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European Technology and Manchu Power: Reflections
on the "Military Revolution" in Seventeenth Century China

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"The rebel soldiers, positioned at the entrance of the mountain pass were not ready [for our attack]. As our troops advanced, we could hear the incessant sound of artillery. On the road we came across some shields that had been dropped by our own troops [during the charge]. Carrying a large flag, I ran forward. As we entered the mountain pass, we saw the rebel army which, rushing out of the encampment, was lining up abatises, shield-bearing troops and elephants. Our Green Standard (Chinese) soldiers charged. The fire from cannons and muskets sounded like frying beans, the earth itself was shaking."

This battle scene is described in the eyewitness account of Zengshou, a Manchu officer who served in the Qing army during the war to suppress the rebellion of the so-called "Three Feudatories," which inflamed southern China from 1673 to 1681. In the end, the government forces won, ensuring the continuing rule of the Manchu dynasty in China (1644-1912). The cannons mentioned in the description of the battle, whether fired from the government or from the rebel side, are likely to owe a considerable debt to European military technology. In fact, it is commonly acknowledged that the war effort was heavily conditioned by the willingness of one Belgian Jesuit, Ferdinand Verbiest, to design and cast "modern" cannons, light and easily transportable, which could be deployed on the rugged terrain of southwest China in order to pound the mountain strongholds of the rebel forces.

By the 1670's the extensive use of firearms and artillery pieces was nothing new in China, and the story of the transmission of European military technology to China is fairly well known in its main lines (Needham 1986, Wang 1947; Goodrich and Feng 1946). What is less well known is the actual use of artillery in the context of the Manchus' invasion of northeast China after 1618, conquest of China in 1644, and final consolidation of their rule in China, against both internal and external enemies (1644-1691).

What role, if any, played firearms in the rise of the Manchus to historical prominence? The thesis that advancements in military technology had a deep impact on the societies that promoted them in the early modern period is shared by several historians, though important aspects of this thesis continue to be debated vigorously. But the idea that in early modern Europe deep changes in military technology altered traditional relationships between army and state and between war and society, thus contributing to the formation of a widening gulf between Europe and the rest of the world, has become widely accepted in the specialized literature.

From a world historical point of view, the "military revolution" thesis (in all of its variations) presents some points of interests not only in connection with its aspiration to explain the rise of the west vis-à-vis extra-European regions, but also with regard to the diffusion, trade, and manufacturing of the new weapons within the network of contacts that linked Europe with the rest of the world in the sixteenth and seventeenth centuries. While the long-term effects of the introduction of firearms remained limited among peoples that lacked relatively advanced technological knowledge, in others, particularly in Asia, firearms soon became a factor that altered traditional ways of warfare. In south and east Asia the introduction of firearms did not lead ipso facto to the establishment of European military superiority over the natives, and in fact sixteenth century Europeans had no illusions that Pizarro's military exploits in America could be replicated in Asia, where large armies could be mobilized, and relied to a considerable extent on musket and cannon (Parker 1991, 176).

On the other hand, advanced European artillery, being desirable to various Asian potentates, was one of the vehicles of European commercial and political penetration in Asia, and thus its diffusion acted as a catalyst of interests that shaped the relationship between Europeans and "Asians" ever since the early stages of the establishment of permanent European bases in Asia. Europeans, both as countries and as individuals used their weaponry skills to the hilt, often coming into conflict among themselves when expert European gunners took the initiative, against the wishes of the European country they worked for, to sell their independent (and well-paid) services to Asian kings.

A second important aspect of the introduction of advanced firearms in Asia concerns the effect they had on local societies. The best studied case in that respect is the Japanese adoption, at staggering speed, of various types of firearms, and the development of battle tactics that suited the potential of the new armament (Brown 1947-48; Morillo 1995). The "giving up" of the musket for the sword in the seventeenth century is an interesting phenomenon that shows the independent ability of Asian states not only to adopt and produce firearms, but also to make choices as to the course of action that suited them best.

The abandonment of the production of firearms in the seventeenth century (some of the best-made by any standards, according to contemporary accounts) after all did not result into an automatic Western military challenge, nor did it prevent Japan from modernizing its army after 1868.

This paper is concerned with a particularly dramatic event in Chinese history: the fall of the Ming dynasty and the rise of the Qing, the Manchu dynasty that was to rule China until the advent of the Republic, in 1912. While a number of studies have traced and documented the importance of Europeans in the introduction of firearms in China, especially in the late sixteenth and seventeenth centuries, this phenomenon has never been analysed in connection with the "MingQing transition." Naturally there are many factors that need to be accounted for when we examine such a macroscopic event, but let us pause to consider the phases of the rise of the Manchus. First, they established a regional power, then they invaded China proper, proceeded to consolidate their rule throughout the former Ming territory, and finally expand into formerly independent frontier regions; all together the process took approximately a century, from the rise of Nurhaci in 1583 to the pacification of the Northern Mongols in 1691. Only towards the end of the seventeenth century wars became less pervasive and destructive, but before then the military side of Qing history can hardly be relegated to a marginal position. The Manchu conquest elite (which included also Mongol and Chinese elements) was structured according to a military-administrative organization, known as the Eight Banner system, whose use of firearms, as well as any changes in military organization, state finances, technology of production and other issues deriving from the adoption of firearms, cannot be easily ignored. Yet the overemphasis placed on the "natural qualities" of the Manchus as warriors have contributed to obscure the role played by firearms in the conquest of China, and the possible consequences that the policies adopted by the Manchus in the seventeenth century may have had on the creation of the technological gap that later separated the Qing military from 19th century European armies.

