-established relations with

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<sup>26</sup> Metropolitan Museum of Art, *The Great Bronze Age of China: An Exhibition from the People's Republic of China* (New York: Metropolitan Museum of Art, 1980).

<sup>27</sup> Metropolitan Museum of Art, *The Great Bronze Age of China*, 36.

Beijing.<sup>28</sup> Austin called the funding of the exhibit “a further commitment to fostering international understanding through cultural exchange with our trading partners.”<sup>29</sup> As the exhibit was being staged at New York’s Metropolitan Museum of Art in early 1980, Coca-Cola was simultaneously breaking ground on their first bottling plant in the PRC. Thus, *The Great Bronze Age of China* also marked the beginning of a new age in Sino-American relations, a fact that was often noted in reporting on its opening.

At the very moment that *The Great Bronze Age of China* made its rounds through American art museums over 1980-1982, John Tuzo Wilson worked with the CSTPPC to create a similar blockbuster exhibit for the modern science center. Like those preceding blockbusters, *China: 7000 Years of Discovery* would be big, expensive, and highly publicized. Especially on the Chinese side, expectations for profit were high. Records detailing the negotiations between the CSTPPC and the Museum of Science and Industry in Chicago, where it would appear between June 1 to October 31, 1983, indicate that money was the main concern of the Chinese curators.<sup>30</sup>

When it came to the content of the exhibit, they operated much more freely than their predecessors. Deng Xiaoping had launched a period of incredible openness for Chinese

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<sup>28</sup> Charles Kraus, “More than Just a Soft Drink: Coca-Cola and China’s Early Reform and Opening,” *Diplomatic History* 43(1) (January 2019): 7–129.

<sup>29</sup> John Asherby, “From the Bronze Age to the Age of Anxiety,” *New York Magazine* (April 28, 1980).

<sup>30</sup> My analysis is based on the correspondence between the CSTPPC and the Chicago Museum of Science and Industry from their archive.

intellectuals that energized historians of science. Even the Chinese National Museum, the very embodiment of the Chinese Communist Party's view of history, had by 1982 largely replaced the Marxist organization of their exhibits with traditional dynastic ones. Now, the exhibit emphasized continuity between prehistory and the present rather than historical ruptures.<sup>31</sup> This political context set the stage for a fruitful and open collaboration between Chinese and Western historians and curators.

<i>China: 7000 Years of Discovery Tour</i>	
Ontario Science Centre, Toronto	May 1 to October 31, 1982
Museum of Science and Industry, Chicago	June 1 to October 2, 1983
Pacific Science Center, Seattle	March 1 to August 31, 1984
High Museum of Art, Atlanta	Nov. 19, 1984 to Feb. 24, 1985
Boston Museum of Science	June 1 to December 1, 1985
Dallas Science Place	June 15, 1986 to January 4, 1987

Contemporary commentators called *China: 7000 Years of Discovery* “a happy combination of Chinese inventions and Canadian presentation.”<sup>32</sup> Turning to the exhibit itself, how did it represent “Chinese inventions”? Furthermore, how did the “Canadian presentation,” meaning the interactive pedagogy that Wilson and the Science Centre staff injected into the exhibit, effect the

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<sup>31</sup> Zhongguo Lishi Bowuguan 中国历史博物馆 [National Museum of Chinese History], *Zhongguo Lishi Bowuguan* 中国历史博物馆 [National Museum of Chinese History] (Beijing: Zhongguo lishi bowuguan, 1982).

<sup>32</sup> Doug Payne, “Science in China: 7000 years of discovery,” *New Scientist* 94(1310) (June 17, 1982).

narrative that it communicated? I argue that for this exhibit, form and substance cannot easily be separated.

The substance of the exhibit presented a self-glorifying history of Chinese science and technology that emphasized the continuity and stability of Chinese civilization across 7000 years. The sense of China as a cohesive and ancient civilization was enhanced by the organization of the exhibit, which represented the highlights of pre-modern Chinese science and technology divided categorically rather than chronologically. Reflecting their long-held prominence both in China and the West, the curators made the four great inventions prominent in the exhibit, giving the magnetic compass, gunpowder, papermaking, and printing their own displays. Other exhibit rooms included astronomy, mechanics and engineering, bronze casting, medicine, ceramics, silk and embroidery, architecture, and traditional handicrafts.

This encyclopedic methodology originated from the most influential historian of Chinese science in the West, Cambridge historian Joseph Needham.<sup>33</sup> While Chinese historians of science had been almost entirely unable to conduct or publish research during the 1960s and 1970s, Needham had become the de-facto leader in the field. Since the early 1950s, he worked with a revolving team of collaborators to publish volume after volume of his magnum opus, *Science and Civilization in China*. The series was encyclopedic, covering the entirety of Chinese science and technology from ancient history to the contact with modern Western science in the 17<sup>th</sup> century. In volume after volume (24 books in all from 1954-2015), *Science and Civilization*

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<sup>33</sup> See Chapter 3 of this dissertation for more on Needham and the great inventions.

established an enormous record of Chinese accomplishments in science and technology. A Marxist and staunch Cold War advocate of the PRC, Needham intended his history to correct the long-held impression in the West that Europe alone had been the birthplace of science – in fact, he sought to prove they had benefited from millennia of Chinese achievement. As historians of Chinese science re-established themselves in the Reform Era, they largely adopted Needham’s methodology, while couching the entire enterprise in the politics of national self-glorification and China’s revival under the “Four Modernizations” policy.

This revivalist narrative came through in the introduction to the English language catalog for *China: 7000 Years of Discovery* written by the Vice-Chairman of CAST, Mao Yisheng (茅以升 1896-1989). Mao’s short introduction in this book sanitized for a foreign audience passages that he had included in an earlier preface to the 700-page compendium *The Scientific and Technological Achievements of Ancient China*, published in China by the Institute for the History of Natural Science (*Ziran kezxuehi yanjiusuo* 自然科学史研究所):

Besides shorts periods of time, China has for these past several thousand years been politically unified from beginning to end. Although a multi-racial nation, China has never been divided like Europe has; we are even less like the Roman Empire or the Mongol Empire which flourished for a brief time, and then declined and fell. We Chinese are not the same as them. We Chinese people have been in existence some 4000 years, towering on this earth, and continuously growing stronger and more prosperous. One primary reason for this, as embodied in the content of this book, is that we have our own glorious achievements of scientific culture.<sup>34</sup>

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<sup>34</sup> Zhongguo kexue yuan [Academia Sinica], *Zhongguo Gudai Keji Chengjiu* 中国古代科技成就 [The scientific and technological achievements of ancient China] (Beijing: Zhongguo Qingnian Chubanshe, 1978), 2.

Remarkably, Mao asserts here a 4000-year history of Chinese unity, smoothing over a reality of frequent dynastic change and outright domination by non-Chinese ethnic groups, which include the Tang (618-907 AD) and Qing (1644-1912) Dynasties. As the ideals of communism were gradually decentered from Chinese historiography in the Reform Era, this narrative of the PRC as inheritor of a long, continuous and unified Chinese civilization was brought to the center. While in the Mao era achievements in science and technology were depicted as proof of working-class ingenuity, here they were, almost perversely in comparison, portrayed as the means of imperial China's longevity. When Mao wrote a similar preface for a to a foreign audience in the *China: 7000 Years of Discovery* catalog, used a quote from Joseph Needham to assert China's greatness, and avoided comparison to the West:

Joseph Needham states that China's technological discoveries and inventions were 'far in advance of contemporary Europe, especially up to the 15<sup>th</sup> century.' Ancient China was able to build a highly developed civilization and maintain the unity of her vast territories and many nationalities precisely because of her cultural cohesion based on a common technology. Visitors will see many ingenious inventions connected with agricultural production, irrigation works, architecture, bridge-building, transportation, navigation and communication.

Thus, the exhibit would tell the foreign audience something essential about Chinese civilization, and the character of the Chinese people. Mao raised the great inventions as a foreshadow of the great contributions that China would again make in the near future:

China's past contributions to the world's storehouse of knowledge include the compass, paper, printing with movable type and gunpowder. If for several centuries she fell far behind in scientific development, she is now rapidly catching up. She has launched man-made satellites and made breakthroughs in many fields. Particularly in some areas of medical and biological sciences and in crop hybridization, she has recently made important and original contributions to the

scientific heritage of mankind. And China's current modernization program is opening up still broader vistas for science and technology.<sup>35</sup>

Mao here frames China's modernization with the narrative that the great inventions were China's "contributions to the world's storehouse of knowledge." He treats "several centuries of falling behind" as an aberration from which China was "now rapidly catching up." Framed by the narrative of scientific discovery as a "great contribution" to the world, China's modernization is depicted as a boon to the world, rather than a threat.

