

The Impact of Early Chinese Thought on Technological Development

Mason Wang*

The University of Chicago

Economic historian Albert Feuerwerker claims that, from 1000 to 1500 A.D., “no comparison of agricultural productivity, industrial skill, commercial complexity, urban wealth, or standard of living (not to mention bureaucratic sophistication and cultural achievement) would place Europe on a par with the Chinese empire” (Fairbank 2). The primacy of pre-Yuan Chinese technology is demonstrated by inventions like silk, porcelain, the clock-escapement, canal locks, printing, gunpowder, paper, the mold-board iron plow, and the stern-post rudder, some of which would only appear in Europe a thousand years later (Fairbank 172). When the governments of Europe and China finally met, China was significantly less advanced than Europe. How did such a dominant society fall behind? On the surface, the answer involves many contingent factors, like population pressure during the Qing dynasty, the preference of creditors to provide profitable short-term loans to farmers instead of risky long-term loans to industry, and a lack of specialization and factory building due to the more efficient production of goods in households. On a deeper level, we can trace many of these contingent factors to weaknesses in Chinese governance, the lack of individual and corporate rights, the corrupt relationship between officials and merchants, and the existence of the educated as the ruling social class instead of profiteers, traders, or merchants. These can be further traced to qualities of Chinese political and cultural practices, like the Confucian disinterest in profit and appraisal of virtuous education, which accounts for the lower social ranking of merchants, or the vertical relationship between ruler and ruled, which explains the lack of individual and corporate legal rights (Fairbank 167-186). Fundamentally, however, these factors can be united by patterns of Chinese thought, which will be the focus of this paper. Specifically, I will discuss three attributes of early Chinese thought that have been present throughout history and explain their impact on the trajectory of Chinese technological development: an obscurantist epistemology and language that stalled the union of science and technology, a cyclic view on history, and long-held beliefs of Chinese superiority. A fourth attribute, the focus on unity and harmony over divergence, is not discussed fully in this paper, but its manifestation in the form of the Imperial examination is discussed as a structural factor cementing other modes of thought.

*masonwang@uchicago.edu

Overall, Chinese scientific thought was hamstrung by a relative lack of causal inquiry, the limited explanatory power and unfalsifiability of correlative cosmology, and the appreciation of obscurity present in Daoism and early Chinese thought. As a starting point, let us discuss Chinese language and the variety of thought that it is conducive to. In English, nouns contain “a kind of substance”. By themselves, nouns have meanings, representing specific things, ideas, or places. In Chinese, words do not always have independent meanings as nouns, adjectives, adverbs, or verbs. Rather, a word’s function is determined by the context of the sentence, the word’s order in the sentence, and the placement of auxiliary words. These auxiliary words connote no independent meaning but are used instead to emphasize word relationships and patterns (Meskill 592-593). This has a variety of practical impacts when it comes to expressing ideas. The English language requires a subject and a predicate, which, according to Meskill, “lends itself to concept of the law of identity, which is the basis for Aristotelian logic” and “gives rise to the philosophical concepts of substance and attribute” (601). In essence, the requirement of subjects and predicates forces us to make judgements about specific objects or ideas. For instance, mathematical proofs can be easily formulated using English, or by using a symbolic language that directly parallels to it and is read aloud in the same way. Subjects become variables or abstract structures, and predicates become judgements made about these subjects, which can be used to create further judgements by utilizing previous knowledge, from which conclusions can be drawn. This forms the basis of causality, scientific thought, and the piecemeal production of knowledge.