In this paper I shall attempt to bring to the surface several linkages that connect the diffusion of firearms in China, the Ming struggle against the Manchus, the Manchu conquest of China, and the European involvement in all of these events, and then discuss them from the point of view of "world historical" concerns related to the role of Europeans in Asia and to the role of firearms in the "rise of the West." As a caveat I should also mention that this discussion is in a preliminary stage and the conclusions are as yet speculative.

We shall begin this discussion by summarizing the key events in military technology transfer; then shall proceed to examining the effectiveness of firearms in the frontier warfare between Manchus and Chinese, and the ways in which the Manchus moved towards the development of artillery capabilities and military tactics in response to the extensive use of firepower by the enemy. In all of these "contexts," the presence of Western military advisors, technicians, and engineers appears central and ancillary at the same time. It is central because without them the level achieved in China between 1600 and 1690 would have been either unattainable or attained at a much slower pace. It is ancillary because it was the adaptation of technology to the specific needs of Chinese warfare (based on decisions made by Chinese officials), which made the adoption of such technology and its further development possible at all. The resulting picture is one that defies any hard and fast rationalization of the military rise of the West. In the case of complex societies, such as China or Japan, a supposed western superiority remains not only untested on the evidential ground, but purely speculative even in theoretical terms, as one cannot base military superiority purely on technology without looking at the ability to mobilize, supply, and coordinate the movements of large numbers of soldiers, all areas in which especially the Qing armies may have outperformed a number of contemporary European armies. We shall therefore refrain from partial analogies and focus instead on the local channels (by "local" I mean originating from within a regional matrix), be they historical circumstances, interests of individuals or groups of individuals, ideas and beliefs, which acted as conduits for the introduction of military technology.

Early introduction of firearms in China and the larger Asian context.

Gunpowder was discovered in China before the 9th century BCE. While the exact route through which it found its way to Europe is still uncertain, its transmission, which occurred sometime between 1220 and 1245, is to be understood as part of the general flow of people, merchandise and ideas that accompanied the Mongol conquest. In the West, Muslim countries obtained it first, and from there its uses spread north of the Mediterranean. It is interesting that while in China gunpowder existed in association with a variety of uses, mostly unrelated to war, western countries seized from the start upon its military potential, and from there the use of firearms developed steadily, reaching a certain degree of maturity towards the end of the 15th century.

The early introduction of firearms as a new component of armies was pursued not only by European countries but also by the Ottoman empire, which developed a huge production of artillery pieces, muskets, and specialized infantry. Muslim attitudes towards firearms were by no means uniform. The Mamluks, whose Central Asian origins may account for a more radical military ethos, rejected the adoption of firearms (except for siege artillery) as something unworthy of a warrior, whose qualities shone in the practice of horse-riding, archery, and closerange sword fights. Not unlike medieval archers and crossbowmen, whose ability to bring down a nobleman at a distance without endangering their own lives gained them the

scornful contempt of European knights, harquebusiers and cannoneers, were frowned upon as cowardly and unskilled soldiers, whose employment on the battlefield was nothing short of dishonourable. The Mamluks' reluctance to develop firearms, except for siege warfare, may account for their final defeat and incorporation by an Ottoman army well stocked with a large arsenal of firearms (Ayalon 1956, 86-108).

With or without ethical misgivings, the usefulness of artillery was eventually appreciated not only in Europe, where the development of siege warfare required the use of powerful wall-breaching cannon, but also elsewhere in the world. Portuguese vessels sailing in south Asia were confronted with kingdoms that had already obtained firearms through the "Muslim network", mostly from the Ottomans (Ozbaran 1988). The Ottoman empire clearly had a vested interest in making the life of Christian merchants as miserable as possible, and the delivery of cannons and cannoneers to Asian states (especially if Muslim) was both politic and meritorious. The khanates of Turkestan, the Crimean Khanate, the Gujaratis in India, the Sultan of Atche in Sumatra and Sultan of Abyssinia were all recipients of Ottoman weaponry (Inalcik 1975, 202-6; Reid 1969, 396-97). In the early seventeenth century battles in the Red Sea and off the Yemenite coast against the Portuguese both Mamluks and Arabs fought with Ottoman fire-arms. After Ottoman rule expanded to Egypt and Yemen (1517) the Ottoman-Portuguese competition continued in the Indian Ocean, where the Ottomans supplied the Abyssinians with firearms. In turn *R&nf* (i.e., Ottoman) firearm found their way to the Mughal Empire in India. The problem was that such an assistance was not at all regular, and depended on many factors, in particular the Ottoman reluctance to sustain the heavy financial burden needed to carry on the naval competition with Europeans in the Indian Ocean, and the misgivings of local rulers with regard to the possible costs of the Ottoman military and political penetration.

As transmitters of military technology, however, there is no question that the Ottomans were central to the military history of Asia, even though the arms they exported, both in terms of types and methods of production, were soon to fall behind European-made guns. The uneven quality of the metal and the lack of standards in training and production detracted from the combat value of Turkish weaponry, and European-made guns were preferred by Asian rulers. Either by purchase or by salvaging them from shipwrecks, Portuguese and Dutch cannon were not uncommon in the hands of rulers in South-East Asia (Boxer 1965) and the skills of Europeans that could make and use guns were highly prized. The flow of western military technology to Asian countries, in effect, resembles more a delta of many rivulets than a single stream. Chance findings of artillery pieces, the capture of European military experts, or the decisions of mercenaries with the right skills to seek high-paying employment at the court of a ruler often overrode the papal prohibition to sell firearms to Muslims, and whatever qualms Portuguese and Dutch government may have had about selling advanced weapons to potential enemies.