In its curation and presentation of this material, *China: 7000 Years of Discovery* transformed the great inventions narrative into a living spectacle for mass consumption like had never been done before. Filling a hall of 45,000 square feet, the exhibit was filled with reproductions of ancient technology and artefacts. Some of these could be seen in action, like a water-powered tea grinder and a hand-operated irrigation pump. Following the "hands-on" pedagogy of the modern science center, visitors could also participate themselves in working with clay, making their own signet seal, and operate a computer display that showed how Chinese pictographs developed through the years, and play with a Chinese typewriter.<sup>36</sup> The exhibit also recreated scenes from daily life in contemporary China, including an area "featuring typical consumer goods and Chinese street recordings," and herbal apothecary. Patrons were

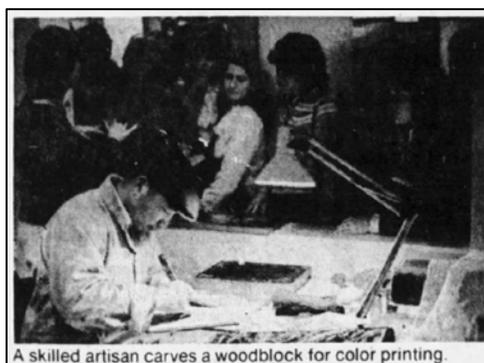
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<sup>35</sup> China Science and Technology Museum and China Reconstructs, *China: 7000 Years of Discovery* (Beijing: China Reconstructs Magazine, 1983).

<sup>36</sup> Doug Payne, "Science in China: 7000 years of discovery."

invited to try their hand at pottery. True to the hand-on pedagogy of the American science center, the exhibit engaged audiences through all of their senses.

The *pièce de résistance* was live demonstrations by a group of 18 Chinese artisans. Following the exhibit throughout its North American tour, these artisans demonstrated silk weaving on a two-story high loom, double-sided silk embroidery, batik fabric print making, bamboo weaving, traditional kite-making, traditional wood construction methods, papermaking, and wood-block printmaking. Accompanying the artisans (to varying degrees) were translators who could facilitate questions and answers with visitors. Including these artisans shifted the exhibit from a representation of history to a reenactment. The viewer could no longer stand apart from the past, and as Mao Yisheng suggests in the catalog, see these technologies as a distant golden age preceding a modern period of “catching up.” Rather, these technologies and skills, embodied in the artisans, were presented as a living connection to the past in a way that was entirely non-threatening. For decades Americans had mainly seen China through the lens of the Cold War, as a junior partner to the USSR in a race to acquire nuclear weapons, amass ballistic missiles, and dominate outer space. By focusing on their ancient past, the exhibit put a new friendly face on Chinese science a technology, as something fun, approachable, that Americans could get to know, admire, and even practice themselves. China as revolutionary leader was thus replaced by China as traditional culture – non-threatening and delightful.



Clockwise from top left:

1 - Papermaking artisan<sup>37</sup>

2 - Children attending the exhibit<sup>38</sup>

3 - Traditional bamboo kite-maker<sup>39</sup>

4 - Woodblock print artisan<sup>40</sup>

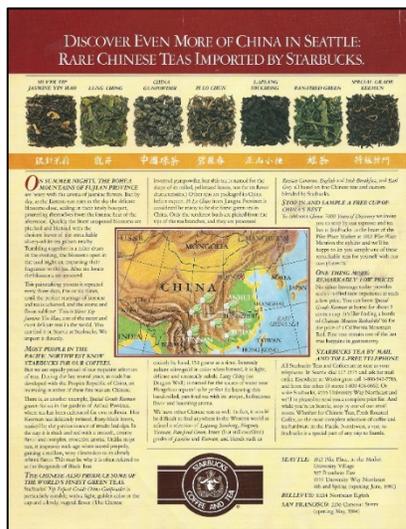
<sup>37</sup> Jerome Sims, "Today in Dallas photo history - 1986: 'China: 7,000 Years of Discovery' exhibit opens at The Science Place," *The Dallas Morning News*, June 15, 2016. <https://www.dallasnews.com/photos/2013/06/15/today-in-dallas-photo-history-1986-china-7000-years-of-discovery-exhibit-opens-at-the-science-place/>. (accessed May 27, 2020)

<sup>38</sup> Ibid.

<sup>39</sup> Ibid.

<sup>40</sup> Bruce Martin, "'One seeing is worth a thousand tellings' China: 7,000 years of discovery," *Pensacola News Journal*, February 10, 1985.

The exhibit also was also innovative commercially. As had already become typical in the museum world, a large souvenir shop was filled with trinkets and books. Audience members could actually buy the products produced by the artisans, like the tiny dough figurines, and hand-made kites, which went for \$80 each. As the exhibit was re-staged across North America, curators contracted with local Chinese restaurants to set up shop within the museum. The exhibit guide also featured advertisements from local businesses that tied into the Chinese theme. For example, in Seattle, the original Starbucks (then just a local café called Starbucks Coffee and Tea) advertised its array of Chinese tea available for purchase, with the headline “Discover even more of China in Seattle: Rare Chinese teas imported by Starbucks.”



**Left:** Articles like this one in the *Chicago Tribune* reported on the exhibit as a cultural-diplomatic event, attended by PRC diplomat members of the Chinese American community.<sup>41</sup>

**Right:** An ad for Starbucks from the Pacific Science Center program.

<sup>41</sup> Margaret Carroll, “International exchange: tradition and friendship at Chinese exhibit,” *Chicago Tribune*, June 10, 1983.

Publicity surrounding the exhibit was highly positive, emphasizing the emotional connections visitors made with the artisans and China. While China and the US had experienced nearly a decade of rapprochement, most Americans in the early 1980s still knew little about life in the PRC. While Deng Xiaoping's mantra that China "open up to the outside" served the goal of catching up with the West, for Americans it was experienced as an opening of doors to an isolated ancient civilization. The exhibit's focus on China's "7000 years" of history certainly played into this narrative, and reviewers largely bought into it.

While some reviewers introduced the exhibit as offering a window into the long-isolated and mysterious East, others highlighted how it prompted American audiences to rethink China altogether. In Toronto, an early review of the exhibit praised its interactive curation, saying that "In each case the displays are arranged so that a visitor will not merely say, 'Oh, look at that Chinese whatever...'; the displays will also provide vivid illustrations of the scientific and mechanical principles underlying many aspects of our lives we take for granted."<sup>42</sup> Reviewers focused most on the artisans. One article in Seattle described a "young fourth generation Chinese kite maker" at work, while "a four-year-old blond American boy – his chin just touching the counter as his father hold him off the floor – watches with utter fascination." The author noted that "as museums across the country have discovered, a reenactment of old-time crafts seems guaranteed to appeal to the inborn American pragmatism."<sup>43</sup> At its stop at the Boston Museum of

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<sup>42</sup> Doug Payne, "Science in China: 7000 years of discovery."

<sup>43</sup> Rushworth M. Kidder, "From China, a chance to see the process of discovery," *The Christian Science Monitor*, April 4, 1984.

Science, a reviewer from Harvard's student newspaper, *The Crimson*, noted that exhibits on acupuncture and Chinese ethnic minorities were "cleverly designed to expand on or dispel much of the common knowledge and stereotypes assigned to the Chinese country and people."<sup>44</sup> This certainly played out in several reviews as the exhibit travelled America. At its stop at the High Museum of Art in Atlanta, one review also highlighted the audience impact, quoting a local University of Georgia student in attendance: "It *is* an education. Just a few moments here has helped me overcome a lifetime of prejudices to the Chinese people – I always thought of them as dreary, ignorant, dirty and undirected dregs of humanity. I was brought up that way – enculturated that way, maybe unintentionally – by my family, my peers...the public education system."<sup>45</sup> Similarly in its stop at the Dallas Science Place, one visitor was quoted, "It makes you feel very humble. We in the West think we invented everything, but to see what the Chinese were doing in science and art thousands of years before us is fantastic."<sup>46</sup> These kinds of anecdotes revealed moments of personal connection. American audiences replaced the image of China as a Cold War rival, with one of a benign and fascinating foreign culture that they could learn from and enjoy.

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<sup>44</sup> Joan H.M. Hsia, "7,000 Years of Civilization," *The Crimson*, July 23, 1985.

<https://www.thecrimson.com/article/1985/7/23/7000-years-ahead-of-civilization-pbtbhroughout/> (accessed April 9, 2020).

<sup>45</sup> Bruce Martin, "One Seeing..."

<sup>46</sup> Jerome Sims, "Today in Dallas photo history - 1986: 'China: 7,000 Years of Discovery' exhibit opens at The Science Place."

*China: 7000 Years of Discovery* not only fulfilled its role as a cultural diplomatic mission, but also was a turning point for American science centers as their first blockbuster exhibit. In all, it toured six museums in Canada and the US, attracting more than 6 million visitors between 1982 and January 4, 1987.<sup>47</sup> The Ontario Science Center lists it as their first significant exhibit after opening in 1969, noting on their website it “broke attendance records, attracting more than 1.5 million visitors.”<sup>48</sup> The exhibit was similarly record-breaking for the Pacific Science Center in Seattle, where it attracted 727,861 visitors, earned half a million dollars more than anticipated, and allowed the Center to launch its first capital drive.<sup>49</sup> It was the first travelling exhibit to visit the Dallas Science Place, where it attracted 270,000 visitors and was declared by the president as “a phenomenon” and a “stunning success.”<sup>50</sup> In the emerging sphere of commercialized education as mass spectacle, Chinese ancient technology, presented as a benign playground of artistry and delight, had proved a hit with American audiences. This lesson was not lost on the Chinese, who have returned often to the great inventions when presenting their history to foreign audiences to this date.

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<sup>47</sup> “Holiday travelers get last look at ‘China’ in Dallas: in surprise decision, exhibit to leave U.S. after closing Jan. 4,” *Southwest Newswire*, December 18, 1986.