In contrast, the Chinese language requires neither subject nor predicate. While sentences in Chinese often contain predicates and subjects, the lack of their requirement can evade questions of causality. Here is a perfect example: a completely valid sentence in Chinese might be “Drop rain”, whose English translation would be, “It rains” (Meskill 602). The English version of this question implicitly raises the question, “what is ‘It’?”, and leads to further inquiry about the causes and origins of natural phenomena. It creates an explanatory vacuum that demands to be filled, by the existence of God or by answering questions in meteorology. The Chinese version seems to hide the cause of the phenomena. The lack of causal questions relates to why the early Chinese “had no creation myth and no creator-lawgiver out of this world, no first cause, not even a Big Bang” (Fairbank 63). Essentially, the Chinese language facilitates a type of relational and pattern-based thinking that is favorable to poetry, correlational logic, and analogical thinking, which can help explain the precocity of Chinese political thought and the abundance of Chinese sociopolitical philosophy (Meskill 603). However, in terms of causal reasoning, Chinese logic “must of course operate with the degree of freedom that is possible within the operational possibilities of the Chinese language itself” (Chao 1). Because of this, restrictions on language limited scientific theorizing.

Instead of analytical logic, early Chinese cosmology relied on analogical logic. Chinese correlative cosmology was based on observing correspondences between things and is characterized by strong numerological habits¹. Cosmologists in the Han dynasty would observe five planets, five directions, five musical tones, five animals, and draw conclusions

about one group of five from observations about another. Correlative cosmology enabled a certain type of scientific thought that resulted in many scientific developments in China, like examinations in acupuncture and astronomy (Fairbank 64-66). However, two aspects of correlative cosmology meant that these fields were perpetually pervaded by mysticism and doubt.

First, is the inherent inability for correspondences to explain all aspects of complex systems. The field of astronomy in particular is one wherein argument by correspondence “could not handle the complex and extremely various phenomena of the heavenly bodies” (Fairbank 66). Such phenomena needed to be reduced to fundamental laws of nature and physics, instead of correspondences to other things in the universe. Instead of rejecting correlative cosmology’s assertion of correspondences, the limited explanatory power of correspondence provided evidence for the humbleness of human understanding, and the inherent inscrutability of the Universe.

Second, is the unfalsifiable nature of correlative cosmology. According to Fairbank, the speculative nature of correlative cosmology meant that it “can be called wrong only because it was not scientifically provable” (65). Such a refutation could not have existed in a society where correlative cosmology was ubiquitous in thinking, and more rigorous alternatives were absent. There would be frequent debates about the correspondences between objects in correlative cosmology. Debates about the specific number of things and the correspondence of the five elements to different dynasties were completely irresolvable. It was a game “any number of philosophers can play” (Fairbank 64). Such unfalsifiability ensured not only that debates could not be resolved, but also that there was no clear method of resolution in the first place. The lack of resoluteness permeated the rest of Chinese thought, relating to the appreciation of contradiction and subjectivism present in Daoism, and the laundry list of unresolved debates in the Zhuang Zi.

The parallels between Daoist ideas and the Chinese language show how early Chinese thought dovetails nicely with the Chinese language. Meskill says the de-emphasis on causality “makes it easy to think of the cosmos as being in a perpetual circular process of transition without postulating an external agency to actuate or control the process,” i.e., Daoism (602). The Chinese language expresses ideas in terms of antonyms, with “rule-chaos” representing “political condition”, or “advance-retreat” for “movement” (Meskill 600). This kind of balance in contradiction is a core tenet of Daoism. The Daoist text Zhuangzi is comprised of stories without resolution, full of contradiction, disagreement, and subjectivism, where confounding questions are posed, and discussions seem to expand on the confounding nature of these questions instead of clarifying them. It demonstrates the Daoist idea that the ultimate nature of reality defied understanding and description, and that our attempts to dissect reality or describe it using language serves to “distort rather than reveal the truth” (Meskill 604). This kind of passive relinquishment does not lead to the kinds of inquiry required for scientific thought.

We can summarize early Chinese and Daoist thought by examining how it is antithetical to the Western Socratic method. The Socratic method constantly begs the question of substance, i.e., “What is X?” (Cohen). The overall structure of the Chinese language, including the lack of independent meaning for nouns and causality, “reflects a lack of interest in substance, the substratum of things” (Meskill 602). Socratic thought delineates between objective thought and opinion, and the elimination of competing hypotheses, while the Zhaungzi values the coexistence of contradictory ideas and subjectivism. Socratic thought mandates requirements for linguistic definitions for the sake of their utilization in analysis, while Daoism distrusts the ability of words to clarify rather than obscure reality (Cohen). Overall, these qualities of thought created unfavorable circumstances for the types of inquiry necessary for scientific thought.