In China the transmission of early firearms seems to have followed a similarly meandering and haphazard route. "European" weaponry appears in China with the Portuguese breech-loading culverins presented at the Ming court in 1522 (called *folangii* or "Frankish machines") whose use to fight the Mongols was advocated in 1530 by Wang Hong. These small cannons, similar to culverins, however, were not the first to reach China, as there is evidence that the Chinese were already making a similar cannon before 1522. In the southeastern province of Fujian the presence of a *folangii* is documented already in 1510; that is, even before the Portuguese reached Malacca in 1511. It is therefore possible that cannons known *as folangfi* may have reached China, through a separate route. According to Pelliot the Chinese *folanji* may have translated not "Franks" but the Turkish term *farangi* which the Moghul emperor Babur used shortly after 1500 to refer to those European cannons. Therefore, a cannon by that name may have reached China through anonymous carriers possibly from Malaya, before the Portuguese themselves (Pelliot 1948, 199207). There is also some evidence that the Muslim principalities of Hami and Turfan during the rebellion against the Ming in 1513 used Ottoman (*R&ni*) muskets, and one cannot lightly dismiss the possibility that the old "Silk Road" played an important role in the transmission of firearm technology to China, especially since during the first half of the sixteenth century there were several Ottoman diplomatic missions to the Chinese court. By the end of the sixteenth century, Ottoman muskets were copied and described in detail in Chinese military literature (Needham 1986, 441-9). Whether by sea or by land, the role played by the Ottoman empire seems to have been relevant to the diffusions of firearms in China.

In the sixteenth century the Ming began to deploy consistently firearms on the northern frontier, along the Great Wall, as a defence against the Mongols, but the actual effectiveness of fire power against nomads at this time is questionable. Qi Jiguang (1528-1588), possibly the most brilliant Ming general and strategist of the time, devised a way of using *folangii* cannons mounted on two-wheel carts which worked as mobile artillery platforms. The so-called "battle wagons" included also protective screens to be raised as the battle started. Twenty soldiers were assigned to each battlewagon, ten of whom were in charge of the artillery pieces placed on the wagon, while the other ten - four armed with muskets - stayed on foot near the wagon. Tactically, the wagons were lined up next to each other to defend the army against cavalry charges. Heavier artillery pieces could also be used, such as the "generalissimo" cannon, which weighed more than 1300 pounds, but these were often found to be too cumbersome to be effective. The combined action of infantry and artillery theorized by Qi to counter Mongol cavalry assaults was never put into practice because the Mongol tribes bordering on the territory under Qi's military jurisdiction reached a diplomatic agreement with the Ming court that brought hostilities to a halt (Huang 1981, 179-81). It is quite interesting to see that the concept of the battle-wagon, that is, a heavy wagon with cannon and arquebuses mounted

on it, and the concept of chaining wagons together to form a barrier around the army was in use among the Ottomans in the fifteenth century, and by the sixteenth had been adopted by Babur via Turkish specialists in his employment (Inalcik 1975, 204). Was the battle-wagon developed by Qi also based on a Western Asian prototype? At present this question cannot be answered but the similarities raise doubts as to the originality of Qi's tactical invention.

Finally, we should consider the development of firearms in Japan and their influence on China. In his writings Qi Jiguang, who was also involved for years in the protection of the south China coasts against the attacks of Japanese pirates, states that the Japanese introduced the musket known as *niao chong* (fowling piece) to China, (Huang 1981, 165; Needham 1986, 429) in the mid sixteenth century. The Japanese musket was made by copying Portuguese matchlocks, but soon Japanese gun-makers attained a high level of proficiency. Moreover, the Japanese adoption of the tactical use of firearms - the volley and the use of regular units of musketeers were already a reality in the sixteenth century - may have also influenced the wider indigenous use of these weapons in East Asia. Therefore, even if the earliest muskets might have been of Turkish origin, there is no doubt that the Japanese attacks along the southern coasts of China and other forms of contacts between the two countries also contributed to the circulation of muskets.

From these preliminary notes we can see that there were multiple routes in the transmission of firearms to China, whose departing points were western Europe and the Ottoman empire, and important intermediaries were Japan, and possibly also Malaya, India, and Central Asia. Therefore, the diffusion of firearms in Asia cannot be understood as the linear outcome of increased European mobility resulting from their progress in oceanic navigation. In order to model correctly the phenomenon of the spread of military technology it is necessary to keep into due account the parallel diffusion that was taking place across Muslim territories, and the genuine contribution that early on China and Japan made towards the improvement of firearms, both technically and tactically. Another observation concerns the specific use that firearms were intended for in the sixteenth century. While the efficacy of muskets was criticised in the fight against Japanese pirates in South China, their use was advocated by Chinese strategists for the defence of the northern frontier against Mongol incursions. Besides the aforementioned Wang Hong and Qi Jiguang, in 1541 the Governor-general of Shensi, Liu Tianhe, recommended that towers on the frontier be equipped with firearms (Serruys 1982, 32). Although the Ming government was often unresponsive or inefficient in dealing with these requests, the development of "fighting towers" on the northern frontier proves that the use of several kinds of fire-arms, from folangji to heavier cannons and muskets, were appreciated for in the defence of static fortifications.

Effectiveness of Chinese artillery against the Manchus

In 1583 the Jurchen chieftain Nurhaci began his political rise by affirming himself as a shrewd commercial operator and a fearless military leader. For thirty-three years he fought a long sequence of tribal wars, which led to the construction of a strongly centralized tribal confederation with the Aisin Gioro (i.e., Nurhaci's) clan at its heart. In 1616 he moved to a new capital, called Hetu Ala (Flat Hill), and declared the founding of the Later Jin dynasty, so named after the Jurchen Jin dynasty (1125-1234), of which he felt he was the political heir. Two years later he pronounced the "Seven Grievances" against the Ming, a political declaration tantamount to an official declaration of war. This act of defiance towards the Ming dynasty, of which he had been till then a subordinate frontier chieftain, finally persuaded the Ming to send a massive expeditionary army to punish Nurhaci and annihilate the Manchu threat on the northeastern frontier. The opposite armies met in 1619 at Mount *~arhu*, and the ensuing Manchu victory marked the true beginning of the ascent of Manchu power. On the plain at the foot of Mt. *~arhu*, today at the bottom of an artificial water reservoir, Nurhaci defeated a mixed force of Chinese, Korean, and recalcitrant Manchurian tribes. Although the Ming army enjoyed superiority in terms of numbers and armament, the Manchus destroyed it thanks to their rapidity of movement,

