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The Great Military Divergence:

The Gunpowder Revolutions of China and Advancement in the West

Pierre Dimaculangan

A Thesis in the Field of History

for the Degree of Master of Liberal Arts in Extension Studies

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Abstract

Of all the inventions of ancient and imperial China, perhaps none is as famous or world-changing as gunpowder. The chemical mixture drastically changed the nature of warfare, albeit over the course of a thousand years. The formula began with Daoist alchemy during the Tang Dynasty, but was applied militarily in the succeeding Song Dynasty. Such an invention created new empires and changed warfare forever. This paper discusses its invention and early military uses in China then investigates how Europeans, among other peoples, were able to advance it far beyond that of the Chinese and other civilizations by the fourteenth century.

The "Military Revolution" has been a popular topic of discussion among scholars for years, but a broader analysis of such a revolution requires a comparison of the military histories of China and the West. This thesis examines how and why it was the Europeans that advanced this military technology and supplanted China as the premier gunpowder superpower of the late Middle Ages. Multiple geopolitical, political, economic, and military factors and preconditions played a role in causing the increasingly widening technological gap in the following centuries. The paper also details how China's position as the unchallenged cultural, economic, and military giant of East Asia for much of the last two thousand years even contributed to its overall decline in comparison to an ascending West. Meanwhile, existential warfare among the fledgling nation states of premodern Europe stimulated hyper intense competition in nearly every field and triggered rapid advancements in weapons technology.

Frontispiece



Side by side models of a Ming Chinese warship with central superstructure (left) and the fifteenth century Portuguese carrack, São Gabriel, (right). These two ships types faced one another in the short-lived Sino-Portuguese War of 1521 and 1522.

Sources: Life of Guangzhou 21 September 2023.
https://www.lifeofguangzhou.com/upload/common/zhouyuan/2020-03-10/UP20200310105457_5.jpg

Bobato Ship Models 21 September 2023
https://bobatoshipmodels.com/product/sao-gabriel-model-ship/

Author's Biographical Sketch

Pierre Dimaculangan is the creator of military style historical fantasy novels which he writes under a pen name. He is also the cover artist and designer for his works and creates all the necessary print and digital media for them. He's also an independent scholar and is a passionate student of Asian civilizations and military history. He sometimes makes presentations at the yearly conferences of the International Society for the Comparative Study of Civilizations (ISCSC).

Pierre enjoys Muay Thai and Parkour and sometimes plays the drums to the tunes of his favorite bands. An unashamed member of geek culture, he often immerses himself in the world of science fiction and fantasy through games, films, books, and television. He is now pursuing an ALM in History from Harvard Extension School.

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Chapter I.

Gunpowder's History in China and Europe

Gunpowder is one of the most revolutionary inventions in human history, transforming and advancing warfare over a period of several centuries. Yet, an age-old misconception lingers about how imperial China made use of the invention for naught more than firecrackers, fireworks, and other pyrotechnical displays for various cultural rituals and ceremonies. In truth, the military potential of gunpowder was realized not long after it was invented, and various experiments were conducted on unleashing its destructive potential over a thousand years ago. With the powerful propellant, once-imposing and impregnable fortresses and castles were reduced to rubble under the bombs and ordnances of the explosive concoction. Through gunpowder, kings and emperors were slain, and entire empires were overthrown seemingly overnight.

Gunpowder literally translates to "fire medicine" **火藥** and first appeared in a ninth century Daoist text. It consisted of sulfur, saltpeter (potassium nitrate), and a carbonaceous ingredient such as charcoal. The text containing the formula even warned alchemists not to mix them together because there was a high risk of burning and incineration.[1] The martial applications for such a fiery concoction were recognized as soon gunpowder developed into more explosive forms. As a result, warfare was no longer limited to bows and arrows or cold weapons of iron and steel. Other than its use for

[1] Joseph Needham et al., *Chemistry and Chemical Technology*, vol. 5 (Cambridge University Press, 1986), 1.

ceremonial or pyrotechnical display, the Song Dynasty began weaponizing it as early as the tenth century. The very first cannons and bombs, although crude and still primitive, were in use by the time Mongol tribes united under the banner of Chinggis Khan and would go on to conquer the Jin Dynasty of the Jurchens in northern China before his successors would defeat the Song Dynasty of China in the twelfth century. The earliest of these weapons began simply from a tube of bamboo spouting flames and metal shards until eventually bronze and iron were cast and employed to propel ordnances of iron and stone across the battlefield. Often however, most of these weapons were cumbersome, unreliable, and even dangerous to use even in the fourteenth and fifteenth centuries.[2]

The first gunpowder weapons were effective as tools for psychological warfare, and they advanced rather slowly, yet gradually. The Chinese were quick to utilize gunpowder weapons against their northern neighbors and traditional enemies like the Jurchens of the Jin Dynasty, who occupied the upper half of China in the twelfth and thirteenth centuries. Later, the both the Jin and the Mongols adopted the gunpowder weapons for themselves during their conquests abroad, usually by employing Chinese engineers and military personnel.[3] The Mongols did use cannon for besieging walled cities throughout Eurasia and are credited, at least in part, for contributing to the spread of gunpowder warfare across the world. Together with the trade routes of the Silk Road, the Mongols were an important conduit for the technology's dissemination in the Eastern

[2] Scott C. Levi, "Asia in the Gunpowder Revolution," Oxford Research Encyclopedia of Asian History, April 26, 2018, https://doi.org/10.1093/acrefore/9780190277727.013.186.
[3] C. J. Peers, *Soldiers of the Dragon: Chinese Armies, 1500 BC - AD 1840* (London: Osprey Publishing, 2006), 137.

hemisphere where the technology built the gunpowder empires of India's Mughal, Iran's Safavid, and Turkey's Ottoman along with the rise of nation states in Europe.[4]

The Full Extent of Imperial China's Weapons Development

To better understand, in proper context, in what ways the West surpassed China in the field of gunpowder warfare, it is important to trace the evolution of the technology where it first began and reveal the full extent of China's domestic arms development prior to foreign contacts. Imperial China developed a host of creative weapons using gunpowder in a variety of applications. Sinologist Joseph Needham listed the five stages of gunpowder weaponry in China to challenge the misconception that gunpowder was immediately explosive when it was first formulated:

1) "Gunpowder as incendiary (projectiles launched from bows, crossbows, trebuchets, and *arcuballistae*;
2) Gunpowder as flamethrower (fire-lances and their variants);
3) Gunpowder as explosive (maroons or bombs launched from trebuchets or *arcuballista*e;
4) Gunpowder as retroactive propellant (rockets);
5) Gunpowder as forward propellant (barrel guns, cannon)."[5]

The Song Dynasty was the first time in Chinese history where gunpowder was applied for military use. A military manual called the *Wujing Zongyao* (Collection of the Most Important Military Techniques) from the year 1044 contains a record of the first

[4] Peter N. Stearns, Michael Adas, Stuart B. Schwartz, and Marc Jason Gilbert, *World Civilizations: The Global Experience*, Combined. Seventh ed. Vol. (Saddle River, NJ: Pearson Education, Inc., Publishing as Prentice Hall, 2015), 586.
[5] Needham, *Chemical Technology*, 147.

true gunpowder formula along with various means in which it was used in war. The manual serves as an invaluable primary source for studying the history of gunpowder in imperial China and also records the first instances of gunpowder weapons used in siegecraft such as primitive cannons, rockets, and flamethrowers.[6]

However, it was in the early decades of the Ming Dynasty following Mongol occupation where such weapons truly evolved to become more effective and recognizable as true guns and artillery as revealed in one of the most notable publications on Chinese military technology first produced in fourteenth century called the *Huolongjing.* Translating literally to "Fire Dragon Manual", the Ming Dynasty treatise provided a comprehensive view of domestic Chinese gunpowder weapons from the previous century until the point of its publication in the Ming Dynasty and serves as yet another invaluable primary source for revealing the full extent of China's advancements in gunpowder warfare.[7]

The seventh volume of Joseph Needham's encyclopedia *Science and Civilisation in China* excerpted various portions of the manual with diagrams and illustrations included. The following paragraphs discuss some of the most developed weapons technology premodern China possessed prior to formal contact with European powers in the sixteenth century, particularly with the Portuguese. They cover merely a few of the many weapons listed in both the *Wujing Zongyao*, and the *Huolongjing*. Gunpowder for military use was first applied to create explosives in the form of bombs and grenades which, according to Joseph Needham, were "very effective in setting fire to siege

[6] Needham, 22.
[7] Needham, 24.

machines and towers on land or 'wooden walls' at sea."[8] One of the most powerful of such explosive devices was poetically named the "heaven-shaking thunder-crash bomb" or simply as "iron bomb." It was sealed in a metal casing and launched by siege weapons like trebuchets. These explosive devices expanded into a vast array of bombs with various payloads ranging from shrapnel and steel barbs to burning oiled paper that stuck to the skin.[9]

Land mines were no exception when it came to variety. One of the most notable of such weapons was a mechanical mine elaborately called "underground sky-soaring thunder." It was constructed using a stash of polearms as a primary feature to bait or lure an unsuspecting enemy soldier. The mine is triggered when a soldier attempts to seize the weapons as war trophies which would then result in the ignition of a fuse. The resulting chain reaction detonates several bowl-shaped bombs buried in the ground to create a devastating blast.[10]

In 2010, an interesting demonstration of this weapon was featured on a television program called "Deadliest Warrior" on the network "Spike TV" in order to put the mine's effectiveness to the test. Through an examination of the test mannequins, the explosion was concluded by the hosts to cause instant death to anyone in the mine's immediate proximity while dealing grievous injury to enemies within the blast radius.[11] While the construction of the mine appeared faithful to the original diagrams and therefore may give the viewers an idea of its overall effectiveness, it should be noted that the television program is purely for entertainment purposes and cannot be cited as a source of scholarly

[8] Needham, 163.
[9] Needham, 183.
[10] Needham, 203.
[11] Tim Prokop et al., "Ming Warriors vs. Musketeers," episode, *Deadliest Warrior* (Spike TV, April 10, 2010).

information or accurate data. This demonstration was only referenced in this paper as a way to show that it may have been possible for such a device to be useful in an actual battlefield.

The first underwater anti-ship mines were also innovated in China. The device was constructed with a slow-burning incense stick floating in the water which would later ignite a fuse traveling down the length of waterproof goat's intestine, thus detonating a bomb beneath the water's surface.[12] Aptly called the "submarine dragon king", the clever invention could be "sent downstream towards the enemy's ships, and when the joss stick has burnt down to the fuse, there is a great explosion."[13] In any case, this research did not find any documented instances of its success or failure in naval battles.

With a specific incendiary gunpowder mixture as a fuel source (which is thought to use sixty percent saltpeter), the world's first rockets were employed on the Chinese battlefield. Not just used for fireworks, the rockets were attached to the shafts of modified arrows and fired en masse against incoming forces.[14] Soon, portable rocket launchers as well as wheelbarrows with multiple attached batteries containing the rockets were being deployed to the battlefield to fire hundreds of rockets in a single volley. Larger rockets featured choke nozzles at the exhaust to generate more powerful thrust; the effect was similar to a thumb partially blocking the mouth of a hose to increase water pressure. This feature known as the "Venturi effect" was five centuries ahead of its formulation in

[12] Needham, *Chemical Technology*, 206.
[13] Robert Temple, *The Genius of China: 3,000 Years of Science, Discovery & Invention* (Hardie Grant, 2007), 262.
[14] Temple, *China*, 264.

Europe. These weapons would be employed as field artillery or in the navy to set fire to enemy ships. [15]

The world's first multi-stage missile was also developed in tandem with the invention of rockets. Called "Fire Dragon Issuing from the Water", it consisted of a large tube with a dragon's head at the front, and was powered by four rocket-propelled arrows. When the rockets burned out, they ignited and launched a second set of rockets within the body of the missile, able to rain high-velocity arrows at the enemy from a great distance.[16]

Such a weapon was successfully tested in the popular science entertainment show "MythBusters" where hosts recreated the missile based on the original designs in the Huolongjing, only having to replace the decorative fish fins at the rear with functional rocket fins. The end result was the successful launching of all missiles and ignition of the second-stage rocket arrows within the tube, with most arrows impacting into the ground. However, simply due to wind factors throwing the projectiles off-course and with arrows falling either too short or too far from the target mannequins, it was judged to be "fickle." It could be easily argued, however, that with more mannequins set in place across a larger target area the test could probably have been judged a success.[17]

The flamethrower is often perceived as a very modern weapon, having been infamously employed by soldiers in both the First and Second World Wars.[18] However, the terrifying weapon had its beginnings much earlier with the proto-flamethrower called "Greek Fire" invented by the Byzantines in the late seventh century. The sophisticated

[15] Temple, 263, 265.
[16] Temple, 265.
[17] Peter Rees, "Duel Dilemma," episode 10, *Mythbusters* (Discovery Channel, June 12, 2012).
[18] The Editors of Encyclopaedia Britannica, ed., "Flame Thrower," Encyclopædia Britannica, accessed on February 2, 2024, https://www.britannica.com/technology/flame-thrower.

device was fueled by a highly volatile liquid created from jealously guarded formula of ingredients. It functioned like a syringe and spewed continual pumps of flame instead of a continuous stream because it was "made from bronze tubes and included a syphon pump and swiveling nozzle."[19]

However, the Song Dynasty Chinese can be credited with the invention of the first true flamethrower. The name of the weapon can be translated as "fierce fire oil shooter" and was made possible by more developed metallurgy which allowed for the invention of the *double action piston bellows* to make possible the aforementioned continuous stream. This device "made of the very best cartridge-quality brass, containing 70 percent copper" allowed for a continuous stream of flame (from a liquid similar to gasoline) to be manually pumped from a nozzle. [20] "A gunpowder slow-match [was present] in the ignition chamber of the petrol flamethrower, identified all but infallibly by the term *huo yao*."[21] The weapon appeared to have been common pieces of equipment by the beginning of the tenth century, though Sinologist Joseph Needham did note that "technicians who used them were despised by the Confucian scholars."[22] Nevertheless, such a weapon could be mounted on ships and cause an enemy vessel to be consumed in flames in mere moments.