This of course, had negative impacts on technological development. During the Song dynasty, there existed no linkage of scientific thought and technological development, in China and in Europe. There was no link between “between the theoretical scholar and the practical artisan” (Fairbank 3). As the symbiosis between science and technology slowly came to fruition in Europe, advanced technology like the steam-engine for boats and trains, lighting, and healthy water supply systems developed. Without this symbiosis, the primacy of Chinese technology achieved during the Song era could not last.

The roots of China’s cyclic view on history can be seen in Chinese cosmology. The cyclical theory of the Five Phases is described by Fairbank as the “fullest expression” of numerological Chinese thought (Fairbank 64). This is the idea that there is sequential correspondence between the five elements of water, fire, wood, metal, and earth, and the five seasons, directions, colors, sage emperors, etc. This progression “stressed the importance of the phase, color, and so forth to be associated with, and so legitimate, each dynasty” (Fairbank 117). The phases were often used by different dynasties to claim the political mandate. For instance, after the Song claimed their affinity to Fire, the Jin rulers claimed their affinity to Earth to qualify their succession. The use of the Five Phases theory to justify political authority proves that cyclical thought extended beyond cosmology. Repetition in the dynastic cycle, the stages of population growth, over-division of land, and insurrection also contributed to (or resulted from) a cyclic view on history. The viewpoint is most clearly stated by Liang Shuming, who writes, “the fundamental spirit of Chinese culture is the harmony and moderation of ideas and desires, whereas that of Indian Civilization is to go backward in ideas and desires [and that of the West is to go forward]” (Bary 308). According to Liang’s assessment, relative to the West and India, the Chinese focus is one not on the past or the future, but of the present. He elaborates by comparing the “conquest of nature on the material side of Western culture,” to China’s lack of it. He goes on to relate the mindset of progress to scientific thought, writing that “there is the scientific method on the intellectual side of Western culture – this also China has none of,” clearly stating the lack of Chinese scientific thought. However, he also states “Westerners have been too strong and too vigorous in their minds and intellect. Because of this they have suffered spiritually” (Bary 380). This relates

to the aforementioned Daoist idea that the will to make the Universe transparent represents a sort of corruption or lack of spiritual humility. This sentiment extends into the Mao era, who went on to claim that “worship of technology was a fetish” (Fairbank 367). Of course, not all thinkers were anti-technologists, and some, like Chen Dixiu, were patently anti-Confucian. Still, analyzing pro-Confucian, pro-technology reformers like Liang Shuming and Kang Youwei can illuminate old patterns in Chinese thought via their attempts to reconcile Western ideas on progress with Confucianism.

One instance of this is in “The Three Ages”, by Kang Youwei, which highlights the special Chinese reverence for ancient wisdom. Kang Youwei’s goal in “The Three Ages” is to interpret another overarching historical progression within Han-dynasty Confucian texts. Not only does this re-invoke the tendency of Chinese scholarship to explain history in overarching terms using numerical phases, but it also underscores its deference to ancient wisdom. Establishing the transitions from “Disorder to Order” and “Order to Great Peace,” he claims, “Confucius knew all this in advance” (Bary 268). Even in a period of great intellectual turmoil, where new Western ideas and technology were turning the world upside down, Kang believes Confucian wisdom applies. This relates to what Guy Alitto calls the Chinese “eclectic urge” – here, it is in the form of integrating foreign events into an old philosophy, instead of replacing it. The reverence for ancient wisdom and order contrasts with scientific ideas of rejecting old knowledge in favor of new knowledge and self-determination. It is a representation of the pastlooking essence of Chinese thought.