1. Nurhaci belonged to the Jianzhou tribal confederation of the Jurchen people. The term "Manchu" was substituted to Jurchen when referring to the native people of Manchuria by imperial decree in 1635. For the sake of convenience I will use the term Manchu to refer also to the people of Manchuria before 1635, even though, strictly speaking, this is anachronistic.

brilliant tactical manoeuvring, and sheer bravery. Chinese and Korean troops carried light firearms and artillery pieces; in particular a Korean force of four hundred cannoneers was sent from P'yongyang (von Mende 1996, 115). These artillery pieces seem to have been used mainly to pin down Manchu cavalry in fortified areas and disrupt their movement (von Mende, 121). These tactics, however, proved ineffective in the context of a campaign that required high mobility and excellent coordination among the four columns into which the Ming army had been divided. According to the account of a Korean eyewitness, the Manchus also fired some artillery shots with Chinese cannons they had captured (von Mende, 123), which may indicate that Nurhaci had already obtained by then some firearms and might have used them to fortify his positions. However, if that is the case, artillery did not yet play an important role in the Manchu army, and firearms do not seem to have played a decisive role on either side.

After smashing the Ming army at ~arhu, Nurhaci launched a campaign to invade Liaodong, the prosperous northeastern province inhabited by Chinese agricultural settlers, with a view to expanding its kingdom and giving it a more solid economic basis. The problem, from the military viewpoint, was that the cities of Liaodong were heavily fortified, and that their thick ramparts were protected with an extensive array of firearms. In *De Bello Tartarico*, an almost contemporary account of the Manchu conquest, the Italian Jesuit Martino Martini explained the tactics used by the Manchus when storming a city:

[The Manchus] were very afraid of muskets and bullets, in the face of which, however, they were able to find a strategy. They divided the army into three columns: the first column was armed with wooden shields and sent to the attack; the second was armed with ladders for scaling the city walls and the third consisted of cavalry. With such an array the Tartar king surrounds the city on all four sides. First the wall of wood advances against the volleys of the artillery, and in the blink of an eye, instantly the soldiers with the ladders have already climbed to the top of the walls, without it being possible for a soldier to fire a second time [...] The Tartars are quick and violent, agile like no other people, and this is their great advantage. They have the advantage to advance and retreat in the blink of an eye. In this type of attack the use of weapons by the Chinese soldiers has no great importance: they do not have time to open fire a second time and the Tartars, have already scaled and entered, and as [the Chinese] come out from all four sides they meet the fast cavalry. (Ma Chujian 1994, 310)

If we are to believe Martino Martini, then, the Manchu technique consisted in charging behind the protection of wooden screens, then quickly scaling the walls before fire-arms could be recharged and shot again. Once engaged in hand-to-hand combat the Manchu soldiers must have been superior fighters, since the Chinese troops, overwhelmed, attempted to flee the city, only to find the Manchu cavalry waiting for them outside the city walls. We should also recall that ever since the beginning of his military rise Nurhaci had devoted much effort to strengthening the Manchu military potential, and that Manchu armament, both armour and weapons, was made of iron and steel, and not inferior to the Chinese. At any rate, it was the Manchu quickness in charging and scaling the walls, and the slow rate of Chinese fire that accounted for the victories the Manchus obtained in Liaodong, where several cities fell one after the other. Thus Nurhaci temporarily overcame the disadvantage of having a cavalry army ill-suited to siege warfare.

In Liaodong the Manchus started to equip part of their army with firearms. The following decree was issued in 1622:

The Chinese officers in charge of four thousand people must produce 200 soldiers; ten large firearms (cannon) and eighty long firearms (muskets) must be prepared for one hundred of them; the other hundred can be employed as they wish. Those in charge of three thousand people, must produce 150 soldiers and equip [seventy-five soldiers] with eight cannons and fifty-four muskets; the other seventy-five can be used as they wish. Those in charge of two thousand people must raise 100 soldiers and equip [fifty soldiers] with five cannons and forty muskets; the other fifty can be used as they wish. The Jurchen [i.e., Manchu] officers in charge of 2,700 people must raise 135 soldiers; of them 67 should be made to handle 6 cannon and 45 muskets; the other 67 can be employed at leisure. Those [Jurchen commanders] in charge of 1,700 people should raise 85 soldiers and distribute four cannons and 36 muskets to 44 of them, while the remaining 41 soldiers can be employed as they wish. Those [Jurchen commanders] in charge of 1,000 people should

raise 50 soldiers, of whom 25 must be equipped with two cannons and twenty muskets, while the other fifty can be used as they wish. Those in charge of 500 people should raise 25 soldiers; ten must be equipped with a cannon and eight muskets and the rest used as they please. (MBRT 11, 474-5)

From this edict we can see that a fairly extensive campaign was launched to raise troops armed with fire-arms. This edict referred to the newly conquered population of Liaodong, which had been placed under Chinese commanders who had defected to the Manchus or Manchu commanders put in charge of the occupied areas. It is quite remarkable that half of the troops recruited from Liaodong were supposed to carry firearms. Allowing a degree of latitude for the computational errors that can be found in the text quoted above, in general two men were assigned to each "large firearm", which therefore might have been folanjis (culverins), while the "long firearms" were individual weapons, obviously muskets. According to a Chinese historian, the term *dagilambi*, which means "to prepare" in the text above refers to guns that had been captured from the Chinese and were being *distributed* among the troops.² The implication is that at this time it is generally believed that the Manchus did not have a capacity to produce firearms (Hu 1986, 49). Given the quantity of weapons involved, however, one wonders whether local foundries had not been involved in the "preparation" of firearms.