Of all the weapons and applications the Chinese had with gunpowder, perhaps none are as significant or as notable as guns and cannons, especially when bronze and iron construction began to unlock their potential. Guns evolved from simple fire lances which historian and author C.J. Peers calls "nothing more than a firework tied to a

[19] Mark Cartwright, "Greek Fire," World History Encyclopedia, November 14, 2017, https://www.worldhistory.org/Greek_Fire/; Temple, 254.
[20] Temple, *The Genius of China*, 254.
[21] Needham, *Chemical Technology*, 82.
[22] Needham, 86.

spear,"[23] to large and heavy iron cannons capable of deploying a large variety of ordnances from stone or iron balls to explosive rounds. "The earliest definitely dated cannon… is ascribed to the year 1332" though cannons and true guns have been around a century prior to that year. [24] Admiral Zheng He's Treasure Fleet in the early fifteenth century was partially comprised of military vessels which according to the late historian Edward Dreyer, were "armed with bronze cannons capable of firing up to 900 feet."[25]

The Chinese were also known for developing the first semi-automatic or repeating guns. Similar to hand cannons, these guns sported three or more barrels each with their own touch holes or fuses. Each fuse could be ignited in quick succession and could fire several times before having to reload. Examples of multi-barreled hand cannons go back to the beginnings of the Ming Dynasty.[26] Handheld cannons were mass-manufactured for use among infantry units, some having as many as three to seven barrels. Each barrel was ignited all at once and acted as a sort of scatter shotgun, then later able to be lit independently allowing the gunner more shots before having to reload. By the 1400's however, Z or S-shaped serpentine levers for holding slow-burning matches or hot cordage were added to the hand cannons as basic methods of control to light the fuses and fire the weapons.[27]

It is also interesting to note, however, that sophisticated triggering mechanisms for shooting crossbows were first invented in China during the Warring States period, a weapon itself also first and independently invented in China by at least the fourth century

[23] Peers, *Soldiers of the Dragon*, 184.
[24] Peers, 184.
[25] Edward L. Dreyer, guest speaker, "China," Episode *Engineering an Empire* 1, no. 11. History Channel, December 11, 2006.
[26] Needham, Chemical Technology, 246, 314.
[27] Needham, *Chemical Technology*, 423-425.

BC.[28] By the third century BC, these crossbows with precise and intricate bronze trigger mechanisms were "abundant in textual references" and thus had become standardized pieces of equipment. Surprisingly, this concept of using "downward-hanging" triggers to "fire" a ranged weapon was age-old in China,[29] but was not applied to domestically-produced hand cannons where their seemingly non-ergonomic design (being attached to a wooden shaft) allowed for them to be wielded as blunt melee weapons or as polearms as early as the thirteenth century, as was the case with the fire lance.[30]

Interestingly, lever-powered repeating crossbows were still employed in Chinese battlefields as late as the nineteenth century[31] and were ineffective against Western powers armed with superior firearms, thus perhaps contributing to the old misconception that the Chinese never developed gunpowder for anything else beyond fireworks or firecrackers.[32] Beyond these aforementioned improvements, Chinese gunsmiths did little to improve or add to their domestic innovations in the firing mechanisms and overall effectiveness of their firearms, a fact which will be demonstrated throughout this paper. This state of affairs remained until China encounters the Portuguese in the early 1500's, discussed later in the chapter.[33]

Although they did not immediately replace traditional means of warfare such as mounted horse archery, cannons and gunpowder-based weaponry within supplemental units revolutionized warfare in China as well as Europe in the centuries it was first

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[28] Temple, *The Genius of China*, 244-245.
[29] Temple, 245, Needham, 465.
[30] Temple, 268.
[31] Ralph Payne-Gallwey, *The Crossbow: Medieval and Modern, Military and Sporting ; Its Construction, History and Management ; with a Treatise on the Balista and Catapult of the Ancients and an Appendix on the Catapult, Balista and the Turkish Bow* (London: Holland Press, 1958), 237; Mark Cartwright, "Crossbows in Ancient Chinese Warfare," World History Encyclopedia, July 17, 2017, https://www.worldhistory.org/article/1098/crossbows-in-ancient-chinese-warfare/.
[32] Peter Lorge, *Asian Military Revolution*, 8.
[33] Lorge, 16-17.

implemented on the battlefield,[34] although China had become a full-fledged gunpowder empire by the Ming Dynasty. Historian Tonio Andrade cited what other historians believe about the development of Chinese gunpowder weapons in contrast to the evolution of much larger European artillery later. They suggested that Chinese guns were smaller and more mobile so to be installed on walls and fortifications to defend against "barbarian" outsiders, and on naval ships. That is to say that according to them, Chinese guns were utilized mainly for defensive purposes and not for besieging walls.[35] More compelling reasons for such a strategy will be discussed later.

With the aforementioned sample weapons by the beginning of the dynasty, China was evidently the most advanced gunpowder civilization in the world until European advancements began in the fifteenth century. It was in Europe that gunsmiths introduced springs and locking mechanisms for triggers that ignited flash pans and fired the bullets. It was also in Europe that the first truly large pieces of artillery were introduced for mass application in warfare, as discussed further in the paper.

Introduction and Advancement of Guns in Europe

Of all the technologies that transferred to the West from China such as paper and the compass (which took centuries), guns transferred the fastest in approximately fifty years, according to historian, Tonio Andrade.[36] This could most likely be attributed to the rapid dissemination of the technology through the expansion of the Mongol Empire in the thirteenth century forward. Skilled laborers, artisans, and soldiers who were in service to

[34] Scott C. Levi, "Asia in the Gunpowder Revolution," *Oxford Research Encyclopedia of Asian History*, April 26, 2018, https://doi.org/10.1093/acrefore/9780190277727.013.186.
[35] Tonio Andrade, *The Gunpowder Age: China, Military Innovation, and the Rise of the West in World History* (Princeton, NJ: Princeton University Press, 2017), 96.
[36] Andrade, *Gunpowder Age*, 76.

them may have carried the knowledge as far as the western edges of the empire.[37] The Mongols eventually adopted this Chinese technology for themselves in their conquests of the Song, the Jurchens, and their other rivals. The Mongols effectively utilized gunpowder in their campaigns throughout Eurasia and thus are often credited, at least partially, for spreading the knowledge of gunpowder warfare across the world.[38] Along with the Silk Road trade routes, the Mongols have been an important conduit for the technology's dissemination throughout Eurasia where the technology played crucial roles in building the Mughal, Safavid, and Ottoman empires as well as the rise of nation states in Europe.[39]

Guns and gunpowder weapons arrived in Europe sometime after the 1320's, as professor of history Tonio Andrade writes. In Europe, the technology of gunpowder and its applications arrived as a "matured" piece of equipment readily recognizable as a weapon of war. The first descriptions of fire weapons in Europe seem to indicate that guns were readily known for what they were, as no descriptions or evidence of fire weapons' gradual evolution into a true gun (i.e. a primitive fire lance like in China during the Song Dynasty) appeared in any records or documents.[40]

Furthermore, the applications of gunpowder outside of military uses, was non-existent in Europe, meaning that the technology arrived already completely weaponized. By the 1320's, European sources were already making clear references to guns.[41] The development of this gun technology was parallel to that being made in China, but

[37] Levi, "Asia in the Gunpowder Revolution."
[38] Timothy May, *The Mongol Art of War: Chinggis Khan and the Mongol Military System* (Yardley, Pennsylvania: Westholme, 2007), 141.
[39] Stearns et al., *World Civilizations: The Global Experience*, 586.
[40] Andrade, *Gunpowder Age*, 76.
[41] Andrade, 76.

historians note that the first technological divergence occurs after the 1300's, mainly in the fifteenth century.[42] Prior to this, historians (according to Andrade) largely considered guns too ineffective to be revolutionary in European warfare because the technology had not yet reached sufficient sophistication. In China, however, the application of gunners on the battlefield was more widespread and well-adapted for effectiveness thanks to the use of coordinated drills and volley fire to compensate for the slow reload times of each gun. In Europe, the use of volley maneuvers and techniques did not begin until much later after having adopted guns in warfare. [43]

The aforementioned "first divergence" in weapons technology between China and Europe was first demonstrated in the short-lived Sino-Portuguese Wars of 1521-1522. The war mainly consisted of one battle for each year between the Ming Dynasty and the expanding Portuguese Empire known as the battle of Tunmen in 1521 and again in 1522. Multiple Portuguese offenses on Ming soil, mainly in Guangzhou, prompted military action from the Chinese. Both battles gave the Chinese decisive victories over the Portuguese ships but there was one prize they managed to salvage from their scuffles: breech-loading cannons. These Portuguese cannons were able to be reloaded far more easily and efficiently by way of a detachable breech rather than through the muzzle.[44]

The superiority of the Portuguese cannons was immediately recognized from the first battle, however, when their guns managed to keep the Ming navy at bay. Admiral Wang Hong, the top-ranking scholar official in overall command of the forces that repulsed the Portuguese, was known to promote making copies of the Western guns to be

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[42] Andrade, 107.
[43] Andrade, 85.
[44] John E. Wills and J. L. Cranmer-Byng, *China and Maritime Europe, 1500-1800: Trade, Settlement, Diplomacy, and Missions* (Cambridge: Cambridge University Press, 2011), 31; C.J. Peers, *Soldiers of the Dragon*, 206; Andrade, 140.

distributed and used across the Ming Empire. It was clear that as early as 1521 the firepower of European forces was so readily recognized, showing to the original pioneers of the gun that the West had already surpassed China in the weapon's overall power and accuracy. Such weapons (called "Frankish cannons" by the Chinese) were known and already in-demand some years before the battles took place, however. Some evidence suggests that as early as 1510 Chinese pirates used them off the coast of Guangdong. Further evidence indicates that the crown prince of Ning (a direct descendant of the Ming Dynasty's founder) desired to arm himself with such weapons for his revolt to seize the Dragon Throne for himself in 1518 and purchased them.[45]

Additionally, the Portuguese were already armed with the *arquebus*—a smaller form of matchlock musket. Such a weapon was the next big step in the evolution of the gun. A pull of this weapon's trigger would activate a lock mechanism that brought down the slow-burning match into the powder in a flash pan to ignite the powder in the chamber which, in turn, launched the ball bullet. As Sinologist Joseph Needham stated in the third volume of *Science and Civilisation in China*, "it would have been just like the locksmiths of the West to take the trigger and take the further step of inserting springs, levers, detents, and tumblers between the trigger and the touchhole."[46]

The Chinese once applied the aforementioned serpentine levers as a means to lower the slow-burning cordage or match and ignite the hand cannon's touch hole, but no locking mechanisms were ever installed to create a working trigger in the European fashion prior to China's contact with the West. The arquebus, with its matchlock mechanism, was easier to operate and was overall superior to the hand cannons used in

[45] Andrade, 137, 141.
[46] Needham, *Chemical Technology*, 464.

China at that time. The matchlock firearm and arquebus replaced the primitive hand cannon on the European battlefield as early as the middle of the fifteenth century.[47]

Interestingly, firearms similar to an arquebus was observed by Portuguese explorer Tomé Pires in the year 1513 when he cited stories of the war exploits of Javanese governor, Guste Pate, who purportedly took with him two hundred thousand warriors, four thousand of which were musketeers.[48] While such a "musket" may have developed independently of European ones, gunpowder warfare was introduced to archipelagic Southeast Asia (mainly Java) during the thirteenth century Mongol invasions. "Southeast Asians were familiar with firearms well before the arrival of the Portuguese…Chinese cannons were carried to Java by the Mongol invasion of 1293."[49] Knowledge of these weapons was further disseminated in Southeast Asia by way of the Arabs. As British historian John Crawfurd wrote, "The parties who introduced the knowledge of fire-arms among the Malayan nations cannot be mistaken. They were certainly the Mohammedan nations of Western Asia, and most notably the Arabs."[50]

In the succeeding centuries, European advances on guns and cannons would surpass that of the Chinese and later, even those of the Ottomans and the Safavids who

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[47] Peter Lorge, *The Asian Military Revolution: From Gunpowder to the Bomb* (New York, NY: Cambridge University Press, 2008), 15.

[48] Tomé Pires, Armando Cortesão, and Rodrigues 1967. Francisco, fl. 1513. English & Portuguese., *The Suma Oriental of Tome Pires: An Account of the East, from the Red Sea to Japan, Written in Malacca and India in 1512-1515 and the Book of Francisco Rodrigues, Rutter of a Voyage in the Red Sea, Nautical Rules, Almanack and Maps, Written and Drawn in the East before 1515 / Tome Pires ; Translated from the Portuguese Ms. in the Bibliotheque de La Chambre Des Deputes, Paris, and Edited by Armando Cortesao* (London: Printed for the Hakluyt Society, 1944), 176.

[49] Anthony Reid, "Full Text of 'Southeast Asia in the Age of Commerce, 1450-1680, Volume Two: Expansion And Crisis,'" Internet Archive, December 13, 2021, https://archive.org/details/southeast-asia-in-the-age-of-commerce-1450-1680.-volume-2, 220.

[50] John Crawfurd, "A Descriptive Dictionary of the Indian Islands & Adjacent Countries," Full text of "A descriptive dictionary of the indian islands & adjacent countries [electronic resource]," August 17, 2008, https://archive.org/stream/adescriptivedic00crawgoog/adescriptivedic00crawgoog_djvu.txt, 22-23.

built gunpowder empires of their own.[51] In Europe, and later, America, continuous significant improvements and innovation would be made in gun technology well until the twentieth century. Later, this paper discusses how the matchlock mechanism eventually evolved into the flintlock, the wheel lock, percussion cap, and several others until the emergence of a conical bullet fired from a cartridge which allowed for the creation of fully automatic guns and far more powerful long-range ordnances.

Europeans even improved the gunpowder itself through a process of "corning" for their projectiles to achieve "supersonic bullet velocity to increase range and killing power"[52] although there is circumstantial evidence that the Chinese have already corned gunpowder prior to official contact with Europeans in the early sixteenth century.[53] Descriptions of some of these firing mechanisms will be discussed later. In the end, European cannons became bigger, and much more powerful and accurate than that of their Eastern counterparts by the sixteenth century, as it was demonstrated in the Sino-Portuguese War of 1521 and 1522. Superior firepower was the determining factor in their imperial conquests in Africa and the Americas as well as the key in the British Empire's victory over the Qing Empire during the first and second Opium Wars where the second great military divergence between East and West was most apparent.[54]

It was in the Opium Wars that the Manchu-led Qing Dynasty could not muster an adequate defense or counterattack against the firepower of industrialized Western nations.[55] As a result, Qing Chinese forces and their ships were destroyed with relative ease. Since Europe's age of exploration began, the rest of the world scrambled to import

[51] Stearns et al., *World Civilizations*, 587.
[52] Needham, 425.
[53] Peter Lorge, *Asian Military Revolution*, 16.
[54] Stearns, 466, 514, 587, 730.
[55] Stearns, 729.

European firearms and made domestic copies based on the Western designs. While the question of the military divergence has been discussed for many years, its theories remain debated and challenged. What drove European technological advances, while that of China and greater East Asia stagnated?

How and Why Europeans Advanced Weapons at the End of the Medieval Era

Past theories, including those from historians and other scholars, have attempted to answer the military divergence question through the lens of cultural factors and influences. In fact, it was once a generally accepted belief that Asians had fallen behind during the great divergence because their purportedly inferior culture was somehow non-militaristic.[56] According to historian Peter Lorge, the role gunpowder warfare played in revolutionizing warfare in Asia was "downplayed… if not entirely denied, because the modern perspective on Asian history is that, before the arrival of the Europeans, Asian military practice as a whole, and military technology in particular was primitive and backward."[57] Other theories of the past state differences in modes of warfare such as the traditional Chinese strategy of defense or European tendencies towards offensive warfare—stereotypes easily challenged by the availability of new data and more recent scholarship.[58]

Certain periods in history accelerated Europe economically and scientifically compared to its contemporaries across the Eurasian continent. One such period was the Renaissance—an era reawakening Europe's Greco-Roman cultural and intellectual heritage—before the scientific and industrial revolutions. First taking root in medieval

[56] Lorge, *Asian Military Revolution*, 2.
[57] Lorge, 2.
[58] Andrade, *Gunpowder Age*, 116.