The somewhat anti-progressive reverence for ancient knowledge is coupled with the desire to return to an idealized golden age of Chinese civilization, the age of the sage kings. This desire was fostered by the chaos of the Warring States period, which resulting in a “widespread yearning for peace and order” (Fairbank 51). Much of the theorizing done by late Zhou philosophers was for the sake of returning to the age of the sage kings, where “according to legend all China had lived peacefully under one ruler” (Fairbank 51). Confucian writings during this time would shape the view on Chinese progress for the rest of history. For example, in the 20th century, anti-reform conservatives forwarded the argument that China is not theirs to change, rather, it belongs to the ancient sage emperors, and the Chinese are simply supposed to maintain it². While these views were inevitably bent during the Century of Humiliation, they show that, before then, Chinese views on progress looked backwards instead of forwards. The Chinese utopia is not characterized by new technology and science, but by the harmony and order of the legendary kingdoms of the past. Developing technology and advancing toward a novel future was not part of the agenda. Technology was developed to sufficiency – for instance, the latest agricultural treatise as of the Qing Dynasty was one written in 1313 in the Yuan, as the efficiency of rice farming in the centuries thereafter precluded the need for further inquiry into agricultural technology (Fairbank 172). In sum, the development of technology was not motivated by the drive to advance toward a novel future.

All of these views on progress and knowledge were accompanied by Chinese isolationism, which is both a cause and effect of Chinese centrality and superiority in thought. First, China's isolation from civilizations of a similar scale and sophistication had led to a sense of Chinese superiority that denies foreign contact. Secondly, China's economic self-sufficiency obviated the need for conquest and exploration. Both resulted in a sense of Chinese centrality: China did not need to conquer the world – in the Chinese view, China was the world. The lesser foreign “barbarians” only sought to harvest some of the prosperity of the Middle Kingdom. This mindset of self-sufficiency is demonstrated in the Qianlong Emperor's letters to Britain, who claims that their trade relationship only exists out of pity and generosity. The letter is full of condescension and haughtiness and dismisses the British as another barbarian tribe. He writes that the Chinese “Celestial Empire possesses all things in prolific abundance and lacks no product within its own borders,” and that China does not have “the slightest need for your country's manufacturers” (Halsall, Peyrefitte 291). China's self-sufficiency was a fact: China did not need textiles or woolens, it had silk. They did not need indigo, they had Prussian Blue. China did not want what Britain had to offer. To combat the imbalance of trade and eliminate the silver deficit due to increasing British demands for tea, Britain had to create demand for a new good, and install a market in opium (Fairbank 195-196).

Here are two more examples of China's lack of expansionist ambition, which will later be tied to the notion of Chinese superiority. First, imperial China lacked a curiosity in foreign objects. The Qianlong Emperor also wrote that the empire simply “concentrates on carrying out the affairs of government properly” and “does not value rare and precious things” (Peyrefitte 291). Additionally, the Zheng He expeditions are a perfect example of how this disinterest in foreign affairs caused a divergence in China's progression from Europe's. After establishing some trade and diplomatic relations with 30 countries, the Zheng He expeditions were never followed up on. Zheng He's fleet was larger and contained bigger and more advanced ships than the fleets of Europe that would explore the world decades later. Instead of leading to a Chinese head start in the age of exploration, Zheng He's expeditions were followed by a Ming dynasty ban on the construction of large ships, and an inward retraction (Fairbank 137-138).

In part, these examples of indifference to expansion can be traced back to Confucian disinterest in trade and profit (Fairbank 138). However, the sense of Chinese superiority is also a cause of both of them. The proof is in the rapid shift of China's approach toward technology and modernization after the superiority of Chinese society was called into question. The Chinese lack of motivation to borrow European technology, engage in foreign trade or colonize others should not be viewed as a humble unconcern for status as the pre-eminent power. Instead, the opposite is true: China was so convinced of its innate and immutable superiority as a self-sufficient nation that there was no need to learn from foreign powers or borrow ideas or technology. The two sides of Chinese history, one of nearly no modernization and isolationism, and the other of rapid modernization and the incorporation of Western and

Soviet ideas, are opposite faces on the same coin. They can both be explained by the belief that China is the center of the world. If any aspect of Chinese thought predates and outlasts Confucianism, it is this one.