There is no doubt that the incorporation of Chinese troops in larger numbers after the conquest of Liaodong promoted a greater differentiation of military specializations, and therefore greater flexibility. At any rate, regardless of the edict he issued, it is uncertain to what an extent Nurhaci could invest in the production of firearms. The general consensus is that Manchu troops at this stage were only equipped with weapons taken from the Chinese arsenals in the cities they had conquered, while still lacking the capacity to manufacture firearms themselves.

On the Chinese side, however, efforts were being made to strengthen the defences of the cities that had not yet fallen. It is in this connection that the work of European gunners acquires special importance. European intervention in the war against the Manchus was the result of pressures exerted by influential Chinese converted to Christianity, who sponsored Western military technology as a means to contain the Manchu threat. Around 1600 the Ming became acquainted with a much larger and more powerful cannon, first brought by the Dutch in 1604 and called by the Chinese the "*hong-yi* [Red (-haired) Barbarian] cannon" (Needham, 392). Larger guns of the same type were produced by the Portuguese in Macao in foundries operated by Chinese blacksmiths under the direction of European technicians. These cast-bronze cannon were approximately 20-feet long, 1800 kg. heavy, and were particularly effective in siege warfare, both offensively and defensively.

² Please note that, after the first sentence, I have replaced the literal "prepare guns for soldiers" with "equip soldiers with guns".

Fearing that the Manchus could attack Peking, Xu Guangqi and Li Zhizao, both Christian converts who had studied with the famed Jesuit Matteo Ricci, persuaded the court to request that Portuguese cannon be sent north. The request was accepted and between 1621 and 1623 several cannons were sent to the capital with Portuguese cannoners. The move was not unopposed. For instance, an incident in which a Portuguese and some Chinese gunners were killed by the violent recoil of a piece caused considerable criticism of the foreign weapons. But nevertheless the Ming made a sustained effort to outfit their city walls with firearms. The Ming victory at Ningyuan in 1626, a city located in a strategic position beyond the Great Wall, is generally attributed to the greater firepower deployed by the commander Yuan Chonghuan, against the attacking Manchus. Manchu armament, still consisting chiefly of bows and arrows, was inadequate to the task. No matter how brave the soldiers, better fortifications, more powerful guns, and the advantage of protected firepower proved superior, and after a siege of six days the badly bloodied Manchu troops had to withdraw. It should be noted that in the Manchu records the defeat was attributed to poor performance of the Manchu troops, made lazy or cowardly by inactivity, to substandard equipment - such as short ladders, weak carts, and dull weapons - and even to the Khan's own complacency, rather than to the superior fire power of the Chinese defenders (MBRT 1958, vol. 111: 1068-69). However, the illustrations that accompany the *Manzhou shilu* (the Annals of the rise of the Manchus, completed in 1635) clearly show a heavily fortified city walls, with crenellated ramparts from where cannon-mouths can be seen protruding. Explosive devices - probably fragmentation bombs - were tossed upon the Manchu troops attempting to

scale or breach the wall, while several wounded soldiers are taken away. The general impression is one of powerlessness against superior defences.

The battle of Ningyuan was important for both sides. On the one hand, the Ming renewed efforts to procure Portuguese cannon, train cannoners, and thus strengthen the northeastern defence line. On the other hand, the Manchus changed tactics and began to develop in earnest their own artillery. Initially, the Portuguese were unwilling to lend more guns to the Chinese as this might weaken their artillery in Macao against aggressive Dutch competition, and therefore did not respond to Chinese requests. But in 1628 the emperor himself requested that ten pieces of artillery and twenty Portuguese cannoners be sent to the capital. On November 10 of the same year seven bronze cannons and three iron cannons were selected to be sent to the capital. They left Canton on February 28, 1629, but reached the north after the Manchu offensive had already begun, at the end of the same year. The leader of the Portuguese contingent, Teixeira, and his companions reached the city of Jinzhou, where they mounted eight cannon on the ramparts and successfully repelled Manchu attacks with rapid fire (Teixeira 1976, 198-99). When the Manchus were repelled, the emperor welcomed Teixeira, Rodrigues, and the other Portuguese, and requested that a contingent of cannoners be brought from Canton to Peking to train 10,000 Chinese artillery troops. It was reckoned that a force of about three hundred specialists should be sufficient. Thereupon the Jesuit Rodrigues was sent to Macao to raise the force, and at the end of 1630 160 Portuguese soldiers, 200 Macao residents and 100 Indians and Africans (as we can see, a number much larger than it had been estimated) left for the capital, attracted by a pay that is said to have been extremely attractive. However, partly because the Manchus had already withdrawn, partly because of the machinations of Chinese merchants in Canton, who feared that the emperor may consent, out of gratitude to the Portuguese, the opening of another trade port, thus damaging the interests of the Chinese commercial lobby in Canton, the force was almost entirely recalled. Teixeira (who had remained in Peking) and some Portuguese soldiers continue to fight for the Ming, and in 1632 set up their artillery in Dengzhou under Sun Yuanhua, another Christian convert who had been staunchly promoting the cause for the utilization of Portuguese guns against the Manchus. Here Teixeira and the other Portuguese artillerymen behaved bravely, but were all killed in the mutiny of the Chinese garrison, except for three. The Manchus

The Ming continued to rely on foreign military expertise to the very end. In 1642, when the dynasty was on the verge of collapse, the emperor ordered Father Adam Schall, the head of the Jesuit mission in China, to use his technical and scientific knowledge to set up a cannon foundry in Peking. What was asked of him was to reduce the size and weight of guns. Schall was reluctant but in the end accepted the charge, and in the first year of his work he made 20 prototype guns, of which 500 were produced the following year. At the same time, he also produced a book on artillery, called *Huogoniz geyao* ("Essentials of Gunnery") (Needham 1986, 394). The efforts of foreign professional soldiers and scientists could not prevent the loss of

³ In the text in Portuguese this city is identified as Chochow, but I believe this to be Jinzhou, where the Ming commander who actually repelled the Manchus, Zu Dashou, had his Headquarters. Zu had already employed foreign artillery in the defense of Ningyuan where he had fought under Yuan Chonghuan.