Italy, the Renaissance was partially made possible through the highly lucrative trade the city-states of Italy, namely Venice, conducted with the Ottoman Empire and the greater Islamic world. Along with the financial backing of powerful and wealthy banking clans such as the De Medici family of Florence, Italy, private enterprise and financial institutions in such a pivotal era in European history were vital, and will be further discussed later in the paper.[59]

The Italian Renaissance eventually rekindled Europe's artistic, philosophical, and scientific culture. The Renaissance was a period marked by "the decline of the feudal system and the growth of commerce, and the invention or application of such potentially powerful innovations as paper, printing, the mariner's compass, and gunpowder."[60] The period was also marked by an increase in literacy rates and the mass availability of books resulting in the accelerated spread of knowledge. This was made possible largely by the invention of Johann Gutenberg's independent invention of the movable-type printing press—a device first invented by Bi Sheng during China's Song Dynasty.[61]

As the resulting literacy rates increased, Europe began to emerge out of the so-called "Dark Ages." The success achieved by Europeans during the early modern period therefore helped to propel their advances in military technology. Europe's "Age of Exploration" created large-scale and intense competition as nation states vied for territories and colonies across the world.[62] According to *World Civilizations*, the Europeans, unlike their imperial Muslim contemporaries the Ottomans and Safavids,

[59] Stefano Carboni, Trinita Kennedy, and Elizabeth Marwell, "Venice's Principal Muslim Trading Partners: The Mamluks, the Ottomans, and the Safavids: Essay: The Metropolitan Museum of Art: Heilbrunn Timeline of Art History," The Met's Heilbrunn Timeline of Art History, March 2007, https://www.metmuseum.org/toah/hd/vmos/hd_vmos.htm.
[60] The Editors of Encyclopaedia Britannica, "Renaissance," Encyclopædia Britannica, February 17, 2024, https://www.britannica.com/event/Renaissance.
[61] Stearns et al., *World Civilizations*, 390, 489.
[62] Stearns, 617.

were "more adept at taking advantage of the gunpowder revolution."[63] The fierce competition for survival between Western European nation-states allowed them to mobilize resources more effectively than the contemporaneous Muslim gunpowder empires that, during the sixteenth century, possessed military technological parity. This fierce competition for survival, however, allowed European nations to become "more receptive to technological innovation, which became a central ingredient of political success in the gunpowder era."[64]

Similarly, Peter A. Lorge writes that "commercial competition [in fifteenth century Europe] and the need to defend urban centers from armies pushed up technological innovation and weapon production."[65] Such economic and urbanized conditions demanding of the advancement of firearms and artillery facilitated Europe's rise to power and global preeminence starting in the sixteenth century until the Industrial Revolution and beyond. Europe's urbanization during the Renaissance cultivated a climate similar to that of China's Song dynasty, an era marked by innovation, commercial revolutions, and protoindustrialization.[66]

Europe's urban centers were also the targets of many battles during this time period. Historian of Western Europe and early-modern European warfare, Geoffrey Parker, promotes the theory that European nation states were born out of military demands brought forth from the need to manufacture more powerful artillery, larger armies, and new fortifications which resulted in the creation of more centralized governments. As a result, firearms ultimately gave rise to the modern European nation-

[63] Stearns, *World Civilizations*, 587.
[64] Stearns, 587.
[65] Lorge, *Asian Military Revolution*, 15.
[66] Stearns, 388-392.

state and the greater advancement of the West.[67] The subsequent centralized states would therefore manufacture and improve upon firearms technology in the succeeding centuries. As a result, according to Geoffrey Parker, the continuous state of conflict within Western Europe created increased centralization which in turn forced the rapid advances in military technology and firearms.[68]

Tonio Andrade, on the other hand, puts forth the argument that it is the differences in the construction of defensive walls and fortifications between the Chinese and the Europeans (as well as the need to destroy them) that contributed to the military divergence in favor of the West.[69] His simple argument stated that European walls, even at their thickest, were thin and flimsy in comparison to Chinese walls and fortifications. Constructed with dense rammed earth and encased in stones or large bricks and often twenty to thirty meters at the base, ancient and imperial Chinese walls were adamantine and highly resistant to artillery compared to those constructed by their European counterparts. Andrade argues that even the monster cannons that Mehmed used to break the walls of Constantinople would not have come close to destroying a typical contemporaneous Chinese walled fortification.[70]

In the case of European nations, the thickest of walls fell to artillery bombardment, and the continuous reinforcements of walls and the need to destroy them in sieges stimulated the need to create larger and more powerful artillery. This motivation, Andrade argued, did not exist in the same way concurrently in China where

[67] Gábor Ágoston. "Firearms and Military Adaptation: The Ottomans and the European Military Revolution, 1450-1800," *Journal of World History* 25, no. 1 (2014): 85, http://www.jstor.org/stable/43286061.
[68] Andrade, *Gunpowder Age*, 117.
[69] Andrade, 96.
[70] Andrade, 102.

any artillery less advanced than those used in the early twentieth century would never have been capable of breaching walls. Therefore, he concluded that the necessity of inventing larger and more powerful artillery like that of the Europeans was never present. In simple terms, the resources needed to create and fire such large artillery would be too large of an investment that was never to be returned because ancient and imperial Chinese walls were virtually unbreakable due to their inherent size, thickness, sloped design, and rammed earth construction techniques.[71]

Ultimately, it was unique circumstances and socio-economic and geopolitical conditions that stimulated Europe's capacity to adopt and advance military technology allowing them to change the tides of the current world order. As Needham himself stated, "the Renaissance, the Reformation, the growth of capitalism, and the scientific revolution… the speed of change in Europe began to outstrip the slow and steady rate of advance dictated by Chinese bureaucratic feudalism."[72] These European technological improvements were crucial factors in challenging and changing the global status quo. In conjunction, advancements in shipbuilding, which allowed for the carriage of heavy weapons, and sailing technology for more efficient utilization of the wind and its directions, gave Europeans the tools necessary to expand their empires abroad and overseas.[73]

Such a similar opportunity the Europeans managed to exploit for global predominance was available to China during the power-projecting expeditions of the Ming Treasure Fleet led by the eunuch admiral Zheng He. For nearly three decades, these expeditions firmly established China as the undisputed maritime superpower of the

[71] Andrade, 100, 102.
[72] Needham, *Chemical Technology*, 10.
[73] Stearns et al., *World Civilizations*, 466.

world. Such ventures were only made possible by unprecedented changes to its traditionally-introverted foreign policy thanks to the visionary and ambitious emperor, Zhu Di. However, the sudden suspension of the voyages together with the radical change in China's military and foreign policy allowed the Spanish, Portuguese, and later the Dutch and British to sail throughout the Indian Ocean trade network largely unimpeded and unchallenged. The power vacuum left behind by the Ming Imperial Treasure Fleet was filled by the Iberians less than a century later.[74]

The continual expansion and conquest they achieved from their dominance in international trade and colonial pursuits compared to the closed-door policy of the Confucian conservative bureaucrats of China were crucial to tipping the scales of power in favor of the Europeans. This will be further discussed in-depth later. In China, the age-old imperial bureaucracy reigned supreme, but in Europe science and invention blossomed under the Renaissance and it renewed interest in the arts and sciences among the elite. Coupled with steep military and economic competition between nation-states, Europe experienced a rapid ascension in the advancement of their weapons and militaries well into the scientific and industrial revolutions.[75]

To further detail this point, Professor of History, Charles H. Parker explains that Western Europe was unique in that it facilitated the formation of smaller independent nation states that inevitably squabbled with each other for more territory or trade access. This state of affairs in Western Europe was in stark contrast to much of the rest of Eurasia where larger, more centralized rule or principal establishments governed large areas like in "China, Russia, Anatolia, Iran, and India." Parker states that the waging of

[74] Stearns, 616-618.
[75] Stearns, 445-446, 587.

war for reasons of commerce has had a long history in Europe. One such example he cited to prove his point was that of thirteenth century Venice where Venetian ships full of crusaders waiting to be transported to Palestine to fight the Muslims were instead convinced to sack Venice's commercial rivals at Constantinople. This allowed the already-powerful city-state of Venice to take full control of trade in the Mediterranean.[76]

It can be concluded that it is from this long history of waging war for reasons of commerce that Europeans acquired their penchant and aptitude for colonization, imperial expansion, and conquest abroad. Parker explains that "as Europeans venture overseas in search of trade and land, this warrior ethos made it natural for merchants and mariners to wage war against one another and indigenous peoples. Competition among European states made them effective and aggressive at empire building overseas."[77] Prior to this, most of the empires in history were entirely land-based and Asian powers in particular did not include the sea as an official part of their jurisdiction. This reality allowed European powers to be left largely unimpeded in the oceans, and free to voyage to any port or sail along any trade route.[78]

It must also be mentioned that European voyages were continually made possible because of free enterprise and the role of private institutions in financing their expeditions. Whereas the government-funded voyages of the Ming Treasure Fleet drained imperial coffers and provided little-to-no return on investment, "competition among [European] countries compelled governments to ally with an assortment of economic elites – merchants, commercial firms, lending institutions, and investors – to finance

[76] Charles H. Parker, *Global Interactions in the Early Modern Age, 1400-1800* (New York, NY: Cambridge University Press, 2012), 17.
[77] Parker, 17.
[78] Parker, 21.

directives and policies." It is this essential direct participation and involvement of businesses with the government, as Parker put it, that the age of European exploration and colonization was able to persist for hundreds of years.[79]

Pivotal moments in European history like the Renaissance would have not been possible without the crucial contributions of financiers like the Medici family of Florence. This powerful banking clan has since been known as the "godfathers of the Renaissance" for their patronage and sponsorship of the arts, architecture, and science.[80] With their immense wealth and influence in politics, Italy blossomed in the cultural rebirth, and as a result, the rest of Europe later on experienced its first steps in ascending out of medieval feudalism. As a result, the West ushered in a new age of discovery, technological advancement, commercial revolution, and cultural development to rival and eventually surpass the rest of the world, including in its capacity to wage war and manufacture new weapons.[81]

Other economic practices such as mercantilism allowed governments to create policies that will increase national wealth through "developing the productive capacities of colonies"[82] or "use their economies to augment state power at the expense of other countries." The practice of mercantilism also meant that "governments sought to ensure that exports exceeded imports and to accumulate wealth in the form of bullion (mostly gold and silver)." The role of private investors and financial institutions has been central to the rapid transformations of Europe, including the gunpowder revolution, which in turn

[79] Parker, 17.
[80] New World Encyclopedia, ed., "Medici Family," New World Encyclopedia, November 8, 2022, https://www.newworldencyclopedia.org/entry/Medici_family.
[81] Stearns, 466; 586-587.
[82] Parker, 17.

contributed to the military divergence.[83]

Mercantilism demonstrates how important governments were in fostering and facilitating the creation, growth, and strengthening of overseas empires. In contrast, the Ming Dynasty canceled the state-sponsored voyages largely because there was no monetary return being made on the massive expenditures required for sailing such a colossal fleet manned by tens of thousands of sailors and soldiers. The voyages of Zheng He in addition to a number of monumental public works being funded by the government in the early fifteenth century Ming Dynasty created an economic strain on the entire empire.[84]

The same government, conservatively inward-looking and fundamentally agrarian as per Confucian tradition, even went as far as to prohibit ocean-going trade for its own private citizens as early as 1402, before the epic voyages even began.[85] This issue will be further discussed in the next sections. For Europe, "state building, imperial expansion, and overseas commercial ventures reinforced one another, as economic elites joined forces with monarchs, ministers of state, and legislative bodies in undertaking colonial ventures." In other words, the pursuit of colonial empire meant big business for multiple industries across Europe and further encouraged the pushing of Europe's colonial frontiers.[86]

Existential Warfare Stimulates Innovation

[83] Encyclopaedia Britannica , ed., "Mercantilism," Encyclopædia Britannica, accessed on December 15, 2023, https://www.britannica.com/money/topic/mercantilism.
[84] Sally K Church, "Chapter 22 Investigating Zheng He's Ships: What Is Known and Knowable?," essay, in *Ming China: Courts and Contacts 1400-1450* (London : The British Museum , n.d.), 197–205, 197.
[85] Kenneth M. Swope and Edward L Farmer, "The Ming As a Eurasian Power," in *The Ming World* (London: Routledge, 2021), 416.
[86] Parker, *Interactions*, 18.

War is perhaps the most powerful stimulant for the advancement of military technology and most of it occurred in Europe more than anywhere else during the fifteenth and sixteenth centuries. Although it was a time of great transition in the Renaissance, it was also plagued by constant existential warfare between emerging and fledgling nation states. It was also constantly threatened by the Ottoman Empire to the east, having had to repel two attempted invasions at Vienna. "European military prowess grew largely from technological advances made by the major powers as they fought one another almost incessantly throughout the Renaissance era."[87]

It is during the span of the Renaissance that the major advances in gunpowder weapons take place. Major conflicts between European powers occurred during these two centuries, on top of their continuing struggle against Muslim powers such as the Ottomans. Participants vied against each other as a matter of survival, territorial expansion, and the installation of colonies abroad. Even European Christendom itself faced violent internal conflict as Protestant monarchies contended with Catholic ones over converts and conquests overseas.[88] In East Asia, the only other gunpowder nation that developed its own sophisticated gunpowder weaponry prior to European contact was Korea during the Joseon Dynasty which maintained peaceful and submissive relations with the Chinese Ming Dynasty.[89] Japan, however, did not employ gunpowder weapons until its encounter with the Portuguese in 1543 after which copies of matchlock arquebuses were mass-manufactured for use in the battlefield during its ongoing civil

[87] "The Military Revolution and European Expansion," American Eras, *Encyclopedia.com*, accessed on September 5, 2023, https://www.encyclopedia.com/history/news-wires-white-papers-and-books/military-revolution-and-european-expansion.
[88] Stearns, et al., *World Civilizations*, 468.
[89] Sebastien Roblin, "'missiles' Have a Centuries-Long History in Korea," The National Interest, July 21, 2020, https://nationalinterest.org/blog/reboot/missiles-have-centuries-long-history-korea-165156.

war.[90]

Sophisticated triggering mechanisms such as the matchlock system were invented in Germany by the 1400's[91] where at the same time most Chinese gunners were still manually lighting the touch-holes on their hand cannons or otherwise used aforementioned serpentine levers to direct the burning cordage into the fuse.[92] China would not adopt the matchlock mechanism or the musket until European contact in the sixteenth century. Furthermore, Europeans even improved the gunpowder itself through a process called "corning" which allowed ball bullets to achieve "supersonic bullet velocity to increase range and killing power."[93] There may be evidence that the Chinese have corned gunpowder prior to contact with Europeans but it is still circumstantial.