<sup>48</sup> Ontario Science Centre, “Major Moments,” <https://www.ontariosciencecentre.ca/WhoWeAre/MajorMoments/>. (accessed May 27, 2020)

<sup>49</sup> Eric Scigliano, “Popular science: what next for the Science Center after the ‘China’ bonanza?” *Weekly* (October 10–16, 1984).

<sup>50</sup> “Holiday travelers get last look at ‘China’ in Dallas...”

At the same time, the hands-on, interactive curation had proved an effective means of presenting the great inventions narrative, and found life in the PRC during the Reform Era. The interactive form of these exhibits created a visceral connection between the audience and history with political ramifications. In the Mao era, the state called on the Chinese people to pursue modernity and progress. They were not meant to return to the past or cherish it nostalgically, but to reflect on it from a distance, and in Mao's words, make it "serve the present." The "New Socialist Man" of the Mao era was not supposed to cherish the past nostalgically, but reflect on it from a distance, and move to create a better future for the collective. That being said, the Chinese Communist Party never completely spurned an attachment to the imperial past – rather, the dominant historiography salvaged certain elements, like the four great inventions, as origin stories that served as the basis of national self-confidence and socialist building. In that period, recollecting China's past invention of papermaking, for instance, was not a plea to preserve the ancient craft, but a call to build up a domestic papermaking industry in the modern era that would rival the West's. A glorious technological past was meant to inspire Chinese citizens to become agents of modernization, not preservation.

But *China: 7000 Years of Discovery* came out of a movement of history as reenactment, which in many ways is the opposite of history as progress narrative. Rather than agents of progress, the viewer was invited to step into the past, to use old technologies, don historic garb, to eat the food using ingredients and cooking methods from the past, and to watch and speak with actors portraying people from another time. Rather than historical narrative, the exhibit invites audiences to have an immediate experience with the past, to time travel. In 1970s America, the shift away from preservation and toward reenactment of history was widespread, not just occurring in museums but also in television dramas like "Little House on the Prairie" and

“Roots,” historic sites like Colonial Williamsburg where historic reenactors performed daily life in the 18<sup>th</sup> century, and in the massive 1976 Bicentennial celebrations.<sup>51</sup> This appetite for historical reenactment undoubtedly spurred public enthusiasm for the Chinese exhibit, with its presentation of Chinese artisans, its galleries that recreated daily life in an ancient Chinese apothecary and street market, and chance to taste Chinese food. As an act of cultural diplomacy, this type of exhibit stripped away the entire framework of Cold War geopolitics, which had so thoroughly defined China’s image amongst Americans in the past. Instead, it was replaced with the inviting sights, tastes, and sounds of an ancient civilization. The CSTPPC effectively imported this interactive model of curation to the PRC.<sup>52</sup>

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<sup>51</sup> M. J. Rymysza-Pawlowska, *History Comes Alive: Public History and Popular Culture in the 1970s* (Chapel Hill: The University of North Carolina Press, 2017).

<sup>52</sup> Throughout the 1980s, ‘90s, and 2000s many other examples of this phenomenon appeared, such as the rise of historic preservation and tourism, the state protection of artisans as “living national treasures,” and the rise of Han clothing nationalism. See Kevin Carrico, *The Great Han: Race, Nationalism, and Tradition in China Today* (Oakland, California: University of California Press, 2017).



Clockwise from top left:

- A. Reproductions of ancient water-powered agricultural technology
- B. Exhibit of the four great inventions featuring Interactive digital displays
- C. Museum guide demonstrating woodblock printing
- D. Visitors interact with a working “south-pointing cart” (*Si nan che* 四南车)

(All photographs by the author, 2017)

Once the Museum of Science and Technology was constructed in Beijing in 1988, the exhibition would form one of the main permanent exhibits, while the modern science exhibit based on the Ontario Science Centre’s *Science Circus* made up the other half. The museum has been relocated twice since then, now occupying a large structure in Beijing Olympic Park. The descendant of *China: 7000 Years of Discovery* still forms a permanent exhibit, now titled *The Glory of China* (*Huaxia zhi guang* 华夏之光). Like its predecessor, it presents an immersive and entertaining experience of history that brings to life the idea that science and technology flourished in ancient China. The ‘Foreword’ sign to the exhibit explains:

The progress of science and technology has pushed forward the advancement of human society. When we are enjoying the happiness brought about by the inventions and discoveries of our ancestors, let us, at the same time, recall the great wisdom and creation of the Chinese Nation with deep gratitude.

This guiding principle of science and technology as a universal good for all humanity is the overwhelming thesis of the entire museum. Entering the exhibit, the visitor steps into a world of functioning ancient technology, where they can operate the machines themselves, and watch artisans at work. The great inventions occupy the center of the exhibit. Following the interactive-pedagogy into the digital age, this exhibit is full of interactive computer displays, where visitors can page through the ancient textual sources documenting early use of the inventions; “mix” her own virtual gunpowder; set movable blocks to make a woodblock print; and interact with a real “south pointing cart,” a mechanical compass from the third century CE. Elsewhere in the hall, museum attendants regularly demonstrate traditional papermaking and woodblock printing. Located on the ground floor, the exhibit serves as the literal and metaphorical foundation upon which sits the wonders of modern science displayed in the upper floors of the museum.

## **The Return of the “Needham Question”**

While *China: 7000 Years of Discovery* had focused entirely on immersing the audience in a legacy of Chinese success in science and technology, buried in the exhibit’s catalog was a great inventions narrative of failure – the “Needham Question.” On the very last page appeared a short essay by Joseph Needham himself, “Rivers of Science,” which he wrote specially for the catalog. The essay was an awkward fit. Needham was the preeminent historian of Chinese science and technology and had been a constant friend and defender of the PRC since the 1940s. But his essay focused on his “grand question,” bearing little connection to the exhibit:

The mainsprings of our own endeavor [to research the history of Chinese science] arose starkly presenting itself when younger Chinese colleagues came to work for their doctorates in Cambridge in 1937 – why had modern science developed in Europe alone? [Furthermore,] why had China been more effective for the previous fourteen centuries in acquiring knowledge of Nature and using it for human

benefit than the Europeans? This is the sort of problem which will be raised in the minds of thinking people who visit this exhibition.<sup>53</sup>

This is the question that had inspired Needham to study China. The title of his series, *Science and Civilization in China* (SCC) pointed to Needham's attempt to investigate the cultural, political, and social forces that enabled or retarded scientific progress in imperial China. The "Needham Question" spurred a massive project to construct a record of the Chinese history of science on a scale that has not been attempted for any other civilization. *China: 7,000 Years of Discovery* probably would not have been possible without Needham's findings. However, the exhibit had not adopted the "Needham Question," with its constant comparative reference to the West, into its narrative. By the 1980s, even Needham had moved on, offering a brief answer to it in this essay that was decidedly tentative (and revealing of his antipathy to capitalism):

It remains a fact, however unpalatable, that the rise of modern science in the West was part of the process which included the rise of capitalism and the Protestant Reformation. None of the phenomena happened in China at all, and one therefore cannot help wondering whether there was not some intimate connection between them. It seems that the rising merchants of the European city-states were able to do what the bureaucrats of the Confucian party never could do, namely bring together the intellectual disciplines of mathematics and the study of Nature. This is something to be pondered on. But equally worthy of consideration is the favourable role of the Confucian bureaucracy in earlier centuries; indeed one may say that the bureaucratic feudalism of China began by being extremely favourable to scientific development and ended by inhibiting it. No doubt as we go further on, we shall learn more – *qui vivra verra* [time will tell]! But at any rate, these thoughts are worthy of being pondered by those who visit this exhibition.

Needham had worked this answer out over the preceding decades, laying it out in the most detail in his 1969 collection of essays and lectures *The Grand Titration* (1969). And yet, as he

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<sup>53</sup> Joseph Needham, "Rivers of Science," in *China: 7000 Years of Discovery* (Toronto: Ontario Science Centre, 1982).

continued to publish new volumes of *SCC*, he let the “Needham Question” fade to the background. As his critics have pointed out, no matter what elements may have led to the rise of modern science in Europe, it does not follow that the lack of those elements in China could explain why modern science did not develop there. In fact, they argued, asking why China did not develop modern science was impossible to answer – much more useful would be to discover what *did* happen in China’s past.<sup>54</sup> And this is exactly the tact that *China: 7000 Years of Discovery* had taken, presenting a rich history of success in science and technology that left audiences walking away with a renewed respect for Chinese ingenuity. Like Needham’s ever-expanding *SCC* series itself, the exhibit turned away from the “Needham Question,” and instead brought to life an encyclopedia of ancient Chinese science and technology.