China, and even when the fighting moved to southern China the Portuguese guns used against the Manchus, while certainly effective, did not stop the advance of the Qing forces in pursuit of the last remnants of the Ming.

On the Manchu side, Hong Taiji, the son and successor of Nurhaci, is to be given credit for a wide-ranging programme of military modernization that focussed both on the production of firearms and on the creation of a body of specialized troops. Following the defeats or heavy losses suffered by Manchu troops attempting to storm "artillery fortresses," the Manchus acquired the ability to make the first large European-type cannon, which they also called *hongyi* *dapao*, except that the character for *yz* was changed, since the word "barbarian," even if referred to Europeans, did not agree with Manchu sensitivity. With the new "yi", the meaning of *hongyi* was changed from "red (-haired) barbarian" to "redcoat" cannon.

Hong Taiji began the production of this type of heavier gun in 1631, a weapon that gave the Manchus the possibility to bombard enemy fortifications before storming a city or attacking a walled fort, thus increasing greatly their success rate in sieges and limiting their losses (Zhang 1993, Li 1997; Re 1994).

Huge rewards in gold and other valuables were given to soldiers proficient in the use of the cannon, who could also be raised to the highest military honours.

In 1642, in preparation for a massive offensive against the Ming, Hong Taiji set up a cannon foundry in Jinzhou, where several *hongyi* cannons were cast. The organization of this factory's production represented a serious effort at standardizing the types of ordnance, since precise specifications were established as to the weight of and caliber of each type of cannon, quantity of gunpowder to be used per charge, and type of ammunition. After the conquest of China another factory was opened in Beijing and placed under the joint responsibility of the Board of War, Board of Public Works and Imperial Workshop (Hu 1986). However, we must say that apart from the Manchus' efforts at making the production of artillery pieces and firearms more efficient, the guns produced were still based largely on Ming types, which were themselves modelled after the Portuguese ones. Serious "native" improvements of military technology were still to come.

With the independent production of firearms came also the training of specialized soldiers. The earliest troops employed specifically as cannoners were Chinese troops organized in a military structure, called *hanjun* in Chinese (lit. Chinese military), which in the 1630s became part of the Eight Banners system. In Manchu the term used for these soldiers was *ujen cooha* (lit. heavy troops) which is often assumed to mean troops laden with a heavy armament, and by extension artillery troops. In a letter to the Ming general Zu Dashou requesting that he surrender, Hong Taiji boasted that he had a whole battalion of Chinese gunners ready to attack. However, the *hanjun* were not the only troops in charge of firearms. Each Banner had at its disposal a certain number of artillery pieces and soldiers in charge of them, and the Manchu troops at the capital had separate bodies of cannoners and musketeers.

After the conquest of China the general tendency was towards the rationalization and centralization of both the production of firearms and the artillery corps. An imperial decree issued in 1673 ordered that each Hanjun Banner should train a battalion of firearm specialists, allegedly because not many Chinese soldiers were suited for cavalry service. In 1688 a new organ was established, called the "Office (*yamen*) of Firearms and Twice-trained Sword Battalion." This office had jurisdiction over all firearms, and also took care of the preparation of specially trained assault units. In 1691 a measure meant to further centralize the control over firearms was enacted, namely, the creation of the "Firearm Battalion." This was a special force that incorporated all the musket and cannon specialists previously subordinated to the Banners. This organism both professionalized artillery as a separate military corps, and brought under a unified command the various artillery units of the metropolitan Eight Banners (that is those resident in Peking), of the provincial Banner garrisons, and the Green Standard troops.

The production of ordnance was likewise centralized. The yearly manufacture of cannons depended upon specific requests. Unserviceable, damaged, or superfluous guns were sent from the provinces to the capital and handed over to the Board of Public Works, which made a decision of whether to continue to use the piece after appropriate repairs and modifications, or cast a new one. In case of provinces which were far from the capital, such as Fujian, Guangdong, Guangxi, Yunnan and others, inoperative guns were not sent to the capital but kept in storage locally. The local authorities sent a memorial to the Board of Works with a request for a replacement, and, after the approval of the Board, after funds had been raised locally, and after the emperor had personally affixed his note of approval, they could proceed to cast a new cannon locally. There is no doubt that getting new weapons must have been a bureaucratic nightmare.

Verbiest's cannons and the employment of artillery in the "War of the Three Feudatories"

The most serious direct military challenge ever faced by a Manchu ruler before the Taiping was the rebellion started by general Wu Sangui at the end of 1673. Wu Sangui was the most prominent Chinese military and political figure at the end of the Ming, and, after his defection to the Manchus, remained the premier Chinese general in the service of the Qing. He was the one who had made the decision to let the Manchus into China in 1644, and he was the one who had pursued the last epigone of the Ming dynasty all the way to Burma. The Manchu rulers had showered him with honours, and had given him the Governor-generalship of Yunnan, where in 1673 he ruled like a local satrap and still commanded possibly the best-trained Chinese troops in the land. The revolt he started soon spread to the whole of southern China, as Wu Sangui was joined by the Governors of Guangdong and Fujian.