In short, by this time, European guns were more powerful, more accurate and reliable, had greater range, and were larger than that of the Chinese. This state of affairs also directly affected the way the civilizations conducted battle. In China, traditional units like archers and spearmen remained to be the bulk of the fighting forces supported by gunners. In early modern Europe, musketeers and cannoneers gradually became the military's backbone where infantrymen exchanged musket volley fire from across the field more and more often. "Even if primitive Renaissance-era firearms rarely proved decisive in open battles, their effects on European warfare were nonetheless far-reaching."[94] Arbalists and archers would soon become obsolete with the mass implementation of the musket and arquebus in the battlefield as ball bullets had far

[90] Samuel Jay Hawley, *The Imjin War: Japan's Sixteenth-Century Invasion of Korea and Attempt to Conquer China* (Lexington, Kentucky: Conquistador Press, 2014), 5-7.
[91] Lorge, *Asian Military Revolution*, 15.
[92] Needham et al., *Chemical Technology*, 425.
[93] Needham et al., 425.
[94] "The Military Revolution and European Expansion," American Eras, *Encyclopedia.com.*

greater effective range and penetrating power than a crossbow bolt or arrow.

Numerous tests conducted and documented online to demonstrate the effects of projectiles against medieval plate armor have consistently shown that bullets fired from even early matchlock firearms had little difficulty penetrating most steel plate. One such example came from historical documentary channel "Modern History TV".[95] On the other hand, one tester found that arrows and bolts shot from even the heaviest crossbows left mere dents and dimples.[96] Secondly, years of training and strength conditioning were required to become proficient as an archer whereas only several weeks of drilling were enough to become an arquebusier.[97]

In China, the Ming Dynasty ruled with absolute power. The empire generally enjoyed *relative* peace, security, and prosperity between the fourteenth and seventeenth centuries. The Ming's major military engagements after China's reclamation from the Mongol Yuan Dynasty were limited to short bursts of conflicts with offensives against the Mongols in the frontiers, defense against Asian pirate coalitions along the coast, a few skirmishes with the Portuguese and the Dutch, and an invasion of Korea by Hideyoshi in 1592 and again in 1598 in which the Ming came to Korea's defense.[98]

In spite of several military engagements and violent rebellions towards its end, the Ming largely enjoyed growth, stability, and peace in the near three centuries it ruled over China. Even Tonio Andrade writes in regards to the advancement of firearms being stimulated by war that "after 1449, China entered an era of relative peace while Europe

[95] Modern History TV, "Medieval 100 Cal! Blackpowder Impact! How Effective Were Early Guns in the Medieval Period?," YouTube, July 20, 2018, https://www.youtube.com/watch?v=kEPG98tTIlU.
[96] John Fortune et al., "Ancient Tank Tech ," episode, *Ancient Discoveries* (History Channel, November 6, 2008).
[97] Hawley, *Imjin War*, 9.
[98] C.J. Peers, *Soldiers of the Dragon*, 191, 194-196, 212-213.

entered a period of sustained intense, existential warfare."[99] Andrade goes on to emphasize that the type of wars engaged in Europe "threatened the very existence" and "survival of the states involved", and thus was a major contributor to Europe's drive for innovation and advancements in guns and cannons. He writes that for China, such a period of sustained, intense, existential warfare occurred between 1200 and the mid-1400's—the same era when Chinese gunpowder weapons advanced and reached their zenith.[100]

Though the Ming Dynasty is often praised as a stable and secure era, it nonetheless engaged in "some 275 large and small wars… from 1368 to 1643,"[101] according to the findings of historian Fan Zhongyi, as mentioned by historian Kenneth Swope. Data revealing these aggressive engagements demonstrate that the Ming Empire was rather militarily aggressive, contrary to popular conceptions about the dynasty. Why, then, did this continual state of military aggression/engagement not trigger it's military's technological advancement in the Ming Empire the way it did in Europe?

Tonio Andrade writes that the aforementioned intense existential wars in China occurred during the Ming Dynasty's period of imperial expansion and consolidation from its beginning in 1368 until the death of the last martial emperor, Yongle (Zhu Di) in 1424, and again in 1449 in the Tumu Crisis against the Mongols. Based on Tonio Andrade's explanation, firearm advancement then reached a plateau as such types of existential warfare ceased to occur despite continued military aggression in smaller conflicts throughout the duration of the dynasty.[102]

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[99] Andrade, *The Gunpowder Age*, 104.
[100] Andrade, 104.
[101] Swope, *Dragon's Head*, 17.
[102] Andrade, *Gunpowder Age*, 113.

The extended period of intense, existential warfare in Europe had multiple overlapping triggers that created conflicts over a period of two hundred years. Between 1500 and 1700, according to historian Paul Lockhart, "there were, perhaps, only twenty-four months of peace." Europe's great dynastic states had become increasingly wealthy and aggressive by the sixteenth century and were thus more willing to pursue their geopolitical interests with military force, especially with their access to newer artillery technology.[103]

Such an era was described by Lockhart as having begun with Charles VIII's 1494 invasion of Naples, Italy to claim the throne, thus heralding "a new age in international relations in the West: an age in which the territorial aggrandizement and the application of brute force for the sake of naked dynastic self-interest would become the common currency of European international politics." With the Protestant Reformation, increasing hostile competition among the nation-states, and the scrambles to explore the new world and start colonial empires, an intense arms race overtook much of the European continent. As a result, armies grew, formal organized navies were for created for the first time, fortifications became more impregnable, and artillery matured in design and increased in size and number. [104]

Lockhart describes the political atmosphere in Europe at that time as "apocalyptic" and borderline paranoid as many among even the elite believed the end of days was truly nigh and anticipated the arrival of the Anti-Christ. The very same fear triggered the advancements of European navies, shipbuilding, and guns. There was a sort of dread of becoming overwhelmed and destroyed by more advanced enemy states and

[103] Paul Lockhart, *Firepower: How Weapons Shaped Warfare* (New York, New York: Basic Books, 2022), 49.
[104] Lockhart, 48.

not having been able to keep up with rivals, but Lockhart explains that national prestige was also on the line, and contributed to the fervor of the ongoing arms race of the sixteenth century. [105]

[105] Lockhart, 49.

Chapter II.

Factors in Imperial Chinese Firearms Stagnation

Scholars of the Military Revolution and the divergence between China and the West often cite the stimulating factors that propelled European military technology to the forefront of innovation and advancement. From the walls used in their fortifications to the constant engagement in existential warfare, European nations had many reasons to advance and adapt, or simply become extinct. In the case of imperial China, particularly during the Song, Ming, and Qing dynasties, a number of unique circumstances and political contexts caused the stagnation, plateau, and even the regression of weapons development, which includes fluctuations in the quality and political status of its military. A number of socio-political, geopolitical, and even cultural factors thwarted continued innovations in gunpowder weaponry in China, but in-depth investigations into its long military history are needed to provide further context.

Song Dynasty Warfare and China's Traditional Enemies

China's traditional enemies have always emerged from the surrounding wilderness regions, mainly the northern steppes, since the era of the Shang (1600-1050 BCE). It is in these steppes that the Xiongnu (a confederation of tribal horse nomads) and much later, the Mongols, would build their domains and rise to consistently challenge Chinese territorial sovereignty and regional supremacy. These warrior nomads periodically harassed and attacked China's frontier regions since before the imperial

era.[106]

Such tumultuous periods were followed by pacifying and volatile trade relations as with the Han Dynasty and the Xiongnu peoples who demanded high-quality Chinese goods. Emperor Wu of Han sent large military expeditions into the frontier regions and beyond to confront the Xiongnu until the expansion of the Han Empire caused their threat to eventually recede.[107] Martial emperors and specific periods of expansionism aside however, ancient Chinese foreign policy generally tended to prefer the construction of a series of walls over the course of different dynasties in an attempt to keep away the warrior nomads from the steppe. Not to be confused with pacificism, this simply demonstrates the sense of responsibility to protect their ordained territory (the empire) and their political sovereignty even through military force.[108]

China's Song Dynasty (907-1276 CE) brought Chinese civilization to a zenith. This proto-industrial golden age was marked by technological innovation, commercial and economic revolutions, growth of urban centers, population explosion, introduction of paper currency and financial institutions, expansion of overland and maritime commerce and trade, and overall prosperity on many levels of society.[109] With this era of innovation came advances in military technology. It was in the Song that the first gunpowder weapons were conceived and deployed on the battlefield. The first cannons and bombs, though crude, were created due to high demand for the empire's defenses and had seen

[106] Patricia Buckley Ebrey, *The Cambridge Illustrated History of China* (Cambridge: Cambridge University Press, 2010), 23, 68-69.
[107] Ebrey, 69.
[108] Feng Zhang, "Confucian Foreign Policy Traditions in Chinese History," *The Chinese Journal of International Politics* 8, no. 2 (April 13, 2015): 197–218, https://doi.org/10.1093/cjip/pov004.
[109] Hok-Lam Chan. "Commerce And Trade In Divided China: The Case Of Jurchen-Jin Versus The Northern And Southern Song." *Journal of Asian History* 36, no. 2 (2002): 135–83. http://www.jstor.org/stable/41933296.

"the perfection of the metal-barreled cannon in the mid thirteenth century."[110]

The Song Dynasty was surrounded by rivals and enemies from many sides of the northern, eastern, and western frontiers. The Khitans with the Liao state, the Jurchens with their Jin Dynasty in northern China, and the Tanguts who created an independent dynasty called the Xi (Western) Xia, carved territories on all sides of the frontier that overlapped with Chinese territories, causing the Song Empire to become an "embattled state."[111] These foreign-controlled territories made use of Chinese administrative personnel, systems, and infrastructure while ruling mixed populations of mostly Han Chinese. However, constant struggles against these foreign powers from the outer regions stimulated the development of gunpowder-based weapons in the Song Empire. While peacekeeping actions were made to the Khitan Liao and the Tangut Xi Xia in the form of pacifying payments, the Song nevertheless made substantial increases to its military expenditures for arms, armor, and the first innovations in gunpowder weapons.[112]

Such military advantages, however, were short-lived as the Song's enemies captured engineers and craftsmen and "set them to producing to comparable weapons and tools."[113] The enemies and rivals that surround the Song from the northern steppe, the central Asian plains, and the deserts beyond come from tribal nomadic or semi-nomadic equestrian nations that relied on the horse and bow as their primary means of hunting and warfare. This was especially the case against their greatest existential threat yet—the united Mongols under Chinggis Khan.[114]

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[110] Geoffrey Parker, *The Military Revolution: Military Innovation and the Rise of the West, 1500 - 1800*, Second (Cambridge: Cambridge Univ. Press, 2016), 83.
[111] Ebrey, *China*, 68.
[112] Ebrey, 138.
[113] Ebrey, 138.
[114] Ebrey, 164-169.

Just like the Mongols, however, the other neighboring powers surrounding the Song were hunters, farmers, and steppe nomads whose expertise were in horse archery and the mobilization of cavalry forces. As a result, the fighting forces of these rival powers, like the Jurchens, consisted almost entirely of mounted warriors who fought in the open battlefields. "The horsemanship, archery skills, and great mobility of the Jurchen army proved far superior and an ominous warning of what steppe cavalry might achieve in the region in the coming centuries [(in reference to the Mongol invasions of the Song)]."[115] In the end, the Mongols managed to conquer the Jin before proceeding to turn their attention to the Song Dynasty which managed to resist them for nearly fifty years.[116] In China's case, combating the frontier "barbarians" required meeting mounted forces with its own battle mounts. The Ming Dynasty, according to Dr. Kenneth Chase, even relied heavily on Mongol auxiliaries to compensate for the inadequacies of its mounted forces.[117]

Being the original inventors, China during the Song Dynasty was thus the only nation in the twelfth century that utilized gunpowder for warfare until the Jurchens and the Mongols adopted the technology to their own advantage. Historian Peter Lorge says that such weapons were only useful besieging cities and fortifications, and were far less effective in the open battlefield being somewhat crude and cumbersome. Premodern cannons were weak in the battlefield as Lorge wrote "the open field weakness of early gunpowder weapons was avoided by using them on ships and fortifications" and that the Song was "not involved in any conflicts in which those weapons would have been

[115] Mark Cartwright, "Jurchen Jin Dynasty," World History Encyclopedia, October 6, 2017. https://www.worldhistory.org/Jurchen_Jin_Dynasty/.
[116] Lorge, *Asian Military Revolution*, 29.
[117] Kenneth Warren Chase, *Firearms: A Global History to 1700* (Cambridge: Cambridge University Press, 2009), 36.

decisive."[118]

Battles during the Jin-Song Wars and the Mongol invasions were generally characterized and determined by the number and quality of the horses and cavalry units deployed on the battlefield. As a matter of fact, "the Song were lacking in cavalry due to their failure to secure adequate areas to raise horses from the Khitan Liao and the Tanguts. Since the Song lacked adequate cavalry, they developed weapons, tactics and training for their infantry to counter heavily armored enemy cavalry formations."[119] The breeding and use of horses for military purposes were given paramount importance even more so than the production of guns given how crucial they were to the defense of the empire against "barbarian" enemies.[120] To summarize the main idea of this section, the nature of China's enemies and the kind of warfare needed to be conducted to repel them called for a cavalry/ mounted-unit response, and thus did not stimulate the continued advancement and innovation of firearms until civil wars for reunification began once again during the end of the Mongol-led Yuan and the installation of the Ming Dynasty.

The Song Dynasty's level of development of gunpowder weapons, for defense or for siege, was determined by its usefulness against enemies which were dependent on highly mobile mounted units. No other civilization or empire challenging China's sovereignty invented and manufactured advanced gunpowder weaponry to stimulate further innovations and battlefield applications. Peter Lorge himself says that "early guns were not very effective against the threat of steppe armies, or at least not effective enough to shift dramatically the balance of military power between the steppe and sedentary

[118] Lorge, 42, 44.
[119] Sandra Alvarez, "The Mongol Siege of Xiangyang and Fan-Ch'eng and the Song Military," De Re Militari, May 11, 2014, https://deremilitari.org/2014/05/the-mongol-siege-of-xiangyang-and-fan-cheng-and-the-song-military/.
[120] Alvarez.

polities, there was no particular urgency in improving guns."[121] This lack of competition and applicable deployment, we may conclude, contributed to an early stagnation in firearms development until the formation and expansion of the Ming Dynasty in the fourteenth century when the aforementioned existential wars took place. The period of conquest and consolidation for the Ming (in which it saw existential warfare) is when it saw the last era of domestic firearms and gunpowder weapons innovation.

It is worth mentioning, however, that historian Tonio Andrade challenges the depth the impact of China's traditional enemies stagnating Ming firearms. He cites multiple examples of the Ming's awareness of the effective use of firearms in defending against Mongol incursions as well as the weapons' deployment into the steppes. Ultimately, Andrade says that the hypothesis still has credence, but not to the extent put forth by Kenneth Chase. According to Andrade, the Ming plateaued in their innovations in guns and firearms simply because, in the context of warfare with its frequency, severity, and its technological demands, there was no need to advance them.[122]

The Ming Dynasty and its Relevance on the World Stage

The Ming Dynasty has already been referenced many times throughout this thesis as it was the ruling empire and dynasty of China at a time of great transition and globalization for the world. While the Europeans entered the Renaissance and engaged in continuous existential warfare, the Ming had already established itself in China as the unchallenged political and military authority of the Asian world order. When the Portuguese and the Spanish ignited the "age of exploration" in the late fifteenth century,

[121] Lorge, *Asian Military Revolution*, 26.
[122] Andrade, *Gunpwder Age*, 112.