Until the end of the 19th century, there was never a sense of insecurity about China's position as the universal center of civilization. Previous invaders, like the Mongols of the Yuan dynasty, had consistently adopted Confucian methods of governance, thus re-affirming the superiority of Chinese society (Fairbank 121-126). By 1901, the dominance of foreign skill was made undeniable. Four wars and four defeats had demonstrated the Chinese's inferior warmaking capabilities, while the introduction of paved roads, steamships, railroads, and gas lighting had resulted in inarguable improvements in the quality of life in port cities like Shanghai (Fairbank 227). China's realization of its own technological inferiority was very damaging for national esteem, as it threatened the idea of Chinese superiority. As Fairbank says, many "felt that technology and the arts were an expression of basic moral and intellectual qualities," and that "it was plain that traditional China was some-how lacking in these capacities that the foreigner demonstrated" (227). The view of China as the center of the world for most of history made the resulting national humiliation much more painful, as the inferiority of Chinese civilization was a conclusion too difficult to accept. The crisis resulted in "the inescapable conclusion that China must make great changes," which would coincide with a distinct brand of intense nationalism (Fairbank 227).

Several phenomena in Chinese history after the 19th century can be viewed as a manifestation of the need to re-achieve the same feeling of universal superiority present throughout all of Chinese history. The overambitious goals of the Great Leap Forward are also evidence of Chinese centrality resulting in intense nationalism. Instead of the more provident strategy of slowing down investment in heavy industry, focusing on smaller-scale production, and making sure there was a steady agricultural base, communist China attempted to industrialize as rapidly as possible (Fairbank 369-370). Two of the nation's goals were to surpass Britain in steel production and reach "communism sooner than the USSR" – goals focused on competition and comparison (Fairbank 379). In other words, the will to reclaim global primacy as soon as possible took precedence over the will to do it carefully. The meteoritic economic growth between 1912 and 1920 (13.8% Chinese exports but is also undeniably linked to policies by the newly-founded Republic of China, founded by Sun-Yatsen and the Nationalist Party, who had three principles, the first of which was nationalism (Fairbank 270-271). Perhaps Yan Fu's introduction of Social Darwinism was so impactful not because it was entirely novel, but because it was integrated into an existing schema of Chinese superiority and provided a theory and solution for Chinese inferiority.

Trade and contact with foreign civilizations create routes to promote new ideas and technology. There were efforts to promote science and technology by European missionaries, but the pervasive disinterest in foreign affairs resulted in the view of missionaries as "foreign subversives," and the bullying of missionaries through a "lurid pornographic literature" (Fairbank 222-223). This meant foreign teachings did not flourish as much as they could

have. There is a clear contrast between the desperate attempts at modernization forwarded by Chinese scholars at the turn of the 20th century and attempts before it. What changed was the perception of valid competition and the threat of non-Chinese dominance. Thus, an explanation for the course of Chinese technological progress is incomplete without an examination of the deeply rooted idea of Chinese centrality and superiority.

Lastly, the Confucian hierarchy and examination system calcified the modes of thought described above, and thus implicitly hindered technological development. This is not to say that there is a lack of diversity of thought in China, but rather that there were forces working against the crediting of these thoughts and their ability to change fundamental things about Chinese society. First, the nature of the Imperial examination itself is focused on the memorization and compilation of Confucian texts, and original interpretations are discouraged. The novel *The Scholars* is a satirical work criticizing the examination system. In it, the venerated scholar of Chienteh County, Mr. Wei, expresses his views on essays. “Essays express the teachings of the sages, and they must be written according to definite rules. . . The Hung Wu and Yung Lo periods had one set of rules; the Cheng Hua and Hung Chih had another. Each reign has a particular set of rules which have been handed down from one group of scholars to another, forming an orthodox tradition” (Hsien-yi and Yang 236-237). Later, when he describes the work of Ma Chun-sang, he says “that kind of man is ruining the editing business...he creates extraordinary confusion and even good essays are spoilt by his abominable commentaries!” These quotes show the distaste for editorialization and heterodoxy in the Imperial examination system, the participation in which was needed to gain power or credit in China. This was supercharged by the sheer volume of Confucian text: Kang Youwei’s story is one of many about how withdrawing from these piles of text was necessary for intellectual escape. He writes, “My intelligence and comprehension became confused, for every day I was buried amid piles of old papers, and I developed a revulsion for them” (Bary 261). Kang Youwei’s epiphany that “Heaven, earth, and the myriad things were all of one substance within [himself]” occurred only after he withdrew from his studies, discarded his books, and “sat in contemplation.” This experience of “scholarship that often exhausted one’s mind and spirit before one began to exhaust the sources” was not uncommon, and a similar epiphany was shared by Wang Gen (Bary 262). The primary organizational system of Imperial China, for a thousand years, was one that punished divergent modes of thought among scholars, and thus made it difficult for China to depart from existing ways of anti-technological thought.