The story of the rebellion is quite well-known and equally well-known is the fact that the Qing emperor sought the help of Verbiest to make different types of cannons, more suitable to the conditions under which this war was fought. Verbiest's brief was to make artillery pieces that were light and handy, easy to transport on rugged terrain, while retaining their range of fire and ability to deliver heavy projectiles (Fu 1966, 1:48). Such guns were necessary because some of the rebel forces' strongholds were located on mountains that were difficult to assault with the use of regular troops, especially since the best Qing forces continued to be Manchu and Mongol cavalry, whose usefulness on the mountains and in the jungle-like forests and rice paddies of southern China was drastically limited. Verbiest's work, reluctantly undertaken, was nevertheless highly successful. Over five hundred of a total of about 900 artillery pieces cast during the Kangxi period were cast under his direction, and on the basis of his designs.

The first cannon that Verbiest made was the so-called 'wooden cannons', in which a lighter barrel was reinforced by a cover of painted wood and mounted on a carriage. The trials were successful and several of these guns were produced and used in the struggle against the Three Feudatories. The main advantage of this gun was that it was easily transportable, but it remained relatively weak and limited in both range and caliber. These guns must have been produced rather hastily, but they fit the requirements and possibly spurred the emperor to continue to invest in the making of new and better guns.

The most innovative cannons were designed and produced by Verbiest after 1681, that is, after the rebellion had already been crushed. Kangxi's plan was to equip every one of the Eight Banners (presumably the Chinese ones) with forty pieces. Thus he ordered Verbiest to cast 320 cannons. The first series of the new Verbiest's cannons, numbering 240, were ready in 1681. This was followed by the casting of other types of cannons, which continued until the death of Verbiest in 1688. What is remarkable in the cannons made by the Belgian Jesuit is the high degree of precision. From some of the surviving cannon, which bear inscriptions on the breech in Manchu and Chinese, we can see that detailed information was given as to the powder to be used, the type and weight of the shot, and the sighting system to be used, besides the names of the engineer (Verbiest), of the supervisors to the production, of the chief craftsman and of the subordinate craftsmen (Stary 1994; Kara 1960).

As for the type of guns, the most important were the *shenwei* cannon, the *wuchengyongyu* cannon, and the *shengong* cannon. The first was a light field gun (200 kg) mounted on a two-wheel carriage; it was effective at a range of 200-300 metres, and shot a cannonball of 900 grams. The second type of cannon was much more substantial: its weight varied between 2 and 3.5 tons, and the cannonball weighed as much as 10 kg. This cannon was also mounted on a wheeled carriage. The *shengong* cannon was mounted on a three-wheeled carriage, and its size was in between the *shenwei* and the *wuchengyongyu*. It weighed about half a ton and delivered a shot of 1.8 kg. In addition, Verbiest also designed a type of trench mortar, called *chongtian pao*, which shot explosive shells on a sharply curved trajectory (Shu 1994).

In addition to designing and casting cannon, in 1682 Verbiest also wrote an important treatise on the theory and methods of employment of artillery, the *Shenwei tushuo* (Illustrated Account of the Magically Awe-inspiring [Cannon]) which seems to have been lost, and a treatise on sighting.

From the latter we can see that in order to ensure the accuracy of shooting, and to calculate the correct positioning of the sighting devices Verbiest relied on geometrical calculations (Shu 1994, 241-43).

Discussion

After the earlier direct imports of cannons, the relevance of Europe in the transmission of artillery to China rests primarily with the use of the Europeans' scientific knowledge to improve upon the existing Chinese arsenal. Both Shao and Verbiest, as missionaries and scientists, had careers that could not be more remote from any military ambition. However, their knowledge in mathematics, chemistry and physics could be applied to metallurgy, ballistics, and explosives, and therefore bring about the necessary changes that military and political leaders required. Chinese artisans were perfectly capable of delivering a product conforming to the specifications required, but the rulers of China must have felt that the foreigners were in a better position to deliver quick results simply because their training placed them in a position to control every aspect of production and testing of artillery, from the thickness of the barrel in relation to the chemical composition of the powder, to the weight and size of the projectiles and to the range that could be achieved. In addition, mathematical calculations were needed to manufacture mortar-type cannons, which

adopted a curved trajectory, and to outfit cannons with appropriate sighting devices. I suspect that it would have been difficult to find in China any single person who could control all required scientific knowledge. Once the standards had been established, naturally Chinese technicians could easily produce the pieces independently, but foreigners found themselves in a privileged position when new types of guns were required.

From a "world historical" perspective this is a significant point, as it was not so much the importation of European military technology per se that affected the development of Chinese weaponry in most of the seventeenth century, but rather the independent application of European scientific notions made at the request of Chinese (and of course Manchu) leaders on the basis of their own internal needs. The principle that it was "internal needs" rather than "external impulses" that drove the development of military technology in China in the seventeenth century is essential to understanding why the eighteenth century was so "dry" of innovations and why, therefore, the gap between China and the west became too large to fill, to the point that in the nineteenth century Qing forces were still fighting with culverins and matchlocks, against howitzers, repetition rifles and machine guns. Once the internal situation no longer presented a need to update their arsenal - which happened at the end of then seventeenth century, when the Qing achieved technological superiority over all their potential enemies (Mongols, Russians, and internal rebels) - the *raison d'être* of technological advancement disappeared, while at the same time the training of intellectuals, administrators, and military officers, continued to be unbalanced and unable to integrate different forms of scientific knowledge in such a way that educated people could be in a position to apply it to practical purposes such as making better weapons. In other words, once the European had helped the Chinese achieve technological superiority, the absence of serious challenges prevented China from going one step further in the direction of the development of a scientific training suitable for military engineering. This is, of course, a much broader issue that invests the nature of education and knowledge in early modern China, but one may still wonder whether the constant need to make better weapons could not have eventually forced the integration of a curriculum based on European mathematics, geometry and physics at least at some levels of the educational system.