As Chinese historians of science reemerged in the 1980s, these two legacies of Needham – a glorious record of ancient achievement in science and technology, and the “Needham Question” – took on divergent intellectual and political lives. The first was embraced by state institutions like the CAST and the Chinese Museum of Science and Technology. This narrative neatly fit the emerging trend in the Reform Era to celebrate the imperial past as a source of national identity. Needham’s progressive, teleological history also played directly into a narrative that supported the relentless modernization policy of the Reform Era. In this narrative, the great inventions were used to show how mastering science and technology had made China a

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<sup>54</sup> The most comprehensive critique of the Needham Question can be found in Nathan Sivin, “Why the Scientific Revolution did not take place in China – or didn’t it?” *Chinese Science* 5 (1982): 45-66 [2005 update]. See Chapter 3 of this dissertation for discussion of Needham.

strong country in the past. The second narrative emerged from leftist intellectual discussions of the “Needham Question,” which these historians saw as synonymous with the problem of China’s present “backwardness.”<sup>55</sup> These scholars adopted Needham’s comparative macro-historical approach, attempting to identify the political, social, and cultural elements that might retard or speed up the development of science. Two scholars in particular emerged from these debates to national attention – Jin Guantao and Liu Qingfeng – when their theory that China’s “ultra-stable” authoritarian system had held back its modernization was included in the famous 1988 CCTV documentary mini-series, *River Elegy*. Both of these groups claimed Needham as their intellectual forefather. The former would become canon in Reform Era China. The latter would disintegrate in the disaster of the 1989 June Fourth Incident.

While older, more established historians working within the CAST had embraced the revivalist aspect of Needham’s legacy, a smaller group of younger leftist historians working within and outside of state institutions embraced his second legacy of the “Needham Question.” This group of scholars emerged within the gradually opening public sphere of the Reform Era, finding an outlet in the *Journal of Dialectics of Nature* (hereafter *JDN*). After the 1978 National Science Conference, *JDN* was brought under the new leadership of Li Baoheng and Fan Dainian

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<sup>55</sup> Liu Dun, “A New Survey of the ‘Needham Question’” *Studies in the History of the Natural Sciences* 19(4) (2000): 293-305.

(范岱年), liberal establishment intellectuals.<sup>56</sup> The journal would play a seminal role in sparking debate on Chinese traditional culture in the 1980s.

Early articles in the *JDN* showed how scholarship on the “Needham Question” became the grounds for anti-authoritarian, pro-democratic arguments, such as two early influential articles by Yu Guangyuan and Xu Liangying. Yu’s “On the Emancipation of the Mind” (1981) was a reaction to Hu Yaobang’s (General Secretary of the CCP 1981-1987) “Emancipating the Mind Movement” (*sixiang jiefang yundong*), which had launched in 1978 to attack the legitimacy of Maoism and open the ideological gates for Deng and his reform-minded allies to take control of the Party. Yu declared the Cultural Revolution a “calamity” producing “ideological rigidity” that took a heavy toll on intellectuals.<sup>57</sup> Reviving the symbols of the 1919 May Fourth Movement, Yu renamed them for the new era “Comrade Democracy and Comrade Science.” He wrote:

Science and democracy are closely related. Political democracy insures the emancipation of the mind and the elimination of obstacles. Ideological questions cannot be decided by majority rule. Academic thinking needs freedom, the freedom that political democracy guarantees academic research.

To advocate the emancipation of the mind is to advocate adherence to truth, and truth is scientific understanding. To obey truth is also to obey science. To promote the search for truth is really to advocate engaging in scientific research. It is not possible to ‘overdo’ scientific research. Just as democracy cannot be confused with anarchism, so the emancipation of the mind can never be lumped together

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<sup>56</sup> Edward X. Gu, “Cultural Intellectuals and the Politics of the Cultural Public Space in Communist China (1979-1989): A Case Study of Three Intellectual Groups,” *The Journal of Asian Studies* 58(2) (1999): 389-431. (accessed March 3, 2020)

<sup>57</sup> *Ibid.*, 392.

with wild flights of fancy. One cannot ‘overdo’ democracy; similarly one cannot ‘overdo’ the emancipation of the mind.<sup>58</sup>

Yu’s article became a mission statement for the group of intellectuals organizing around the *JDN*, who embraced the belief that the scientist had been liberated under Deng Xiaoping, and would take the vanguard of national progress. In some ways, Yu here was merely echoing Deng’s own arguments, that scientific progress depended on intellectual independence from politics, and that Mao era demands to not “overdo” scientific research by balancing it with political education and adherence to the unquestionable “truth” of Party ideology was absurd. This point was illustrated in many articles appearing in *JDN* in this period on Trofim Lysenko, who gained Stalin’s support in the 1930s to discredit the science of heredity, leading to a deadly purge of genetic scientists and the crippling of Soviet biology and agricultural science for decades. However, when Yu called for political democracy and an obedience to truth that bent to no master, he was stepping into uncharted territory. For Deng, the restoration of the intellectual sphere was in service to the Four Modernizations, a policy that would strengthen the state with the Chinese Communist Party in command. The kind of democracy Yu pointed to here, which declared an obedience to “truth” and “science,” made no room for an overriding loyalty to the Party-state, but rather envisioned an enlarged role for intellectuals in the nation.

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<sup>58</sup> Yu Guangyuan, “On the Emancipation of the Mind,” in *Chinese Studies in the History and Philosophy of Science and Technology*, ed. Fan Dainian and Robert S. Cohen, translated by Kathleen Dugan and Jiang Mingshan (Dordrecht; Boston: Kluwer Academic Publishers, 1996), 2. Originally published in *Journal of Dialectics of Nature* 3 (1981), 1-2.

Xu Liangying advanced a similar argument in his essay published in the *JDN* also in 1981, “The Role of Science and Democracy in Society.”<sup>59</sup> Xu called science a “Revolutionary force that serves to push history forward,” and a “harbinger of ideological emancipation.” He echoed the Deng’s developmentalist ideology, writing that science was “a crucial factor in deciding the future historical development of mankind and the rise or fall of modern nations.” However, he went a big step beyond Deng with the next part of his argument, that “political democracy and academic freedom are necessary to guarantee the flourishing of science.” These ideas tied the ascendancy of scientists to a democratic political movement.

This enthusiasm for the liberation of scientists in Reform Era China was the context behind the rise of the “Needham Question.” In 1982, the *JDN* hosted the “Reasons for the Backwardness of Modern Chinese Science” (*Zhongguo jindai kexue luohou de yuanyin* 中国近代科学落后的原因) Conference on October 16-22, in Chengdu. Fifty papers were submitted and discussed at the conference, some of which were later published in the book *Scientific Traditions and Culture: Reasons for the Backwardness of Modern Chinese Science*.<sup>60</sup> They represented a completely new take on the great inventions narrative that became a scholarly

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<sup>59</sup> Xu Liangying, “The Role of Science and Democracy in Society,” in *Chinese Studies in the History and Philosophy of Science and Technology*, ed. Fan Dainian and Robert S. Cohen, translated by Kathleen Dugan and Jiang Mingshan (Dordrecht; Boston: Kluwer Academic Publishers, 1996): 5-11. Originally published in *Journal of Dialectics of Nature* 1 (1981), 3-6.

<sup>60</sup> Fan Dainian, et al, eds., *Kexue chuantongyu wenhua-Zhongguo jindai kexue luohou de yuanyin* 科学传统与文化: 中国近代科学落后的原因 [Scientific tradition and culture: reasons for the backwardness of modern Chinese science] (Xi'an: Shaanxi Kexue Jishu Chubanshe, 1983).

and public phenomenon in the 1980s. Like Needham, they sought to identify the social, political, and cultural causes that had impeded or blocked outright the development of science and technology in the past, so as to facilitate China's modernization in the present. Some papers addressed the failure of specific sciences to flourish in China, such as "Causes for the Standstill of Mathematics in China after the 14<sup>th</sup> Century" by Guo Jingbing, "On the Causes of Backwardness of China's Agricultural Science and Technology in Modern Times" by Zou Dexiu, and "On Causes for the Lagging-Behind of China's Metallurgical Technology in Modern Times" by Qiu Lianghui. Other scholars attempted broader answers to the Needham Question, such as in the essays "Why did Modern Science not Emerge in China" by Lin Wenzhao, or "Inquiry into the Causes of Backwardness of Science and Technology in Modern Chinese History" by Dai Nianzu.

The most prominent voices to emerge from this collection were the historians of science Jin Guantao and his wife Liu Qingfeng, who along with Fan Hongye coauthored "The Structure of Science and Technology in History: The Factors Delaying the Development of Science and Technology in China in Comparison with the West since the 17<sup>th</sup> century."<sup>61</sup> It introduced a novel approach to the type of comparative macro-history of Chinese and Western history of science that Needham had pioneered, drawing on social and natural sciences, statistical analysis,

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<sup>61</sup> Jin Guantao, Liu Qingfeng, Fan Hongye, "The Structure of Science and Technology in History: The Factors Delaying the Development of Science and Technology in China in Comparison with the West since the 17<sup>th</sup> century," in *Chinese Studies in the History and Philosophy of Science and Technology*, ed. Fan Dainian and Robert S. Cohen, translated by Kathleen Dugan and Jiang Mingshan (Dordrecht; Boston: Kluwer Academic Publishers, 1996), 137-183.

and cybernetics. It was only the seed of a larger manuscript the couple had already completed for *Ascendancy and Crisis: On the Ultra-stable Structure of Chinese Feudal Society* (1984).