In summary, several aspects of early Chinese thought proved to be unfriendly to scientific and technological progress. Correlative cosmology and Chinese language reduced effective scientific inquiry. A cyclical view on history deterred the drive for futuristic progress. The sense of Chinese superiority led to isolation from new ideas, and the examination system discouraged divergent ways of thinking. These factors are not independent or even separate from one another, but mutually reinforcing. Chinese centrality and isolation cause presentism in thought, due to the absence of foreign change and competition, and presentism results in

the disinterest in foreign “precious things.” The reverence for the ancients in cyclic Chinese thought diminishes the importance of new ideas and divergent thought. Many more questions can be explored here. Perhaps the prioritization of order over dissident thought speaks to a broader mindset of compliance reinforced by the Confucian hierarchy, a mindset that is extant even in post-imperial China. Mao’s quest to understand the demands of the Chinese peasant during the Yan’an period found that the peasants’ participating in the revolution, paradoxically, had the principal desire of “first of all, local peace and order” (Fairbank 318). The Chinese peasantry were “remarkably inured to following the dictates of authority,” because it “represented the peace and order on which their livelihood depended” (Fairbank 369). However, the presence of rebellion throughout history makes sweeping generalizations of this sort dubious.

Further analysis would trace these patterns in Chinese thought further, to even more immutable and long-standing factors like the geography of China. China’s abundance of resources, and the fact that it is surrounded by less arable regions likely contributed to their sense of superiority, via their self-sufficiency and the “barbarianism” of the surrounding civilizations. Returning to the question of compliance, perhaps China’s unique ability to support the world’s largest population necessitated a philosophy that emphasized unity and harmony in order for there to be any stabilizing force. However, the relational nature of Chinese language also resulted in excellency in political thought and an emphasis on harmony – can we really say that this was a product of geography? Confucius’s texts were supposedly written before Qin Shi Huang united China for the first time. How can we say that the necessity of maintaining Chinese unity created hierarchical social theory, when such theorizing was done before China had been united? Many of these contradictions will need to be reconciled by more unpacking and need more work than is presented here.

Works Cited

- Bary, Theodore de, et al. *Sources of Chinese Tradition*. Columbia University Press, 1966.
- Chao, Yuen Ren. “How Chinese Logic Operates.” *Anthropological Linguistics*, vol. 1, no. 1, Jan. 1959, pp. 1–8.
- Cohen, S. Marc. “Socratic Definitions.” *Socratic Definitions*, University of Washington, 2004, <https://faculty.washington.edu/smcohen/320/socdef.htm>.
- Fairbank, John King, and Merle Goldman. *China: A New History*. Belknap Press of Harvard University Press, 2006.
- Halsall, Paul. “Emperor Qian Long’s Letter to King George III, 1793.” *Modern History Sourcebook*: Wellesley College, 1997.
- Meskill, John Thomas, and J. Mason Gentzler. *An Introduction to Chinese Civilization*. Columbia University Press, 1973.
- Peyrefitte, Alain, and Jon Rothschild. “A Suzerian’s Letter to His Vassal.” *The Immobile Empire*, Vintage Books, A Division of Random House, Inc., New York, 2013, pp. 288–292.

Sturgeon, Donald. “Zhuang Zi.” Chinese Text Project, 2006, <https://ctext.org/zhuangzi>.