"[the Ming was] the most populous, wealthiest, and potentially the most powerful polity of its time."[123] For approximately the first century of its existence, the Ming Dynasty was a leader of gunpowder warfare development until Europeans (specifically the Portuguese) proved their technical superiority in the matter by the early years of the 1500's and the Chinese adopted Western weapons forthwith.[124]

However, gunpowder and the manufacturing of guns and cannons were considered state secrets, and therefore such knowledge of the technology was fiercely guarded. Regarding this matter, Peter Lorge writes "knowledge of gun and gunpowder making became more restricted outside of the military, and bureaucratic controls were placed on who within the government had access to that information."[125] Such policies had even greater implications. According to the text *World Civilizations*, "the Chinese scholar-gentry limited innovations in gunpowder weaponry and its use in warfare because they feared that these changes would lead to the dominance of the military in Ming and later Qing society."[126] In other words, the civil bureaucracy maintained fears of a powerful military bureaucracy that could otherwise threaten their prime status and position in the imperial government.

The first several decades of the Ming Dynasty saw a high status and power placed upon the military bureaucracy over that of the civil officialdom, having been founded by a martial emperor who depended upon his army for the Ming's conquest and consolidation of power in China. After the years of the early Ming, officials and even emperors grew apprehensive about the military and its potential to threaten their own

[123] Swope and Farmer, 409.
[124] Andrade, *Gunpowder Age*, 104, 141.
[125] Lorge, *Asian Military Revolution*, 71.
[126] Stearns et al., *World Civilizations*, 586.

power within the government. According to the late Ming historian Dr. Edward L. Dreyer, the military administration and institutions enjoyed greater political influence and leverage than the civil bureaucracy which had once provided financial and logistical support for the former during the early decades of the Ming. However, a change or even reversal of this state of affairs was made in the early fifteenth century after the death of the last martial emperor, Zhu Di (Yongle Emperor). This reversal caused the military establishment to become more subordinate to the increasingly assertive civil bureaucracy and caused their influence, effectiveness, and overall status in the imperial government to suffer.[127]

The scholar-gentry and the elites of officialdom maintained the highest control and influence in the politics, society, and culture of the Ming. This means that many prospective officials among the scholar gentry aimed for a lofty position in government by working their way up the meritocratic imperial bureaucracy by way of civil service examinations. Through this system, the best test-takers earned the highest government offices. This, in turn, meant that the literati who wished to be promoted focused primarily on studies revolving around a Confucian education (with a core on the Four Books and Five Classics) instead of technical knowledge like the sciences.[128] Military personnel were therefore regarded as nothing more than "technical support staff" for lofty officials who had passed the civil service examinations.[129]

The subsequent low status of soldiers during the Ming detracted from the effectiveness of its military. Historian C.J. Peers writes about the consequences of such a

[127] Edward L. Dreyer, *Early Ming China: A Political History, 1355-1435* (Stanford, CA: Stanford U.P., 1982), 6.
[128] Hawley, *The Imjin War*, 29.
[129] Hawley, 36.

civil-official centrism in Ming government: "After about 1400 Chinese military technology began to stagnate – a consequence of the low status of soldiers, the lack of sophisticated enemies to stimulate development, and the suspicion with which emperors… regarded innovations, especially those which might weaken the power of the state." As a result, military careers in general were held in low esteem in the Chinese social hierarchy, a hierarchy which favors those who were educated in the classical Confucian education system in order to enter esteemed careers in government.[130]

As was usually the case during the Ming Dynasty, government policies were opposed to any sort of "innovation" that could threaten the status quo or the current political establishment. Ultimately, the results of these policies together with the lowered status of the army contributed to the overall decline of the Ming Dynasty's military and a decrease its effectiveness after the reign of the Yongle Emperor. It wasn't until brief revivals under General Qi Jiguang and the Wanli Emperor in the mid-late sixteenth century that the army saw renewed strength and prestige to a large degree in order to combat rampant piracy along the coastlines as well as during the campaigns to aid Joseon Korea during the invasions of Japanese warlord Toyotomi Hideyoshi.[131] And because military matters were generally, though not always, held in such low regard by the civil officialdom, technical matters essential for the advancement military technology were not given necessary precedence.

As a result, fields of study outside of anything that will help them earn advanced degrees or get promoted in careers in their government careers were held in low regard. The Chinese History Manual by Endymion Wilkinson provides further perspectives on

[130] Peers, *Soldiers of the Dragon,* 185.
[131] Swope, *Dragon's Head*, 21, 22.

the official attitudes towards practical knowledge and writes: "most members of the educated elite did not pay much attention to technical subjects, let alone study or write about them, because they were no help in getting ahead in the official world." Wilkinson goes on to provide further examples to demonstrate this claim, saying that some of China's notable mathematicians and inventors, for example, remained rather obscure during their time because they were not counted as members of the scholar-gentry and were most probably among those who had failed their examinations a number of times.[132]

In other words, men who did not hold titles as prominent scholars or officials received little to no attention regardless of their contribution or accomplishment. One such example is that of Bi Sheng, the inventor of movable type printing, who lived during the Song Dynasty nearly four hundred years before Johann Gutenberg. Wilkinson writes that "he was a wealthy businessman and craftsman and not a scholar" and was therefore mentioned only briefly and identified as a commoner in contemporary writings. Such is one of the major reasons, Wilkinson says, that the likes of Bi Sheng are rather obscure despite what he had accomplished as the first inventor of movable type. Perhaps his name may have been better known in Chinese history if held the necessary prestigious titles. [133]

Yet another example was seen from Song Yingxing, the author of a Ming handbook on technology who "concluded his preface by warning, 'an ambitious scholar will undoubtedly toss this book onto his desk and give it no further thought: it is a work that is no way concerned with the art of advancement in officialdom.'"[134] Minor exceptions to this disregard for the natural sciences were granted for disciplines like

[132] Endymion Porter Wilkinson, *Chinese History: A New Manual* (Cambridge, MA: Harvard University Asia Center, Harvard University Press, 2015), 469.
[133] Wilkinson, 469.
[134] Wilkinson, 469.

mathematics, astronomy, and medicine which Wilkinson says sometimes received "imperial patronage" since all three were essential to the emperor's personal affairs and as well as official imperial rites throughout most of Chinese history.[135]

This general lack of interest in domestic science and technology, I argue, would result in a negative impact on the potential for China to conduct further research and experimentation in order advance their military technology, explaining why and supporting the reasons for China's scientific stagnation. This in conjunction contributed to causing the military divergence. Thus, being ignorant of the sciences, scholars who wrote on martial affairs during the Ming demonstrated a degree of incompetence on the subject of war and weaponry. The following paragraphs demonstrate.

As Joseph Needham himself writes, "During the following couple centuries, the knowledge of firearms was a 'restricted' item in the Ming dynasty. Hence scholars were not sufficiently acquainted with guns and cannon to deal with them adequately in their writings."[136] It was not until the arrival of Europeans, namely the Jesuits like Matteo Ricci, that Chinese interests in mathematics and the sciences were piqued. These European missionaries won favors among some of the scholar-officials through displays of modern Western astronomy, mathematics, and other sciences, all of which had been proven to have already surpassed that of China's in their development and calculative accuracy.[137]

In comparison to contemporaneous empires the early modern era, however, China was relatively isolated after it canceled the epic voyages organized by the visionary Yongle Emperor. Trade and any other form of interactions with foreigners were relegated

[135] Wilkinson, 469.
[136] Needham et al., *Chemical Technology*, 310.
[137] Stearns et al., *World Civilizations*, 615.

to the port city of Guangzhou, the southern coast's gateway to the Ming Empire.[138] While receiving tribute missions from Joseon Korea and the Ashikaga Shogunate of Japan, the Ming's foreign interactions with other nations, particularly the expanding Europeans in the sixteenth and seventeenth centuries were that of limited trade and military encounters. The Ming, however, did maintain a certain degree of awareness of other nations and empires to the West, as historian Edward L. Farmer writes. But the conservative Confucian political culture and its tendencies towards a more isolationist foreign policy left China ignorant of the rising technological capacities of its contemporaries like that of the Ottomans and the Western European states.[139]

The Ming's founder, Zhu Yuanzhang, laid the foundations for the Ming's particular preference for more "introverted" policies apart from Confucian traditions. He strictly forbade foreign military ventures and expansionism, writing in his Ancestral Instructions, directed to his descendants, saying in the fourth article: "As they [foreign barbarians] are not a threat to China, should we rashly send forces to attack them, it will also be inauspicious for us. I fear that later generations of my offspring will rely on the wealth and power of China, and, coveting a momentary martial glory, will rally forces without provocation, at great cost to human life. Always remember that this is forbidden."[140] This policy was generally heeded by succeeding emperors with one notable exception with Zhu Yuanzhang's fourth son, the Crown Prince of Yan, Zhu Di, who would usurp the throne to become the third Ming Emperor in the late 1300's. It was Zhu Di (the Yongle Emperor) who commissioned the Treasure fleet to embark on seven

[138] John E. Wills and J. L. Cranmer-Byng, *China and Maritime Europe, 1500-1800: Trade, Settlement, Diplomacy, and Missions* (Cambridge: Cambridge University Press, 2011), 20.
[139] Swope, Kenneth M., and Edward L Farmer. 2020. "The Ming As a Eurasian Power." Chapter. In *The Ming World*, 409. Routledge, 410.
[140] Farmer, *The Ming World*, 415.

epic voyages of led by the eunuch admiral Zheng He to project the power of the Ming Dynasty to the known world.[141]

It was Zhu Di who embraced guns and gunpowder technology, expanding its use and application in the Ming military far beyond that of his father who himself had utilized the technology heavily in the Ming's conquest and consolidation in China.[142] It was during the reign of Emperor Zhu Di that Ming military might and naval prowess was flexed on the world stage as the seven epic voyages of the mighty Ming Treasure Fleet navigated the great trade routes of the maritime Silk Road. Otherwise known as the Indian Ocean Trade network, these flourishing trade routes stretched from East Africa all the way to the Malay Archipelago and Indonesia. Through these campaigns of power projection from the years 1405-1433, China asserted its authority, establishing a Sino-oriented world order for Asia.[143]

The fleet was impressive and was comprised of hundreds of vessels—large nine-masted treasure ships purportedly 450 feet in length (though such dimensions are contested by some maritime historians and shipbuilding engineers as impossible) though realistically, some scholars say it was most probably 250 feet.[144] Additional ships include a host of five-masted warships, troop and horse transports, and supply ships carrying grain. As many as 27,000 to 28,000 thousand soldiers and crew manned the ships as they sailed around the known world.[145] It was, without a doubt, the greatest and most powerful, heavily-armed navy in the fifteenth century, unrivaled, perhaps until the

[141] Hing Ming Hung, *From the Mongols to the Ming Dynasty: How a Begging Monk Became Emperor of China, Zhu Yuan Zhang* (New York, NY: Algora Publishing, 2016) 204, 246.
[142] Swope, Kenneth M., and Tonio Andrade. 2020. "How Yongle Learned to Stop Worrying and Embrace the Gun Perspectives on early Ming military history." Chapter. In *The Ming World*, 71. Routledge.
[143] Parker. *Global interactions,* 70-73.
[144] Sally K Church, "Chapter 22 Investigating Zheng He's Ships: What Is Known and Knowable?," essay, in *Ming China: Courts and Contacts 1400-1450* (London : The British Museum , n.d.), 197–205, 197.
[145] Church, "Zheng He", 198.

Spanish armada of 1588 or even the nineteenth century Royal Navy after the Napoleonic Wars.[146]

One such example of the great Ming Empire's assertion of power abroad occurred in 1410 or 1411 upon Eunuch Admiral Zheng He's arrival at Ceylon (present-day Sri Lanka). The island nation's Singhalese people had been embroiled in wars against the Tamils of South India and a Muslim usurper trying to install Islam as the primary religion. The island's leading warrior chief against the Tamils was Alakeswara who soon harbored ambitions of seizing Ceylon for himself away from the legitimate royal family at the capital city of Kotte. It was Alakeswara who made contact with Zheng He upon the eunuch admiral's arrival and it was he who refused to pay tribute to the Ming. [147]

Ultimately, the warrior chief beat the Chinese back to their ships and the Ming Treasure Fleet continued on its trade and tribute-exacting missions in Quilong, Cochin, and Calicut. The Ming returned with a vengeance, however, and according to the Chinese account of the event, Alakeswara tried to exact tribute from Zheng He and when the latter refused, he sent fifty thousand troops to try to take the Treasure Fleet. This left the capital city of Kotte undefended, allowing Zheng He to send a force of 2,000 troops (out of the 27,000 total with the rest of his fleet) to go to Kotte and capture Alakeswara along with his family and many officials. The Ming troops repeatedly beat back the Singhalese (who returned to the city to try to stop the Ming) over the course of six days before making it back to the fleet and escaping, where they took Alakeswara to the capital city of Nanjing to be judged by the emperor. As a result, the rightful ruler Parakramabahu VI and royal

[146] Kyle Mizokami, "5 Most Powerful Navies of All Time," The National Interest, July 12, 2015, https://nationalinterest.org/feature/5-most-powerful-navies-all-time-13311.
[147] Louise Levathes, *When China ruled the seas: The treasure fleet of the dragon throne, 1405-1433* (New York: Oxford University Press, 2007), 114.

house was reinstalled over Ceylon at the full backing of the Ming Empire. Sri Lanka maintained peaceful trade and diplomatic tribute relations with the Ming Dynasty in the years that followed.[148]

Shortly after Zhu Di's death in 1424 and after one final voyage in 1433, the Treasure Fleet was dismantled and the voyages were canceled. The new Hongxi Emperor and later, the Xuande Emperor returned to the isolationist policies of the Ming's founder, and to the satisfaction of the conservative Confucian officials in the court who understood the overwhelming costs of funding such voyages. The government then focused on fortifying its defenses in the north and to focus on issues within the empire itself.[149]

The scholar-officials of the government had always been opposed to the voyages of Zheng He which ran in conflict with old political traditions, and served to increase the power of their political rivals, the eunuchs.[150] One can only surmise the course of history and the changes in the global world order had China not canceled the voyages of the Treasure Fleet. Perhaps the Europeans some eighty years later would have been far more hesitant, if not far less audacious, to pursue their colonial conquests in the century that followed if they had laid eyes on the Ming Empire's immense treasure ships and the heavily-armed warships. Such a scenario will be forever left to the imagination.