The most novel aspect of the article was a statistical analysis of the scientific and technological achievements of China and the West over two thousand years. This was inspired by the very tentative graph that Joseph Needham himself had sketched out (fig. 1) “very cautiously” comparing scientific and technological development in China and the West. Jin, Liu and Fan put real numbers behind this sketch, transforming it into a statistical plotting scientific and technological achievement. They explained their methodology thus:

First, we statistically analyzed almost 2,000 scientific and technological achievements over the 2500 years from the sixth century B.C. to the end of the nineteenth century, dividing them into three categories: scientific theory, scientific experiment and technology. Based on the position of each achievement within the discipline and the degree of its social impact, we assigned it a score and constructed cumulative curves of the level of Chinese and Western science and technology. Second, we used different time scales to calculate the net increase (absolute increase) of scientific and technological achievements in China and the West during different historical periods.<sup>62</sup>

Setting aside their methodology, these graphs supported the commonly accepted narrative of slow scientific and technological progress in China, compared to a rise, sharp decline, and rapid rise in the West. According to this narrative, during the golden age of Ancient Greece, the West enjoyed parity with China before plunging into the Dark Ages. During the twelfth to fifteenth centuries, translations and a literary Renaissance lay the groundwork for the advent of modern

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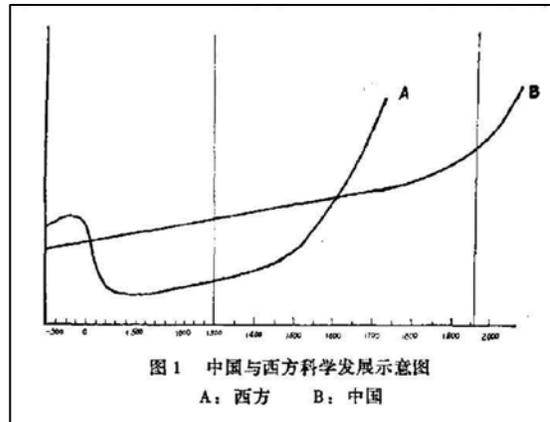
<sup>62</sup> Jin Guantao, et. al., “The Structure of Science and Technology in History...,” 137.

science and rapid growth from the 16<sup>th</sup> century. Meanwhile, China was characterized by slow and steady growth until adopting modern science in the 19<sup>th</sup> century.

What set Jin Guantao and Liu Qingfeng apart, however, was their argument that the long, slowly rising curve of Chinese history was the sign of a strong and unified nation, but an “ultra-stability” that that was the source of China’s backwardness, even still in the 1980s. Remarkably, they accepted the notion shared by their more established colleagues who had curated the *China: 7000 Years of Discovery* exhibit, that China had been a culturally cohesive civilization that had lasted without interruption for millennia. However, rather than see this as China’s strength, they saw it as leading China down a weaker developmental path in science and technology. Breaking these curves into scientific theory, experiment and technology, the authors concluded that in the West, theory led the way, while China was most successful in technology. This had long been observed by Westerners, who in the Enlightenment distinguished the lower technological discoveries of unknown artisans or foreigners from the ultimately more valuable theoretical knowledge of philosophers. But here, these authors made a further insight into the impetus for Chinese technology – it empowered a centralized state, retarding the development of science and the potential for the joining of theory, experiment, and technology that produced modern science in the West. They focused on the four great inventions in particular as “technologies of unification”:

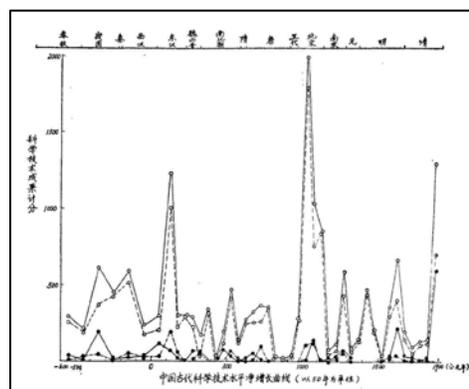
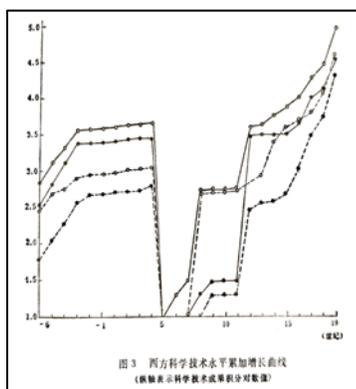
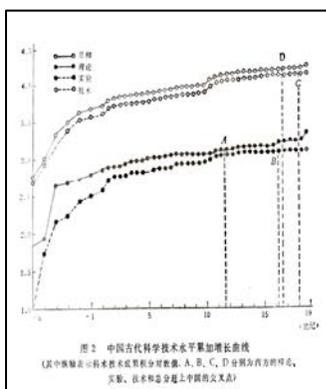
It is well known that the four great inventions (the compass, paper making, gunpowder, and printing) were great technological achievements, presented to the world by the Chinese people, which changed the history of mankind. Here we want to emphasize that these treasures, shining with Chinese wisdom, not only represent the level and the highest achievements of our ancient science and technology but also display important features of Chinese science and technology and its intrinsic relationship with the social structure of antiquity.

First, the four great inventions are crystals which gradually formed within the developed technological system of ancient China. They reflect the characteristics



**Left:** “Reasons for the Backwardness of Modern Chinese Science” Conference attendees, Chengdu, October 1982.

**Right:** Overall development of science and technology in China and the West.



**Left:** Cumulative growth curve for ancient Chinese science and technology (A, B, C, D mark the point on each curve where the West caught up with Chinese achievements), separated by sum-total (the highest line), technology (the second highest, representing 80% of all achievements), scientific theory (13%), and experimental science (7%).

**Middle:** Cumulative growth curve for Western science and technology, separated by the sum-total (the highest line), theory (the second highest line), technology and experiment. Development is initially on par with China’s during the rise of Ancient Greece, rapidly declines during the Dark Ages, but beginning in the thirteenth and fourteenth centuries, theory and technology begins to climb up, followed by experiment in the sixteenth, and an overall acceleration in the eighteenth century.

**Right:** Net growth curve of Chinese science and technology from the 6<sup>th</sup> century BC to 1900, separated by dynasty. The pinnacle of growth is during the Northern Song Dynasty in the 11<sup>th</sup> – 12<sup>th</sup> centuries, when movable type was invented, and gunpowder weaponry became widely used. To create the Y values for this curve, the authors assigned a score to each discovery.

of Chinese civilization which lasted for several thousand years without interruption....

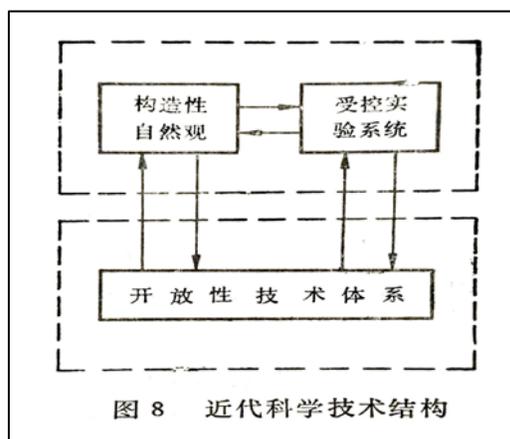
These inventions obviously differed from those demanded by the agriculture and handicraft industries which directly satisfied the need for food, clothing and housing. They served the society by helping to form powerful, unified national organizations extending over large areas. Needless to say, paper, the compass, and printing function as means of social communications (transportation). Although gunpowder came from alchemy, it became a technology after the Tang dynasty mainly because of the need to unify the country. ...The four great inventions together indicate the degree of development of ancient Chinese science and technology are closely related to the unified organization of Chinese feudal society. We know that continental Europe was broken into hundreds, even thousands, of small parts during the Middle Ages. These economic and cultural units were very loosely connected and relatively independent. In sharp contrast, in Chinese feudal society, ever since Qin Shihuang unified China, the prevailing form of social control, close internal communication within the economy and commerce, and a unified culture and beliefs, all required developed communication technology (means of transportation, cultural communication and dissemination), powerful military strength, a calendar ...etc. We call these 'technologies of unification.'<sup>63</sup>

This was a dramatic reinterpretation of the great inventions narrative. As the authors delivered this very paper in Chengdu, their colleagues in Toronto were boasting of China's *7000 Years of Discovery*, not 7000 years of intellectual oppression and inertia. Jin, Liu and Fan echoed Mao Yisheng, the Vice-Chairman of CAST, in writing that the great inventions had "served the society by helping to form powerful, unified national organizations extending over large areas." But they tapped into an anti-authoritarian narrative in raising the specter of Qin Shihuang, the leader who was as famous for unifying China as he was for his tyrannical, Legalist style of rule, symbolized by his "burning of books and burying of scholars." This was exact opposite of previous associations of printing, paper, gunpowder, and the compass with exploration and the

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<sup>63</sup> Jin Guantao, et. al., "The Structure of Science and Technology in History...", 143-144.

flourishing of culture, and the European Enlightenment. In China, Jin, Feng and Hong argued, they had been the crystallization of a millennia-old feudal authoritarian system. Jumping from this argument, they presented a new graph of Chinese technology that separated technologies of agriculture, ‘unification technology,’ handicraft industry, medicine and other. More than 30% were ‘unification technologies,’ the largest by far. Setting this against the backdrop of dynastic change, they concluded that “the development of ancient Chinese technology was entirely determined by the unified social organization.”