The Ming-Kotte war is but one of several other incidents during these voyages in which the Ming Empire demonstrated its imperial might to the known world—a proactive display of assertiveness China would never exercise again for the rest of its imperial

[148] Levathes, 114-115.
[149] Jiangshan Wang et al., eds., *Imperial China: The Definitive Visual History* (New York, NY: Dorling Kindersley Publishing and Encyclopedia of China Publishing House, 2020), 209, 224.
[150] Stearns et al., *World Civilizations*, 618.

history. It was at this time that China unwittingly abandoned its position as the global world economic and military power. The words of author Louise Levathes effectively articulate the consequences of ending these voyages:

> Half the world was in China's grasp, and with such a formidable navy, the other half was easily within reach, had China wanted it. China could have become the great colonial power, a century before the great age of European colonization and expansion… Within a hundred years the greatest navy the world had ever known had willed itself into extinction… The period of China's greatest outward expansion was followed by the period of its greatest isolation. And the world leader in science and technology in the early fifteenth century was soon left at the doorstep of history, as bourgeoning international trade and the beginning of the Industrial Revolution propelled the Western world into the modern age.[151]

Had the Ming Dynasty found alternative means to maintain the Treasure Fleet, if not continue the voyages, maritime dominance may not have been so lopsided in favor of the Spaniards, Portuguese, and later, the Dutch, the French, and the British. Through the creation of its own inward-looking policies and the cancellations of both the fleet and the voyages, the military divergence was inevitable. The voyages drained Ming imperial coffers and such government-funded voyages were too expensive to fund without getting immediate economic benefits in return. Demonstrations of one's power and the exacting of tributes did not cover the costs of the show of force.[152] This is in sharp contrast to the state of affairs in Europe where the aforementioned private institutions, capitalism, and mercantilism helped to fuel the continued voyages across the seas and facilitate colonial imperial expansion.

The sovereignty of a Ming-oriented Asian world order was finally defended in the 1590's during the Imijn War when Japanese warlord Toyotomi Hideyoshi invaded Korea in an attempt to conquer China. Such bold campaigns of conquest were halted with a

[151] Levathes, *When China Ruled*, 20.
[152] Jiangshan Wan et al., 223.

Ming-Korean (Joseon) military alliance when Ming land forces came to the aid of Joseon and beat back the Japanese from 1592 to 1598.[153] As this paper will demonstrate, however, upon the fall of the Ming this military divergence would only worsen and accelerate during the Qing Dynasty when the Manchu people seize control of China in 1644.

China's Relative Isolationism and its Effects on the Military Divergence

Imperial Chinese foreign policy did not seek territorial expansion by way of colonization in the manner of the Europeans. As previously noted, power-projection and the exacting of tributes from foreign nations alone were the objectives of the Treasure Fleet, and this was largely the case before and after the epic voyages. The native Chinese governments of the imperial era sought to secure their territory and would rather build walls and fortifications to keep barbarians out than to subdue peoples beyond the mountains, deserts, and the seas.

"The Middle Kingdom" which was considered to be "All Under Heaven" is the name given to China, and the prevailing belief since the time of Confucius in the sixth century BC was that anything beyond the borders of the Middle Kingdom was not worth exploring or conquering. Since the Warring States era, "there was a strong feeling of Chinese identity and of a divide between civilized China and the 'barbarous' regions that surrounded it."[154] China was flanked by vast steppes to the north, deserts to the west both populated by "wild" men and horse nomads, mountains to the southwest, and a vast Pacific Ocean to the east.

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[153] Kenneth Swope, *A Dragon's Head*, 87, 150.
[154] Tim Marshall, *Prisoners of Geography: Ten Maps That Explain Everything about the World* (New York, NY: Scribner, 2016), 43.

Imperial Chinese politics, influenced by Confucian teachings, placed high importance on securing the borders of Chinese territory and to not look beyond any further for exploits and conquests. It is from the teachings of Confucianism, the basis of imperial Chinese political doctrine since the Han Dynasty, which this tradition of isolationism originates, only to be reinforced by the policies put in place by the first Ming emperor. Confucius, with his emphasis on familial obligations, preached staying close to parents to care for them and taught that the a life spent in search of profits over righteousness was not for the superior man.[155]

This mentality is also the reason why merchants, with their business of trading wares and goods created by others, were given the lowest social status in the Chinese social hierarchy, since Confucianism placed a low regard for the lifestyle regardless of the amount of wealth they had achieved from it. Europeans in contrast embarked on their colonial conquests to expand on trade and commerce and waged wars in order to dominate altogether. Charles Parker writes, "Confucian thought extolled the virtues of the soil, enshrining agriculture as the most noble of occupations" and that "trade was at best a necessary evil to be regulated."[156] In conjunction, the Ming Dynasty, with its relatively conservative Confucian government, placed restrictions on overseas trade and banned ocean-going commerce altogether for most of the dynasty, although such restrictions were relaxed during the reign of the Yongle Emperor and in its later years.[157]

The greatest episodes of imperial expansion occurred under the only two foreign dynasties to ever rule China—the Mongol's Yuan Dynasty and the Manchu's Qing

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[155] Confucius, *Analects: With Selections from Traditional Commentaries*, trans. Edward Slingerland (Indianapolis, ID: Hackett, 2003), 33.
[156] Parker, *Interactions*, 44.
[157] Roland L. Higgins, "Chapter 5: Deserts and Islands," in *The Ming World* (London and New York: Routledge, 2021), 105–6, 105.

Dynasty. Under the Ming isolationist policies, the court continued to receive tributes from neighboring countries nevertheless, such as Korea, Japan, Vietnam, and even the Sultanate of Sulu in present-day Philippines, while trade continued to be secluded to the port at Guangzhou. Nevertheless, it is interesting to know that Ming merchants and businessmen maintained numerous contacts and relations throughout Asia regardless of the official laws, which in themselves, were not strictly enforced. This resulted in the growth of many large Chinese populations and settlements across Southeast Asia, creating a Chinese diaspora that stretched to the Philippines, Sumatra, Malaysia, and Indonesia. These activities abroad were often found to be aligned with imperial interests and thus "while the Ming had prohibitions on Chinese traveling abroad, they were frequently willing to ignore these restrictions and welcomed the overseas Chinese," as Kenneth R. Hall writes.[158]

This traditional and conservative policy of isolationism, having found its roots in Confucian doctrine, caused China to become an inward-looking empire, as it turned a blind eye to a rapidly-changing and evolving world being shaped in the European image. Even as the Ming adopted and made copies of European firearms, the elements necessary to trigger continuous military growth and advancement (as seen in Europe) did not exist in its state of isolation, and as this paper demonstrates, inadvertently played a significant role in causing China to fall behind in military divergence.

China during the Ming was a time of great commercial revival and a blooming of the arts and culture. At the time, "the great commercial boom and population increase

[158] Kenneth M. Swope and Kenneth R. Hall, "Contested Histories of Ming Agency in the Java Sea, Straits of Melaka, and Bay of Bengal Region," in *The Ming World* (London: Routledge, 2021), 434–36.

that had begun in the great Song was renewed and accelerated."[159] However, the conservative Confucian socio-political culture, combined with the strict and omnipresent government regulating all aspects of life, created conditions that were not conducive to invention and innovation in China.

As a result, Ming society did not see the level of invention and early industrialization it experienced during the Song Dynasty, and the military also ceased to develop and advance its weapon technology beyond fourteenth century hand guns and cannons as a result. The fall of the Ming Dynasty began decades before its final collapse as the empire was beset by rebellion, famines, droughts, epidemics, and rampant political corruption from weak leadership in government.[160] Interestingly, Tonio Andrade lends less credence to the theory of conservative isolationism and government autocracy, saying that Sinologists today do not believe China at the time was as autocratic, isolationist, or conservative as previously perceived.[161]

[159] Stearns et al., *World Civilizations*, 613.
[160] Jiangshan Wan et al., *Imperial China*, 228-229, 233.
[161] Andrade, *Gunpowder Age*, 112.

Chapter III.

Shortcomings of the Manchurian Qing Dynasty

By the seventeenth century, the direct descendants of the Jurchens were later known as the "Manchus" and had conquered the whole of China when it usurped the Ming's rule in 1644 and established the Qing Dynasty, and only because they were officially invited through the Great Wall to help quell a rebellion. Such a decision was proven to be a fatal mistake for the dynasty as the Manchus overstayed their welcome and exploited China's weakness to take control of the empire for themselves.[162]

The Qing dynasty's rulers marked themselves unique and separate from mainstream Chinese society while having adopted Chinese government systems and customs to become more "Sinified" and keep the preexisting Confucian government systems in place. Under the Qing, China's territory expanded to its largest extent, annexing territories such as Tibet and Mongolia through the sheer size and power of its military. This military power included a strong musket corps and the heavy use of many European-styled cannons and artillery as demonstrated, for instance, in the sieges of Albazin in 1686 during territorial disputes with Russia.[163] Though severely outnumbered and outgunned, the elite Russian defenders managed to return and rebuild their fort after having been forced to surrender to Qing demands in 1685. In July of 1686, after heavy losses and a realization that the fort could not be held, Russia surrendered the territory.[164]

The Qing however, has been long regarded being weak and militarily backward in comparison to the West by the nineteenth century, as demonstrated by its devastating

[162] Stearns et al., 724.
[163] Andrade, *Gunpowder Age*, 219-222; Peers, *Soldiers of the Dragon*, 237-238.
[164] Peers, 237-238.

losses during the Opium Wars. China during the Ming and Qing dynasties was once highly regarded by Western observers for its size and grandness, but by the time of the Opium Wars in the 1800's, the West's technological superiority dictated Asia's geopolitical terms. "In the mid-nineteenth century, the Qing Dynasty, so strong under Kangxi and Qianlong emperors, declined rapidly."[165]

Along with this accepted narrative is the understanding that the Qing, at least for much of its lifespan, was averse to innovating and adopting newer [foreign] military technologies in favor of tradition and old-fashioned horse archery. Such policies directed from the government itself would have adverse effects on the competency of its armed forces especially against foreign powers in the nineteenth century where bows, crossbows, and antiquated muskets had been employed against the sophisticated rifles of the Western powers. One such example of the Qing's aversion to advancing military technology was demonstrated in Emperor Qianlong's official edict, declaring the necessity of preserving traditional horse archery and abstaining from the dependence of muskets which were unideal to use while on horseback. The following is an excerpt from the imperial edict:

> The original vocation of we Manchus focused on riding horses and shooting. Ordinarily, in hunting, we had no need for guns, and only used bows and arrows. Previously, when the Solon hunted in a battue, they never used guns. Now I hear that they do not do things using bows and arrows anymore, but instead seek what is convenient, and have generally become accustomed to using guns.
>
> The use of the bow and arrow in hunting is a longstanding custom, and a principle suitable to diligent practice. Moreover, the Solon are hunters, and certainly should be proficient in archery; for this reason, among our crack troops, they have always been especially commended for their skill.

[165] Frances Wood, *The Silk Road: Two Thousand Years in the Heart of Asia* (Berkeley: University of California Press, by arrangement with the British Library, 2002), 149.

> If they think only about obtaining game the easy way, with time their traditional archery skills will certainly weaken. Send this to General Furdan and order him to rigorously convey this edict to his Solon men.
>
> Henceforth when mounting a battue, they must abide by the old rules and use bow and arrow to hunt game. For each gun currently in their possession, give them one tael of silver; collect them all without exception. My thinking is that these guns must also come from their own sources, since [the soldiers] certainly do not make them themselves. Now, once the prohibition has been implemented, we must ascertain clearly the actual number [of these weapons] and store them securely.
>
> Let Furdan take extreme care in counting and collecting them. After they have been collected, strictly prohibit their illicit purchase and production, and ferret out and promptly punish violators. In addition, issue explicit instructions to the Solon: 'The reason we are now collecting your guns is particularly because in hunting too many of you do not use bows and arrows, but instead are learning to use guns. His Majesty desires that you not abandon your old ways, but return to your original vocations. You all should follow the example of His Majesty's compassionate guidance and sincere intention: when you go to hunt in battue, do not use guns, but, as before, use bow and arrow; you must return to the old customs. Those who not only excel but also adeptly shoot from horseback can receive the favor of being raised to official ranks like Imperial Guardsman. Use this to clearly instruct them.[166]

Manchurian policy dictated that cultural and martial traditions took precedence over foreign or domestic innovations. The Qianlong emperor prized their traditional archery as well as "original vocations" at the risk of the Qing army's decreased effectiveness in a changing and soon-to-be industrializing world. According to the edict, he even went as far giving silver taels in exchange for the guns in order to see this fulfilled. Consequently, Qing culture and government policy regarding the equipping and training of troops has often been blamed as the culprits for China's scientific stagnation and even regression that would ultimately lead to its humiliation against Western powers and Imperial Japan.

[166] David Porter, "Gun Control, Qing Style," Manchu Studies Group, March 9, 2013, http://www.manchustudiesgroup.org/2013/03/09/the-solon-way-2012-edition/

In similar fashion, the Jiaqing Emperor banned firearms entirely for the sake of traditionalism, and ordered his bannermen to depend wholly on mounted archery and equestrian skill, for such skills, he believed, were at the very heart of what it meant to be Manchu. “For most banner soldiers, military training focused exclusively on horsemanship and archery.” According to Rhoads, rifle detachments abandoned modern weaponry in favor of horsemanship and archery in Beijing and throughout the provincial garrisons.[167] In fact, until the nineteenth century that the Qing would still utilize antiquated matchlock muskets in battle against the mechanized and industrialized forces of the West beginning with the Opium War, and in few numbers at that.[168]

A Rude Awakening in the Opium War

The Opium Wars began with a large trade imbalance between the British Empire and the Qing Empire in which imports of tea, silk, and porcelain goods from China far exceeded British exports that were of little demand and thus had to settle for silver bullion. To compensate for such an imbalance, the British began importing opium from India to China, creating an entire nation of addicts, and threatened Chinese social and economic stability.[169] Chinese emperors and the central government made efforts to forbid the trafficking of opium but enforcement of the decrees were minimal until the 1830’s when an incorruptible official named Lin Zexu was charged with ridding the empire of opium. Unable to win the cooperation of naval officers and the British merchants, Lin Zexu resolved to create a blockade of Canton’s trading ports with their

[167] Edward J.M. Rhoads, *Manchus & Han: Ethnic Relations and Political Power in Late Qing and Early Republican China, 1861-1928*, version Open-access edition: DOI 10.6069/9780295997483, *Amazon* (Seattle, WA: University of Washington Press, 2000), https://www.amazon.com/Manchus-Han-Relations-Political-Republican-ebook/dp/B0719TF5S3/, 57.
[168] Peers, *Soldiers of the Dragon*, 234.
[169] Stearns et al., *World Civilizations*, 729.