Jin Guantao, Liu Qingfeng and Fan Hongye’s diagram of “The structure of modern science and technology”:

**Upper left box:** “The structural view of nature”

**Upper right box:** “Controlled experiment”

**Lower box:** “An open technological system”

Much like Needham, the authors identified the factors that had enabled modern science to bloom in Europe, and judged ancient China to have lacked the features. They argued that a virtuous feedback loop between theory, experiment, and technology had enabled the development of modern science in Europe (pictured above). The first feature was a “structural view of nature” – meaning that theories form a cohesive, logical model of nature that is falsifiable and predictable. The emergence of such a structure during the Renaissance allowed Europeans to apply theories in one area to another, such as applying the laws of mechanics to both the movements of apples and wooden balls to the movement of planets. In China, a “Confucian model of cognition” caused thinkers to use personal experience to make rational

inductions, but rarely expanded these observations into larger theories of nature that could be tested and applied elsewhere. The second feature was “controlled experiment,” which emerged in 16<sup>th</sup> century Europe with Galileo. In Europe, experimentation emerged “almost entirely as a result of cooperation between craftsmen and scholars.” While the craftsmen contributed their technological instruments that could control and measure nature, scholars could apply their findings to a larger cohesive theory of the natural world. In China, the authors bemoan, “there was always an impenetrable, high wall between ancient Chinese scholars and craftsmen” because of the “traditional Confucian view that ‘the learned do not engage in crafts.’” Moreover, the feudal state was governed by landlord intellectuals whose energies were devoted to bureaucratic administration and moral self-improvement, a system in which investigation of the natural world was of little professional value. Third was “an open technological system,” meaning that “technology is dissociated from the hands of the individuals who control it and from the concrete product (purpose) for which it was produced.” In Europe, the twin dynamics of capitalism and an emerging structured view of nature enabled this open system. Only after a structural view of nature and the practice of controlled experimentation had matured by the eighteenth century did a fully open technological system emerge, and technological development begin to rapidly accelerate. In ancient China technology developed to unparalleled degrees within certain industries, but “no matter how superb the technology, its relationship with the social structure prevented the formation of an open technological system.” For instance, Chinese porcelain making was the most advanced in the world, but this process was made a closely guarded state monopoly, only handed down from one generation of craftsmen to the next. The result was that these methods were never applied to other industries, such as glassmaking, nor were porcelain making techniques ever integrated into a larger theory of nature. At every-step in this cycle, the

authors showed how the grip of traditional Confucian civilization had blocked China's potential to develop modern science.

This totally upended the mainstream narrative of the great inventions embraced by most historians in the PRC, who saw them as a credit to the ingenuity and strength of Chinese civilization. According to Jin, Liu and Fan these "great contributions" had served to stifle the development of science, rather than promote it. The great inventions narrative had always relied on a historical record of their use in the West, where they were associated with the birth of the modern age, and the rise of Europe to global hegemony. Chinese authors who saw the inventions as a source of national pride relied on this narrative also, allowing them to claim significance for technologies like movable type, which had little impact in China itself but transformed Europe. Needham has always seen China as having failed to develop modern science *despite* their incredible early lead in technology. The reason for this seeming contradiction was the essence of the "Needham Question." But here, the authors showed how step by step, China had failed to develop the conditions for modern science that Europe established, it was thwarted by traditional Confucian culture enforced through an all-powerful state. The great inventions were the very tools by which scientific progress was impeded, themselves the answer to the "Needham Question." The implications for China's present modernization were that merely possessing advanced technology was not enough for Chinese science and technology to flourish. "History shows," they concluded, "that advanced technology and theories which emphasize technology cannot alone guarantee the development of science and technology. The important question is

how a rational structure of science and technology can be established and how such a structure can continually be adjusted so it is suitably and rationally related to the social structure.”<sup>64</sup>

In fact, Jin Guantao had a clear vision of the type of changes necessary for Chinese science to flourish. He harbored a grand ambition to launch a full-blown Chinese enlightenment movement, defined by the values of democracy, reason, and liberty.<sup>65</sup> To achieve this, Jin Guantao and Liu Qingfeng eagerly sought opportunities to engage in the public sphere, and gain an audience for their ideas outside of elite intellectual circles in Beijing. To this end, they contributed to the popular TV miniseries *River Elegy* in 1988, which made their great inventions narrative a pop-culture phenomenon. By 1988, the question of China’s failure to modernize resonated with audiences, as many of the early reform efforts failed to materialize ten years into Deng Xiaoping’s leadership. Written by Su Xiaokong and with input by Jin, Liu, and their colleagues, the series explored Chinese history over six episodes in June 1988. The series spliced together old footage from newscasts and historical films, as well as contemporary interviews with historians (including Jin and Liu), overlaid with narration and music. Like the “Needham Question” debate, it meditated on China’s failure to modernize as the West had, and advanced a bold and controversial argument – that the dying Chinese traditional culture could no longer survive, and must be replaced by a new civilization through the process of modernization and Westernization. It returned to images of the dragon, the great wall, and the Yellow River as

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<sup>64</sup> Jin Guantao, et. al., “The Structure of Science and Technology in History...,” 163.

<sup>65</sup> Gu, “Cultural Intellectuals...” 397.

symbols of a decay, compared with the blue ocean of Western enlightenment and freedom. The depiction of China as a great civilization with an ancient culture, the show argued, was a sham. The show also adapted the narrative of the great inventions as representative of China's failure to modernize, its historic backwardness – a theme that by this point, also had become a critique of the ineffectiveness of Reform Era policies.

The great inventions were the focus of the third episode of the series, whose title “The Light of the Spirit” (*lingguang* 灵光), connoted the idea of divine inspiration, of spiritual and cultural enlightenment. The episode began with footage of the American moon landing, overlaid by this narration:

Humanity has entered the space age. The group of astronauts who first landed on the moon are probably the proudest leaders of this era. However, they are all Caucasian....

How did the light of Chinese civilization, which had been ahead for a thousand years, fade away after the 17<sup>th</sup> century? Why did such an intelligent nation become sluggish and senile? What did we possess yesterday, that until today discover that we lost, what exactly is it?

Here the narrator introduces the idea of China's “falling behind” the West in science and technology. It exactly adopts the narrative of Needham, that China excelled in science and technology until the 17<sup>th</sup> century when the West created modern science and China fell behind.

As the narrator recounts the past success of Chinese culture and knowledge, he brings up the great inventions:

Humanity's first use of explosives was on the Central Plains where the Song and Jin battled. At the latest around the year 1000AD, the Chinese were able to use crossbow guns to launch “exploding medicine,” but they never imagined that the same Chinese people, 800 years later would be defeated by foreign guns.

This sense of painful irony here is the main theme of the entire series, that Chinese culture had declined from incredible heights to be overtaken by the West. The narrator continues:

[Papermaking, movable type, the compass and gunpowder] all passed from China to the dark Europe of the Middle Ages, where the earth shattered. The great inventions of the Chinese nation made European feudal society reach the highest peak in technological development since Ancient Greece. However, the four great inventions in their hometown were fated to be of no use.

We Chinese who first ignited gunpowder failed to be the first to fly to the stars. We possessed paper and printing, but had no explosion of knowledge for 1000 years. We knew of the magnetic declination of the compass since the 11th century, yet China has never been a maritime power, and the Western powers used the compass to reach our doorstep. What kind of powerful trick is this on the Chinese people?



Stills from *River Elegy*

This narration overlays footage of Western versus Chinese use of paper. In the West, businessmen use paper in conjunction with modern computers. Meanwhile in China, paper is used to print old books that collect dust in the archives – what the narrator refers to as “books, words, and old piles of paper.” This was exactly the critical view of the Chinese past that had been embraced by New Culture intellectuals in the early twentieth century. In fact, Lu Xun had made almost the same remark about the inventions in 1937, lamenting that the Chinese had only

used them for fireworks and feng shui.<sup>66</sup> Like those New Culture intellectuals, the creators of *River Elegy* also argued that adopting the Western liberal tradition was necessary to solve China's problems. As the episode continued, the narrator compared the invaluable great inventions that the West took from China, to the meaningless luxury goods that Chinese took from the West, such as the Western-Style Palaces in the Old Summer Palace in Beijing. He asks, "China's science and technology, and cultural divine light helped the West create a new era of history. Why is the light of culture and science from other places only faintly discernable in China?"

Liu Qingfeng also makes an appearance, summarizing the argument advanced in her earlier work with Jin Guantao:

The ancient Chinese science and technology were developed, but in fact it was mainly technology that was developed. The four great inventions are all technological inventions, and they are not ordinary technologies. They are related to national unification, and are compatible with the feudal landlord economy, such as communications, water conservancy, and military affairs, etc. It puts shackles on ancient Chinese science, it is very hard to achieve a transformation.

*River Elegy* suddenly shifted this critical great inventions narrative from academia to the mainstream. Zhao Ziyang, then the Premier of the CCP, loved the series, and ensured its rebroadcast on CCTV in August, 1988. However, it enraged other party leaders like Vice State President, Wang Zhen, who saw it as insulting to the Chinese nation, and naïve about the character of the "bandit" West.

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<sup>66</sup> See Chapter 2 of this dissertation for a detailed discussion of this period.