"warehouses searched and all the opium confiscated and destroyed."[170]

The outraged European merchants demanded military action against what they called a crime against free trade and property rights. Despite official warnings from the British, Lin Zexu proceeded undeterred in his anti-opium campaign and resulted in the military confrontation.[171] The naval battle resulted in the absolute destruction of the outdated Chinese warships as they were completely unable to contend with British guns which were far more powerful and had much greater range. The Qing's defeat in the battle in 1839, and later again in the 1850's, forced China to submit to European powers and humiliating one-sided terms. The Opium War was an "Anglo-Chinese conflict which ushered in a century of enforced exploitation of China, and a still-emotive symbol for Chinese resentment of the West."[172]

Insufficiencies of the Qing Government

The Opium Wars was a violent wake-up call to the Qing Dynasty that the world had moved on and that they had been left behind. Such a call, however, was heeded to little effect, as the dynasty regressed in the decades following the Opium Wars and China, as a whole, plunged deeper into the "century of humiliation" at the hands of an industrialized Japan and the West. China's efforts to self-strengthen through reforms and modernize itself in the face of a changing world were often hindered by an outdated imperial bureaucratic system as well as the lack of institutional reforms. Japanese scholar late Qing reform, Hatano Yoshihiro, identified the bureaucratic system above other

[170] Stearns et al., 730.
[171] Stearns et al., 730.
[172] Richard Holmes, *The Oxford Companion to Military History* (New York, New York: Oxford University Press, 2001), 676-677.

economic or cultural factors as the reason why nineteenth century China clung to its old systems.[173]

Benjamin A. Elman wrote about Qing self-strengthening reforms and attempts to modernize its navy (for example) after 1865 ended in technological and scientific failure. He says in volume 38 of the *Journal of Asian studies* that, "according to Hanato, Qing officials and literati never fully understood the external crisis they faced because they were schooled in the traditional examination system and thus were ignorant of the outside world."[174] In other words, China at the time was not even equipped or prepared on a government level to facilitate the technological growth and modernization of its own navy, much less the empire.

Furthermore, China's losses forced the Qing into unthinkable concessions, terms of agreements, and the acceptance of ambassadors to the Qing court itself. Such an act forced the Chinese to concede that the Europeans were their civilizational equals—a completely unprecedented change of policy considering that China had always seen itself the civilizational center of the world since the beginning of its recorded history.[175] Foreigners, whether nomadic or European, have always been officially recognized as "barbarians" who must first submit to the superiority of the Celestial Empire. Therefore, when foreigners barged their way into China, "the British among them… carved the country up into spheres of influence. It was, and is, the greatest humiliation the Chinese suffered since the Mongol invasions."[176] The Qing had no choice since their predicament

[173] Benjamin A. Elman, "Naval Warfare and the Refraction of China's Self-Strengthening Reforms into Scientific and Technological Failure, 1865-1895," *Modern Asian Studies* 38, no. 2 (2004): 289, http://www.jstor.org/stable/3876516.
[174] Elman, "Refraction", 289.
[175] Stearns et al., *World Civilizations*, 731.
[176] Marshall, *Prisoners of Geography*, 45.

put them at the gunpoint of superior European powers.

This gap in military technology was the difference between defending sovereignty and submitting to "barbarians." Ultimately the Qing's inefficient and outdated bureaucracy, relative isolation, and pervasive anti-gun policies had severe consequences that contributed to its eventual defeats at the hands of foreign powers. The addition of costly setbacks in rampant government corruption, heavy taxation, the Opium Wars, the Sino-Japanese War, the Boxer Rebellion, and the greatest rebellion in Chinese history (the Taiping Rebellion of 1851-1864 that ravaged China), the Qing Dynasty ultimately fell short of its efforts of self-strengthen through reforms. As a result, the military divergence was the greatest it had ever been since the first guns were introduced into the battlefield as "European battleships and firepower gave [the Chinese] little choice."[177]

[177] Stearns et al., *World Civilizations*, 732.

Chapter IV.

Investigating the Evolution of European Guns and Artillery

Europeans remained at the forefront of gunpowder weapons innovation from the fifteenth century up until the modern era. While domestic Chinese firearms reached their zenith with the likes of the three-eyed gun, Europeans had already developed the aforementioned matchlock mechanism known as "the earliest mechanical means of firing a firearm [dating] to the early 15th century."[178] Such a system allowed for a slow match to be held within a serpentine bar and mechanically brought down to ignite the touch-hole through a triggering mechanism.[179] The matchlock system began to evolve in sophistication until the development of the flintlock mechanism by the end of the 1600's. In this system, a triggering system activates a hammer holding a flint which then strikes a frizzen—a piece of steel. The resulting sparks ignite gunpowder in a flash pan which, in turn, ignites the gunpowder inside the firearm's barrel.[180] Such a system replaced matchlocks and achieved widespread use across Europe by the middle of the seventeenth century.

The wheel lock mechanism was innovated as early as the sixteenth century and, in strictly simple terms, involved a spring-activated wheel that spins to create sparks against pyrite with the activation of the trigger. The sparks then ignite the powder in the flash pan

[178] Holmes, *Companion*, 558.
[179] Holmes, 558.
[180] Holmes, 305.

which ignites the powder inside the gun's chamber.[181] This extremely sophisticated, expensive, and delicate mechanical system was available only to the wealthy and the elite, however, and therefore such firearms did not see widespread use in the military.[182]

Of all the Europeans' advancements on gunpowder weaponry, none were as revolutionary as the conical bullet and the self-contained cartridge of the 19th century. Prior to the 1800's, bullets around the world were spherical and varied in size depending on the weapon, but were particularly inaccurate or inconsistent in their accuracies.[183] However, as early as 1825, the French were experimenting with "cylindroconoidal" bullets but the challenge of fitting the projectiles into the tight barrels of muzzle-loading firearms remained.[184] The problem was solved by one "Claude-Étienne Minié of France, who in 1849 developed a soft lead bullet with a cavity in its base into which a conical plug was fitted."[185] The smaller bullet could be pushed through the bore with ease, but the ignition of the gunpowder propellant pushed upon the conical plug that expanded the bullet snug against the bore and become an accurate projectile.[186]

As a result, the modern bullet was developed in the 19th century, bringing together a number of innovations made over the course of gunpowder warfare's history and those of the early nineteenth century. These modern bullets were fired from the barrels of firearms with "rifled bores" which are spiraling grooves on the inside of a barrel that causes the bullet to spin in flight, thus greatly improving its velocity, range, and accuracy. This type of bullet was developed in nearly in tandem with the cartridge case where the

[181] Virginia Gorlinski, ed, "Matchlock." Encyclopædia Britannica, November 15, 2023. https://www.britannica.com/technology/wheel-lock.
[182] Holmes *Companion*, 994.
[183] Holmes, 159.
[184] Encylopaedia Britannica , The Editors of, ed. "Bullet." Encyclopædia Britannica, October 4, 2023, https://www.britannica.com/technology/bullet.
[185] Britannica.
[186] Britannica.

bullet was attached to the front end of a hollow tube (case) filled with gunpowder that had a percussion cap or primer at its base. A firing pin activated by the firearm's trigger ignites the primer and the powder that launches the bullet. The cartridge, or case, is then mechanically ejected to load a new bullet into the firearm's chamber.[187]

After these innovations in bullets and firing methods, the West applied sophisticated mechanical engineering to invent new forms of firearms that allowed for semi-automatic and automatic firing by the late 1800's. The first by Austrian arms designers, Ferdinand von Mannlicher, inventor of the cartridge clip, innovated semi-automatic and automatic firearms.[188] The latter was by Hiram Maxim, inventor of the first machine gun. As a result, the centuries-old method of painstaking muzzle-loading gunpowder and singular bullets into the barrel of guns and cannons had come to an end.[189] From the sixteenth century, polities and nations outside the West adopted and imported European style arms and for over four hundred years the West led the way in firearms and artillery innovation and invention.[190]

When foreign powers engaged the Qing in warfare, the Chinese forces, however, still employed antiquated matchlocks, cannon, and repeating crossbows that used designs dating back more than two thousand years to the Han Dynasty or even earlier. In contrast to the West, Barton Hacker writes, in the first half of the 1800's Eastern gunpowder weaponry were on standards two hundred years late and were utilized only as auxiliary

[187] Britannica.
[188] Encyclopædia Brittanica, ed., "Ferdinand, Knight von Mannlicher," Encyclopædia Britannica, March 25, 2024, https://www.britannica.com/biography/Ferdinand-Ritter-von-Mannlicher.
[189] Encyclopædia Britannica, ed."Hiram Maxim," Encyclopædia Britannica, March 26, 2024, https://www.britannica.com/biography/Hiram-Maxim.
[190] Lorge, *Asian Military Revolution*, 154.

units like lances and pikes.[191] Hacker goes on to say that "the land-oriented Manchus had never displayed much naval skill, and what water forces it had were strictly adjuncts to its armies." Such a truth cannot be overstated, for a powerful navy is crucial to achieving global predominance and is a key factor in facilitating the continued growth and advancement of military technology, particularly artillery and infantry guns. The Qing had never constructed nor maintained a navy in the same caliber as that of its predecessor the Ming.[192]

Superior Naval Power Facilitates Continued Military Dominance

As previously discussed, the geopolitical situation in medieval Europe, such as the constant state of existential warfare in which it found itself, contributed greatly to the stimulation of weapons development and technological advancement. However, the role of economics is just as crucial in the creation of the military revolution and evolution. Centuries of colonialism and imperial expansion resulted in hyper-competition amongst colonial empires which, in turn, fed the fires of military advancement in Europe. It would be amiss to discuss the military divergence without conducting a study of European global colonization which was made entirely possible by their sophisticated large, heavily-armed ships. The resulting economic impact was significant especially for the West's acceleration in military technology. This would then also first include an analysis of the West's application of naval power and technology which were critical for its ongoing expansion and enforcement of its territorial claims.

European global predominance in the premodern and early modern eras began at

[191] Barton C. Hacker, "The Weapons of the West: Military Technology and Modernization in 19th-Century China and Japan," *Technology and Culture* 18, no. 1 (1977): 47, https://doi.org/10.2307/3103204.
[192] Hacker, *Weapons*, 47.

sea. The aforementioned cancelation of the Ming Imperial voyages left a power military vacuum in the oceans of East Africa and Asia. The rich trade routes of the Indian Ocean and maritime Southeast Asia were then ripe for exploitation and the start of their seizure of global trade by the time the Portuguese and the Spanish arrive in the late fifteenth and early sixteenth century. Several advancements in naval technology paved the way for this to be possible. Improvements in sails, ship hulls, navigational devices (like the compass, another Chinese invention), and preexisting gunpowder armaments gave the Europeans tools to begin their global conquests.[193]

Shipboard heavy artillery upon large (capital) ships was the backbone of European naval might for over three centuries. Such a ship was "one of the greatest technological inventions of medieval Europe [and] had become the most important sailing vessel in the Atlantic."[194] Such ships, with their size, build strength, sailing capabilities, and ability to be heavily armed "facilitated the voyage of discovery and the overseas colonization; with its powerful construction, capable of absorbing the recoil of outgoing gunfire as well as the impact of incoming rounds, it opened the way for the ship-smashing broadside."[195] The ability of these large war vessels to be heavily armed was accommodated by the applied combination of other unique innovations made by Europeans that resulted in ships able to hold and fire broadside cannons in succession port and starboard. By the early sixteenth century, 1,000 ton ships carrying scores of heavy artillery and hundreds of light guns were serving the Scottish and the English, for

[193] Stearns et al., *World Civilizations*, 466.
[194] Andreas Dorpalen. *The Cambridge Illustrated History of Warfare: The Triumph of The West*, edited by Geoffrey Parker (Cambridge University Press, 1995), 123.
[195] Dorpalen, *Warfare*, 124.

example.[196]

Additionally, heavy artillery replaced onboard fighting soldiers who used the grapple-and-hook techniques of medieval ship warfare. This meant that a ship's crew could be drastically reduced, along with its costs, without compromising its fighting capabilities. Only enough of the crew was left to run the rigging and fire the cannons on one broadside. The cut in the costs also meant that ships could save far more in supplies while being able to sail longer distances, create effective blockades, or provide artillery support along the coastlines.[197]

Concurrently, Chinese naval ships made for river patrols and coastal defense had regressed in their strength since the days of the mighty Ming Treasure Fleet. In an ironic twist, those within the Ming Chinese had chosen not fully equip their ships with artillery in the same manner or capacity as the Europeans. Political decisions once again, it would seem, contributed to China's military and technological stagnation. Historian Geoffrey Parker takes note that the employment of artillery was "fully compatible with the traditions of the Chinese warfare at sea." The Chinese utilized ship-borne artillery as early as the beginning of the Ming Dynasty and even earlier as recorded in the navy of Ming founder and first emperor, Zhu Yuanzhang. Cannons capable of firing up to 900 feet were upon ships of Zheng He's fleet, as previously mentioned and cited. Lastly, the Ming navy did fight the Portuguese with cannon-armed ships in the short-lived Sino-Portuguese War of 1521-1522, after all.[198]

However, according to Parker, by the 1550's Ming officials altogether rejected

[196] Dorpalen, 124.
[197] Chase, *Firearms*, 72.
[198] Geoffrey Parker, *The Military Revolution: Military Innovation and the Rise of the West, 1500 - 1800*, Second (Cambridge: Cambridge Univ. Press, 2016), 83.

ship-borne artillery and decided that they were not effective enough to be employed or further improved upon, especially against the pirate plague of Japanese and Asian pirate coalitions terrorizing China's coasts. Ming military commanders decreased their dependence on guns, field artillery, and ship-borne weapons, citing logistical challenges and making complaints on issues regarding the weapons' reliability and effectiveness against the pirates.[199]

Instead, the Chinese forces relied on overwhelming land assaults against pirate bases stationed along the coast by using more traditional weapon units like archers and lancers.[200] Along with military operations came the more covert methods like inciting division amongst the pirates to separate the Chinese from the rest, and applying diplomatic pressure upon the pirates' supporters in Japan.[201] Ship quality in the Ming Dynasty saw an overall decline, as observed by Peter Mundy upon seeing a Ming warship in 1637. He took note of its use of many small cannons which would do more anti-personnel damage but could never sink a ship, because it was not built well enough or strong enough to carry and fire larger, heavier guns.[202]

Perhaps the greatest naval innovations in East Asian shipbuilding and warfare came not from China, but Joseon Korea, during the aforementioned Japanese invasions led by Toyotomi Hideyoshi in 1592 and again in 1598. With the mighty "Turtle Ships", the great lord admiral, Yi Sun Shin, defended Korea with his fleet, even when outnumbered by the Japanese vessels. Such ships were possibly the first iron-clad warships in history, with iron spiked hexagonal plates supposedly covering the ship like a

[199] Parker, 84.
[200] Parker, 84.
[201] Parker, 84.
[202] Dorpalen, *Warfare*, 120.

turtle's shell. The ship carried up to forty cannons of the 36-pound variety, and the oarsmen and gun crew inside were protected behind four inch thick wooden planks that were impervious to arrows and matchlock fire.[203]

Such an innovative ship design, with its long-range guns and speed, was necessary to provide the Korean navy a necessary edge against the Japanese fleet. Nevertheless, it was Yi Sun Shin's tactical genius that brought victory to Joseon in the water. However, like the Ming and Qing Chinese, the Koreans did not seek to venture out into the sea to conquer and colonize other lands through heavily armed ships, but the creation of the turtle ships do strengthen the argument that war and the necessity of sufficient military defense against powerful neighbors is in fact the most powerful stimulator of technological innovation.[204]

The Europeans, on the other hand, maximized all the technological advantages on their vessels which not only allowed them to sail great distances into unknown waters, but conquer and consolidate their claims in foreign lands from the barrels of their cannons and muskets beginning in the late fifteenth century. The Portuguese were quite aggressive in their approach to overseas exploration, and in the creation of their empire in the early 1500's, Portuguese "commanders blasted away at coastal towns to bring strategic areas under Portuguese control."[205] From prosperous Islamic trading city of Kilwa, East Africa all the way to Goa, India, the Portuguese coerced their terms of trade and commerce upon the long-established Indian Ocean trade network simply because