In 1989, Jin and Liu got involved in more direct political activism when they signed on to a petition by Fang Lizhi asking Deng Xiaoping to pardon Wei Jingsheng and other political prisoners who had protested for political reform. Fang Lizhi gained attention when he wrote a call for democracy in China in January 17, 1989, that was an important step in the fomenting of what became the Tiananmen Square Democracy Movement.<sup>67</sup> declared the last forty years of the CCP's leadership a failure, that was "attributable to the social system itself. This is why," Fang wrote, "in China today the pursuit of modernization has replaced faith in [socialist] ideology." Fang applauded the reintroduction of the May Fourth Movement slogans of "science and democracy," but criticized the government for failing to enact political reforms, disrespecting human rights, and holding in contempt "even a basic right such as the right to knowledge, which has little political impact... What we have now is not a democracy but a dictatorship." The same month, Fang wrote a letter to Deng Xiaoping, requesting the release of Wei Jinsheng, a political prisoner, noting that 1989 was not only the fortieth anniversary of the founding of the PRC, but also the 200<sup>th</sup> anniversary of the French Revolution. "Liberty, Equality, and Fraternity thereby is now generally respected by mankind in every sense," he noted. Many of Fang's views aligned with critiques that Jin and Liu had made. However, after they (along with the director of *River Elegy* Su Xiaokong) signed onto his letter on February 16, 1989, they were unprepared for the

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<sup>67</sup> Fang Lizhi, "China Needs Democracy," *Liberacion* (Paris) (January 17, 1989): 5. Reproduced in *Beijing Spring, 1989: Confrontation and Conflict – The Basic Documents*, ed. in Michel Oksenberg et al. (M.E. Sharpe, Inc. 1990), 163-166.

trouble it caused them.<sup>68</sup> They both went to the United Front Department of the CCP to try to explain themselves, and avoid the wrath of the CCP. However, for the attempt they were perceived as traitors by Beijing intellectuals. They were mere onlookers to the Tiananmen Square protests that quickly unfolded in Beijing, ending with the June 4 massacre. Nonetheless, they were attacked by the CCP for inciting antigovernment sentiment during the movement. As a result, they fled to Hong Kong where they reside to this day.<sup>69</sup>

## Conclusion

Deng Xiaoping's 1978 speech at the National Science Conference inaugurated a new era for science and the history of science – but this was an opening that led to many different possibilities. As historians of science sought a place for themselves in the Reform Era, two politically divergent groups latched on to the great inventions narrative to stake out their own territory in the shifting intellectual sphere. Established historians working at the highest positions within state institutions embraced a revivalist great inventions narrative. In this narrative, the inventions symbolized a glorious past that proved the ingenuity of the Chinese people and Chinese civilization, and their ability to make China a technological superpower again. As Deng Xiaoping and his supporters ushered out Maoist, socialist ideology, this revivalist great inventions narrative provided a new center of national identity that complimented the economic

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<sup>68</sup> “Open Letter to the Party and Government from Thirty-three Famous Chinese Intellectuals,” *News from Asia Watch* (March 15, 1989). Reproduced in *Beijing Spring, 1989: Confrontation and Conflict – The Basic Documents*, ed. in Michel Oksenberg et al. (M.E. Sharpe, Inc. 1990), 167-168.

<sup>69</sup> Gu, “Cultural Intellectuals...”

ideology of modernization. In this way, the revivalist narrative was a throwback to an earlier narrative embraced by the KMT government beginning in the 1920s, as a source of ethno-nationalist pride. These historians also used this narrative as a new form of cultural diplomacy. Adopting methods of historical and scientific curation from the West, they produced a travelling museum exhibit introducing in an edutainment genre that was a hit with Americans, and was imported back to the PRC where it meshed well with the culture of commercialism and patriotism of the Reform Era.

A second group of less-established historians created an anti-authoritarian great inventions narrative, as the basis for a Chinese enlightenment. This view also echoed the past, sounding much like critiques by New Culture intellectuals, who saw the inventions as representative of China's failure to capitalize on their early possession of technologies that had allowed Europeans to colonize the entire world. As in that earlier period, intellectuals like Jin Guantao and Liu Qingfeng used this narrative to support a critique of traditional Confucian culture, and advocate for Chinese adoption of Western, Enlightenment values. This narrative spread from academia into mainstream discussion with the TV mini-series *River Elegy*. Ultimately it was squashed when this series and its creators became associated with the Tiananmen Square Democracy Movement in 1989.

However, these two great inventions narratives contained their own contradictions.

For the second, the idea that the great inventions were "tools of unification" is not a closed case. Indeed, historians of the West have seen them as the exact opposite. Once they began with the premise of Chinese unification being an impediment to science, they too easily decided that technology must have been a cause. It is within the very nature of technologies of

communication and military force that they can be used to serve authoritarianism and democracy. The first narrative, which attempted to preserve the ancient past as a record of Chinese success that, besides the minor hiccup of the “century of humiliation,” could segue into China’s modern rise, is even more absurd, requiring a total blindness to the fact China has not mastered modern science by simply looking inward toward her own traditions.

Ultimately, only one of these narratives could survive after 1989. In response to the Tiananmen Incident, the CCP reinstated patriotic education to a new degree. More than ever before under Mao, the ancient past was glorified as the wellspring of a cohesive national identity that Chinese should rally around. Because of this, the revivalist great inventions narrative represented in *China: 7000 Years of Discovery* would thrive in the Reform Era. By rolling back the Cultural Revolution and dramatically curtailing communism as the core of national ideology, a shared national history became all the more important to the Party-state. Furthermore, by the late 1970s, Americans in Washington, Wall Street, and the public at large were ready to move beyond Cold War animosities and accept this new image of China. For Washington, the new narrative marked a turn away from the geopolitics of revolution, and a conformity to a world system in which a “global village” of nation-states co-existed in a world order dominated by the West. American capital was even more eager to usher in the new era, as it would allow them to take part in and profit from China’s modernization, and a long-held dream to plant their flag in China’s enormous marketplace. Historians at CAST also learned how to please the foreign public, by using curatorial methods pioneered in the US and Canada to make Chinese culture intriguing, non-threatening, and fun. In this context, Needham without the “Needham Question” was supremely useful to powerholders in China and the West.

## Conclusion / Epilogue

The narrative of the great inventions was created by Enlightenment philosophers to illustrate their assertion that science and technology were the key to human progress and happiness. In the four hundred years since Francis Bacon immortalized printing, gunpowder, and the compass in the *Novum Organum* as having “changed the face and condition of things all over the globe,” this argument has proved wildly convincing. But as European empires used their superior artillery to force their way to global dominance, Asian observers drew a different conclusion: technology was the key to wealth and power, and national survival. Over the course of the late eighteenth, nineteenth and twentieth centuries, discussions around the development of technology became intimately tied to the issue of East-West relations, and what place China might take in the global capitalist order of nation-states. This dissertation has shown how intimately these two issues have been intertwined over the last four centuries, and the many subjects who have been involved in shaping the discussion, both in China and the West.

So long as the belief in the power of science and technology remains prevalent, the history of the great inventions will maintain its allure – as well as its inevitable controversies. Today, the great inventions narrative is more relevant than ever to leaders in Washington and Beijing, who both use their history to shape how domestic and global audiences understand China’s rise as a technological superpower.

In China, cultural, academic, and political elites have invested heavily in the narrative of the great inventions as cultural heritage, supposedly revealing the peaceful nature of China’s technological power. As Chapter 5 of this dissertation argues, this turn in the narrative was the product of the combined efforts of actors in the United States, Canada, and the PRC. As the

Deng Xiaoping administration pursued international cultural diplomacy as part of an overall policy of Reform and Opening to the West, political elites, academics, and corporate interests on both sides popularized the idea that China's rise would be good for everyone.

Over the nineteen-nineties and first decade of the twenty-first century, Beijing frequently leaned on the four great inventions narrative to increase what it saw as China's "soft power" abroad, thus framing an ever-more ambitious policy of technological and industrial growth in benign terms.<sup>1</sup> The most spectacular example of this was the inclusion of four great inventions in the Opening Ceremony of the 2008 Beijing Olympics Opening Ceremony. Directed by Zhang Yimou, the ceremony began with a massive display of fireworks representing gunpowder. In the iconic Bird's Nest Stadium, a giant digital scroll unveiled as a centerpiece of the entire performance, representing the invention of paper. Later, a long segment features an undulating set of printing blocks, spelling out the character *he* (和), meaning "harmony," a key slogan that the Hu Jintao administration adopted from Confucianism in order to express the CCP's ideal to construct a "harmonious society" at home and peaceful relations abroad. Finally, the image of an

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<sup>1</sup> The idea of "soft power" was created by the American political scientist Joseph Nye in 1990, meaning a nation's ability to attract, co-opt and persuade through (1) the appeal of a state's values, (2) the legitimacy of its foreign policy, and (3) the attractiveness of its culture. (See Joseph S. Nye, *Bound to Lead: The Changing Nature of American Power* (New York: Basic Books, 1990). I prefer the term "cultural diplomacy," as I argue that Nye's theory has led many to overestimate the power of cultural activity in the balance of international politics, underestimate "hard-power" elements such as military strength, and to downplay the coercive and manipulative role that so-called "soft power" initiatives (such as Confucius Centers) can take. I include the term "soft power" here because Nye's theory heavily influenced Hu Jintao, who inserted it into national policy (translated as *wenhua ruan shili* 文化软实力). At the 17<sup>th</sup> National Congress in 2007, then-President Hu announced that, "The great rejuvenation of the Chinese nation will definitely be accompanied by the thriving of Chinese culture... We must enhance culture as part of the soft power of our country... We will further publicize the fine traditions of Chinese culture and strengthen international cultural exchanges to enhance the influence of Chinese culture worldwide."

ancient compass appeared, along with dancers and ships portraying the Ming Dynasty voyages of Admiral Zheng He, which mirrored China's present-day integration with the world. Viewed by



Images from the 2008 Beijing Olympics Opening Ceremony representing clockwise from top left: Movable-type printing; gunpowder; the south-pointing spoon (an early compass); paper.

millions and perhaps billions of people around the world, the Opening Ceremony was widely deemed a major success, the coronation of China's "coming out party" as a major world power.