[203] Marc Jason Gilbert, "Admiral Yi Sun-Shin, the Turtle Ships, and Modern Asian History," Admiral Yi Sun–Shin, the Turtle Ships, and Modern Asian History, June 15, 2023, https://www.asianstudies.org/publications/eaa/archives/admiral-yi-sun-shin-the-turtle-ships-and-modern-asian-history/.
[204] Kenneth Swope, *A Dragon's Head*, 118-119.
[205] Parker, *Global Interactions,* 21.

they had the firepower to do so. “Using superior ships and cannons, the Portuguese blasted rival ships out of the water, crews were arrested or killed and their cargoes confiscated.”[206]

The Spanish followed closely after their Portuguese rivals in their quest to create and expand their colonial empires for riches and the spread of the Roman Catholic faith. For the Spanish, naval power was also instrumental in their conquests. Such a consequence of this dependence on this was demonstrated when the Spanish Castiles, under the famous navigator Ferdinand Magellan, explored as far as maritime Southeast Asia (Malaysia and East Indies) and later, an archipelago that will be later christened “Philippines.” These islands which sat on the crossroads and eastern edge of Asian trade were known for their armed merchants, international mercenaries, raiders, and pirates all of whom sailed on large longboats armed with bronze swivel cannon called “lentakas.”[207]

Upon landing in the central islands of the archipelago in 1521, they forged alliances with two local chiefs, but sparked the ire of a warrior chieftain, Lapulapu. Out of the sixty men in Magellan’s detachment, forty nine jumped into the water to face approximately 1,500 enemy fighters, at least according to Antonio Pigafetta, the Venetian explorer who chronicled these events. *The Spanish ships were out of range and were unable to provide artillery support thanks to the rocky shores of low tide*. Arbalists and musketeers fired volleys of bolts and bullets with little effect.[208]

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[206] Mark Cartwright, “Portuguese Empire,” World History Encyclopedia, July 19, 2021, https://www.worldhistory.org/Portuguese_Empire/.
[207] Luis Francia, *A History of the Philippines: From Indios Bravos to Filipinos* (New York, New York: Overlook Press, 2019), 38.
[208] Antonio Pigafetta, “The Philippine Islands, 1493–1898: Explorations by Early Navigators, Descriptions of the Islands and Their Peoples, Their History and Records of the Catholic Missions, as Related in Contemporaneous Books and Manuscripts, Showing the Political, Economic, Commercial and Religious Conditions of Those Islands from Their Earliest Relations with European Nations to the Close of the Nineteenth Century, Volume XXXIII, 1519–1522,” ed. Emma Helen Blair, trans. James Alexander

Pigafetta's accounts say that the projectiles harmlessly passed through wooden shields or were otherwise evaded and dodged. Lapulapu's men aimed their weapons at the Spaniards' exposed legs because they wore steel corselets and helmets. In the end, Magellan died fending off his enemies while the rest of the men retreated back to the boats. Magellan's force lost eight men and suffered multiple wounded. Four of their Visayan allies tried to come to their aid but died due to fire from Lapulapu's lentaka cannons. Only fifteen of Lapulapu's men were killed.[209] Land-based warfare without naval artillery support or native allies whilst engaging against numerically superior forces who also utilized steel weapons and cannons led to the certain defeat of Magellan and his men. This is yet another example of the crucial role naval superiority played in Europe's global conquests, apart from which expansionism would have been close to impossible.

Nevertheless, it was still the same superior naval power, weapons, and technology that granted Spain a successful conquest of most of the Philippines in 1565 upon its defeat of the heavily armed and fortified trading city of Maynila (present-day Manila). The process of conquering the Philippines involved few major battles and many skirmishes, but Spanish victory was largely attributed to native allies and naturally, superior cannons, and the heavy use of muskets.[210] This pattern of conquest repeated itself all over the world for next few hundred years and saw the creation of the largest empire in world history under the British.

Europe's Multiple Revolutions Fuel Military Divergence

Robertson, The Project Gutenberg EBook of The Philippine Islands, 1493-1898, Volume XXXIII, 1519-1522, by Antonio Pigafetta, June 5, 2013, https://www.gutenberg.org/files/42884/42884-h/42884-h.htm#pb178, 178, 180.

[209] Francia, *Philippines*, 54-55.

[210] Francia, 52-59.

Europe's initial weapons were central to their early success in the sixteenth century, and were the result of geopolitical and military circumstances unique from the rest of the world. They were also vital to fueling the ongoing advancement of military technology that propelled the West ahead of China and other empires. The aforementioned Renaissance brought Europeans to a new age of commerce, science, and cultural revival, breaking away from the previous patterns of the Middle Ages. The Age of Exploration and colonial expansion brought a degree of wealth and power to the bourgeoning nation states of Europe and stimulated technology-advancing hyper-competition, further establishing them with cultural, economic, and scientific predominance. In conjunction, the growth of central governments in addition to the employment of trained bureaucrats allowed much of Europe to reach an increased level of political development and government administration achieved much earlier in China's meritocratic imperial bureaucracies, for example.[211]

The centralization of governments, especially for larger states, was crucial for triggering the development and mass employment of artillery, given the cost to produce and deploy cannons and bombards in the field in large numbers. As military historian Clifford J. Rogers wrote in his essay, "the central governments of large states could afford to acquire and maintain large siege trains: their subjects and smaller neighbors, in general, could not."[212] The creation and increase of artillery trains gave central governments power to expand their territorial control which allowed them to increase their tax revenues which, in turn, enabled them to fund and maintain even more artillery,

[211] Stearns et al., *World Civilizations*, 497.
[212] Clifford J. Rogers, "Military Revolutions of the Hundred Years War," essay, in *The Military Revolution Debate Readings on the Military Transformation of Early Modern Europe* (New York, NY: Routledge, Taylor & Francis Group, 2018), 55–93, 74.

and the cycle goes on.[213] All in all, these courses of events created a new arms race among the large European states as colonial empires scrambled to carve new territories and spheres of influence for the next several hundred years, beginning with the commercial revolution in conjunction with the resulting scientific, cultural, military, and later, industrial revolutions.

Along with such revolutionary changes came the concurrent advances in military technology, namely gunpowder weapons and artillery. Clifford J. Rogers also posits in his paper that "the most dramatic, most revolutionary changes in European military affairs took place [during] the period, roughly, of the Hundred Years War (1337-1453)."[214] One of such two military revolutions was that of the artillery. Within the first century of its use in warfare, cannon were utilized alongside traditional siege weapons in which they did not differ in power, and they were "small and inexpensive," thus not revolutionary enough to cause great change in European warfare.[215] Historical records from the early 1420's and prior reveal that besieged towns would often surrender due to hunger and dwindling supplies within walled or fortified areas, and not because they were succumbing to the destruction caused by bombards and cannons.

However, after the mid 1420's, garrisons began surrendering because bombardments have made their fortified positions indefensible rather than because of starvation or lack of supplies. This trend continues in the following decades where besiegers could force their enemies to surrender after the employment of the latest cannons which typical European fortifications could not resist. Thus according to Rogers, the largest improvements to gunpowder artillery take place during the 1420's and 1430's,

[213] Rogers, 75.
[214] Rogers, 56.
[215] Rogers, 64.

approximately one hundred years since the first time history records Europeans having acquired gunpowder weapons. Since their first inception in the early fourteenth century, cannons have gotten only larger, stronger, more accurate, and more numerous, especially at the earlier years of the fifteenth century.[216]

This is what Rogers refers to as the Artillery Revolution from 1400 until 1430 where "developments included changes in the design and manufacture of the guns themselves, in loading methods, and in powder formation." These changes included the lengthening of the barrels in proper ratio of the round diameters in order to achieve maximum potential range, accuracy, and muzzle velocity. Other advances in metallurgy and manufacturing techniques allowed cannons and the use of cannons to become much cheaper, reliable, and widespread, and the production of iron even more affordable.[217]

Therefore according to Rogers, "a whole series of interconnected innovations synergistically improved the power and efficiency of gunpowder artillery. The development of the hooped staves method (of manufacturing) made it possible for even the largest cannon to have longer barrels, the adoption of which increased, power, accuracy, and rate of fire. The new iron refining process… made guns cheaper to buy; and corned gunpowder made the both more powerful and cheaper to use. The number and size of guns increased rapidly."[218] All these early fifteenth century innovations in combination put Western European gun technology ahead that of Ming China's where gunpowder weapons had already reached their own zenith and remained largely unchanged and stagnant until the arrival of the Portuguese.

European gun development experienced another "jump" by the 1450's.

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[216] Rogers, 67, 73.
[217] Rogers, 68, 73.
[218] Rogers, 73.

Attribution can be partially given to brothers, Jean and Gaspard Bureau of France, with the former in particular being an expert in the science and engineering of artillery. Jean studied artillery in-depth along with the "revolutionary developments in gunpowder and gun manufacture and the implications they held for land warfare." Jean had been an administrator for the French king, Charles VII, and later with his brother had been put in charge of supervising the royal artillery as part of the king's sweeping military reforms during their war against the English. The brothers immediately modernized and grew the king's siege weapons, proving to be instrumental in their campaigns against England.[219]

With their new and abundant weapons, the Bureau brothers brought their firepower upon the outdated English fortifications which had been originally designed as defense against infantry forces.[220] Thus sieges that otherwise would have taken months or years were completed in just weeks, sometimes even days. "Altogether, the French royal artillery under Bureau's direction played a crucial role in about 60 sieges, both large and small, during the campaign." Ultimately, because of the Bureau brothers, French artillery gave France a definitive cutting edge against their military enemies into the next century. It was also because of the Bureau brothers, that the English were driven from France once and for all. The legacy of the brothers in France are in stark contrast to the political atmosphere of contemporary Ming China, where the previously discussed state of affairs discouraged further development and innovation of their own domestically-produced gunpowder weapons.[221]

Gunpowder changed the world radically, albeit slowly, in ways not seen since the

[219] William E. Welsh, "Jean Bureau, Master Gunner of France at Castillon," Warfare History Network, June 29, 2016, https://warfarehistorynetwork.com/jean-bureau-master-gunner-of-france-at-castillon/.
[220] Welsh.
[221] Welsh.

agricultural revolution and the rise of the first civilizations. Until then, warfare since the Bronze Age until the end of the medieval period had changed little, with armies, tactics, and battle formations being recognizable, for instance, to the Crusaders as it did to the ancient Persians.[222] As this paper demonstrates, castles, fortifications, and walls had slowly become obsolete in the centuries since cannons were first forged in the Song Dynasty and later matured in fourteenth and fifteenth century Europe.

This means that combatants could annihilate one another from distances with greater range than bows, crossbows, or traditional siege engines. Ships became heavily-armed floating fortresses that could rain devastation from hundreds of meters, and later, kilometers away. Empires were built through and because of gunpowder, while others were brought to their knees and destroyed altogether. Guns, cannons, and all manner of artillery decided which civilizations prospered and which ones were conquered.

[222] Hawley, *Imjin War*, 8.

Chapter V.

Conclusion

The reasons for how and why the West triumphed through and because of these inventions while China ultimately did not are deep and complex. There are not yet any absolute answers that would satisfy the questions surrounding the military divergence, but an investigation and analysis of the patterns of history provide many clues and evidences that show gunpowder's effects on various societies and how culture, geopolitics, government, and economics all contributed to China's stagnation and Europe's rise to preeminence and global predominance well into the twentieth century. Weapons technology allowed the West to conquer large swathes of the globe and extract resources, traffic humans, monopolize trade, and dictate geopolitical terms through their colonial empires.

It is important, however, not to oversell the economic gains of colonization and the wealth resulting from colonial empires for the Europeans. Colonial expansion was an expensive undertaking financially and logistically, as was the case with the Portuguese Empire, for example. "Partial domination of the Indian Ocean and much of its valuable trade did not bring Portugal's crown as much profit as had been anticipated…The Eastern footholds were expensive to maintain, and frequent mishaps to vessels of the Indian fleets, from shipwreck or enemies, reduced gains."[223]

More than anything, as this paper emphasizes, Western imperialism and colonialism stimulated intense competition among European states that advanced their

[223] Richard A. Webster, Charles E. Nowell, and Harry Magdoff, "Portugal's Seaborne Empire," ed. The Editors of Encyclopaedia Britannica, Encyclopædia Britannica, 2023, https://www.britannica.com/topic/Western-colonialism/Portugals-seaborne-empire.

weapons and naval technology far ahead of their contemporaries to the East, including China. It also involved the active participation and cooperation of multiple industries, private enterprise, and financial institutions, causing a chain reaction within European economies. This helped to ensure that the costly ventures to expand colonial empires were well-funded and created a profitable return for the investors.

As an ancient civilization, China flourished for millennia and has been at the forefront of science and technology, industry, and commerce throughout the dynasties. From the Han and then the Tang, Song, and much of the Ming and Qing, Chinese civilization enjoyed multiple periods of prosperity, great instances of invention and ingenious innovation, cultural development, and imperial expansion through incredible military power. But the rise and zenith of every dynasty is usually followed by a descent into social upheaval, political turmoil and corruption, civil war, and even foreign invasion.

In the end, this dynastic cycle along with cultural factors that influenced imperial politics and military policies thwarted China's rise to global preeminence, if not, its maintenance of a Sino-oriented world order in Asia. While it was able to effectively resist the belligerence of European powers in the early sixteenth century, the gap in military capabilities and technology had grown too great by the nineteenth century. A Qing Dynasty that had only antiquated matchlocks and cannons to complement its archery units was no match for the industrialized firepower of the West.

In the end, the West was so ahead in military and economic power it managed to hold much of the world at gunpoint while the Americas, Africa, and Asia were forced to surrender their power, resources, and prestige. However, the story of world civilizations

has always been a competition for space, food, and resources, and it only happened that it was the West that experienced all the right economic, political, and military preconditions necessary at the end of the Middle Ages to become the world's dominant civilization by the nineteenth century.

However, as many civilizations rose and fell, Chinese civilization has continued forward through world history to survive the powers of the Japanese and the West combined to establish a modern republic in 1911. Of all the great inventions of Chinese civilization, perhaps historians will remember best their pioneering of modern warfare and how it was they who inadvertently caused the West to rise, and with that, their weapons. The eventual abandonment of their own inventions and innovations surrounding gunpowder warfare has led many to believe China used gunpowder for naught more than fireworks, firecrackers, and pyrotechnical displays.

As this paper explained, domestic innovations did continue for a short time, stimulated temporarily after contacts with the Europeans in the sixteenth century and the adoption of European innovations. Nevertheless, many of the stimulants and conditions that compelled Europe to advance their military technology were not all present in China at the same time. The future now holds what the next great inventors will present for humanity in the following centuries. Perhaps one day science fiction will become science reality and projectiles may eventually be replaced by plasma bolts and portable direct energy weapons. In the end, tribalistic competition between peoples and nations can only show the limitless devastation human beings are capable of committing.

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