In the 2010s, the PRC launched two initiatives that would bring increased relevance to the great inventions narrative. These were the Belt and Road Initiative (originally called One Belt One Road, and dubbed the "New Silk Road" in the press - henceforth BRI, 2013), a transnational development strategy that included the export of infrastructure and technology, and Made in China 2025 (2015), a plan to increase the domestic content of Chinese-produced goods, and to become a world leader in I.T., robotics, green energy, and more. These policies formed the backdrop to the appearance of a twist on the great inventions narrative appearing in 2017 – "China's new four great inventions." The slogan first appeared in a video produced by the Party-run People's Daily in May 2017 overlapping with the BRI Forum held in Beijing. In the video,

foreign students hailing from twenty countries participating in the BRI heralded “China’s new four great inventions” of online shopping, high-speed rail, mobile banking, and bike sharing.<sup>2</sup> Speaking in English and Chinese, they presented these new inventions as modern corollaries to paper, printing, gunpowder, and the compass, that they hoped China could introduce to their home countries. “I will definitely choose Alipay,” said an Egyptian student of the mobile banking app, “because Alipay has brought great convenience to our lives. Now you don’t need to bring your wallet with you when you go out.” Nabina from Nepal said, “I would love to bring the high-speed rail back to Nepal. Because Nepal’s terrain is complex, transportation is inconvenient and unpleasant. For Nepal, high-speed rail is perfect.”

Repeated endlessly in op-eds, online content and political rhetoric, this telling of the great inventions narrative signaled that China had finally arrived as a technological superpower, fulfilling a century of nationalist dreams. Sun Yat-sen, Mao Zedong, and Deng Xiaoping – the most important Chinese leaders of the twentieth century – all used the story of the great inventions as a call to action for the Chinese people to study science, reverse Chinese decline, and make China a technological superpower once again. In deploying the language of developmentalism, this new version of the narrative asserted that China was finally a capable agent of modernization, fulfilling a century-old dream to “make great contributions to the world” in the fields of science and technology. And perhaps most importantly, pulling ahead of the

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<sup>2</sup> Liu Jie 刘杰, “Yidai yilu 20 guo qingnianjie cai, dingyi Zhongguo xin si da faming” 一带一路 20 国青年街采, 定义中国新四大发明 [Youth from 20 One Belt One Road countries define China’s new four great inventions], *Renmin Ribao Kehu Duan* 人民日报客户端, May 9, 2017. [http://app.peopleapp.com/Api/600/DetailApi/shareArticle?type=0&article\\_id=600817](http://app.peopleapp.com/Api/600/DetailApi/shareArticle?type=0&article_id=600817). (accessed July 27, 2020)

West. When Xi Jinping spoke at the Opening Ceremony of the BRI Forum in May 2017, he emphasized the ancient four great inventions as examples of “mutual learning” and “mutual benefit” that would be renewed through the BRI.<sup>3</sup> When the 19<sup>th</sup> CPC National Congress convened a few months later in October 2017, Xi hammered on the theme of scientific and technological innovation, declaring that “Innovation is the primary driving force behind development; it is the strategic underpinning for building a modernized economy.”<sup>4</sup> The language of “catching up with” or “learning from” the West, so prevalent under Mao and Deng, was absent. Instead, Xi declared that “China has become a global leader in innovation.”<sup>5</sup>

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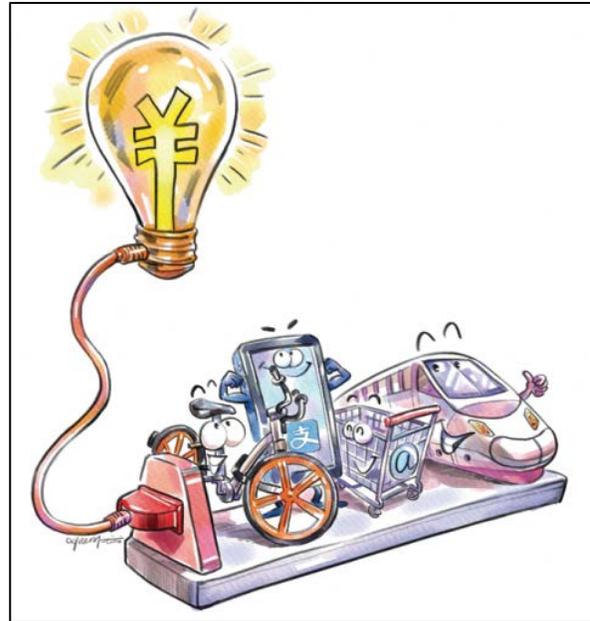
<sup>3</sup> Xi Jinping 习近平, “Work Together to Build the Silk Road Economic Belt and the 21<sup>st</sup> Century Maritime Silk Road” (Speech, Opening Ceremony of the Belt and Road Forum for International Cooperation, May 14, 2017).

<sup>4</sup> Xi Jinping 习近平, “Secure a Decisive Victory in Building a Moderately Prosperous Society In All Respects and Strive for the Great Success of Socialism with Chinese Characteristics for a New Era” (Speech, 19<sup>th</sup> National Congress of the Communist Party of China, Beijing, China, October 18, 2017), 27.

<sup>5</sup> Ibid., 24.

**Left:** Students from Belt and Road Initiative countries sing the praises of Chinese bike share, mobile pay, online shopping, and high-speed rail in a video by *People's Daily*, 2017.

**Right:** Image of the “new four great inventions” from the *China Daily*, 2017.



In the United States, the country that ushered China into the global capitalist system during beginning in the 1970s, enthusiasm for China’s rise has soured dramatically. American corporate interests and consumers were happy to move high-tech supply chains and production to China. But in the last decade, American politicians, NGO’s, and journalists have accused Beijing of advancing unfair trade policies, currency manipulation, cyber espionage, and intellectual property theft on a grand scale. President Donald Trump, with the guidance of fringe economist Peter Navarro, made these grievances the center of a trade war in 2017 that has upended Sino-American relations on every level. While the Trump Administration has focused on these trade issues along with racist attacks and conspiracy theories,<sup>6</sup> a bipartisan chorus has independently emerged portraying China’s rising technological power as constituting “digital

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<sup>6</sup> For instance, Trump’s repeated assertion that global warming is a “Chinese hoax” (asserted by Trump numerous times since 2012), or calling the Covid19 virus the “Chinese virus” and “kung flu” in 2020.

authoritarianism” that poses an “existential threat” to the United States.<sup>7</sup> In telling this narrative, the language of development and modernization is completely replaced by an old Cold War dichotomy of democracy versus authoritarianism. These critics focus particularly on the ways in which China uses its surveillance technologies to fiercely monitor and control its own population. They also see the expansion of Chinese tech companies abroad, a key goal of the BRI, as an expansion of the power of the Chinese Communist Party to coerce and manipulate foreign countries, and threaten a world order that has long benefitted the United States. Seeing China’s appeal to ancient history such as the great inventions as mere propaganda, these critics remain strictly focused on China’s recent actions, which they see as a threat to American values and global supremacy.<sup>8</sup>

The great inventions narrative is never settled. This is because the history of gunpowder, printing, paper, and the compass raise questions that have remained extremely important to human survival in the modern age: How does technology shape our world? How can we utilize it for good? Are inventions the product of humanity’s shared effort, or do they spring from one civilization or nation alone? Should we share our inventions for the good of all, or will humanity be best served by guarding them jealously? What place will a powerful China take in the world?

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<sup>7</sup> Robert Menendez, *The New Big Brother: China and Digital Authoritarianism*, a Democratic Staff Report prepared for the use of the Committee on Foreign Relations, U.S. Senate, July 21, 2020. For a similar criticism by a Republican senator, see Ben Sasse, “The Responsibility to Counter China’s Ambitions Falls to Us,” *The Atlantic*, January 26, 2020.

<sup>8</sup> For an early view of Chinese use of ancient history as propaganda, see John F. Kerry, *Another U.S. Deficit – China and America – Public Diplomacy in the Age of the Internet*, a Minority Staff Report prepared for the use of the Committee on Foreign Relations, U.S. Senate, 112<sup>th</sup> Congress, 1<sup>st</sup> Session, February 15, 2011.

This dissertation has shown how political leaders, philosophers, historians, popular and children's writers have been in constant conversation with each other around these issues, through the narrative of the great inventions. Even at the height of the first Cold War, and now on the precipice of another, we continually turn back to the great inventions to make sense of what technology is, and how it will shape international relations.

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