Yet the absence of integrated scientific knowledge suitable for making advanced firearms was not the only factor that inhibited the independent development of military technology in China. Another factor was the extreme centralization of the military organization that presided to the production and use of firearms. The creation of the Firearm Battalion (*Huoqi ying*) in 1691 was the crowning act of a process set into motion by Hong Taiji. In Europe the private manufacturing of firearms and their commercialization was already widespread in the sixteenth century, and in the seventeenth century cast-iron cannon were traded throughout Europe in large quantities. The increasing needs of cannon balls, gunpowder, and better guns, felt especially in northern European countries to fight both in Europe and overseas, fanned the flames of European foundries. Given that countries were able to supply themselves with artillery imported from countries they were at war with, such as in the case of Holland's import of English guns, attempts were made to regulate ordnance trade. These were often circumvented, but economic pressures on the production of guns, both in terms of domestic consumption and foreign trade, made the demand always superior to the offer. Hence, technological advancements were desirable to produce cheaper weapons, a pressure that led to the tendency to replace cast-bronze with cast-iron cannon in the early seventeenth century. Cast-iron guns were less expensive but more difficult to make, and therefore required technological progress to attain acceptable standards of performance (Cipolla 1970, 35-72). The European "military revolution" of the sixteenth and seventeenth centuries, therefore, took place in a situation of constant warfare and military competition among states, expanding trade opportunities due to constant demand for ordnance, private and independent (i.e., non state-controlled) manufacturing of weapons, and economic pressures that put a premium on efficiency and cheaper production. These circumstances, which objectively favoured the increasing outputs, circulation, and amelioration of firearms, were simply absent in China, especially after the Manchu conquest of China and consolidation of their rule. When a cannon burst in China, they simply sent in a request for a new one, while in Europe they sent in a request for a better one. Europeans could not afford to have cannon burst - especially if engaged in a naval battle - but in China the Qing dynasty had better cannon than any available to its enemies, and a replacement was sufficient to keep local military units in working order.

Another factor that potentially inhibited the growth of a heavy weapon industry in China was the general preoccupation of the Qing dynasty to limiting military expenses. The tendency of Inner Asian societies to

ignite an upward spiral leading to rapid and seemingly unstoppable proliferation of the military side of society can be observed also in the case of the Manchus on the eve of the conquest. The militarization of Manchu society occurred throughout the period of the rise of Nurhaci to regional primacy, especially after 1600, and consisted essentially in the rapid increase in the size of a military aristocracy whose members depended on emoluments granted by the Khan in exchange for military services. This meant that more male members of the society were recruited into tribal armies, and that the only way the Khan had to remunerate these soldiers was to expand constantly one's power basis by conquest. This tendency towards a larger military was aggravated by the growth in size of the imperial clan, either by the accumulation of wives often resulting from diplomatic marriages (and subsequent dramatic increase in the number of children fathered by members of the clan), or by bringing into the clan members of allied tribes as "son-in-laws" (Manchu *efu*). This meant that the retinues of the imperial clan members, which often included sizeable bodyguard corps, subtracted more people to productive activities and placed an additional burden on the state finances. The Banner system devised by Nurhaci after 1600 was structured in such a way that, once the conquest of China was completed, spoils of war could no longer be relied upon to complement the emoluments granted to the soldiers, and the state had to support this disproportionately large military establishment with salaries. This could be done because the Bannermen and the other members of the military class remained a relatively small percentage of the Chinese population, but the danger that an increase in the military expense could reach critical proportions was always present to the Qing leadership, and efforts were made early on to contain the size of the Bannermen dependent on state salaries and to limit military expenses to an acceptable proportion of the national budget. By all accounts the Manchus were fairly successful, and even though the Qing military is often said to have become, by the early 19th century, a monstrously expensive and inefficient apparatus, Chinese military expenses were much lower, in terms of percentage of fiscal income, than those of contemporary European states. If we then identify the reduction of the military size of society, the containment of military expenses, and the streamlining of military bureaucracy as true concerns of the Qing rulers, what would have been the purpose of establishing ordnance factories - surely very expensive in terms of personnel, raw materials, and logistic structure - after the military situation had been pretty much stabilized? Only a major threat would have justified it, but such a threat, simply, was not there.

A fourth factor that can be deemed responsible for inhibiting the production of firearms was the process organization of firearms specialists, which not only centralized the command of artillery personnel, but also, in doing so, limited circulation and access to firearms. Let us consider briefly the structure of the Qing military class. This comprised the members of the Eight Banners, to which all Manchus, several Mongols, and a select number of Chinese (the *Hanjun* or "Chinese Military" Banners) belonged. Bannermen resided in the capital or were assigned to garrisons throughout China. The army called "Green Standard Battalion," created with the remnants of the Ming army, was an additional component of the Qing armed forces, although its general structure was more regional than "national." The Manchu and Mongol aristocracy dominated the military establishment and constituted the backbone of the chain of command. Such a position reflected the martial origin of the Manchu and Mongol elite, justified its position of privilege, and helped retain it, but should not lead automatically to the conclusion that the role of the Chinese (Han) soldiers was perfunctory. In fact, the participation of Chinese soldiers in just about any major campaign cannot be underestimated, and the common perception that Manchus and Mongols, as steppe people, were imbued with superior martial spirit, while the traditional Chinese elite remained disdainful of military prowess and engaged in literary pursuits can only be carried so far.' In reality, the Chinese military, even the supposedly inferior Green Standard troops, performed quite well on several occasions.

If we take the War of the Three Feudatories (1673 -168 1) as an example, we can see that Chinese troops on both the Qing and the rebel sides performed as adequately as the Manchu and Mongols troops. In fact, towards the end of the war Kangxi relied more on Chinese than on Manchu generals to carry out his commands in the final showdown with the last remnants of the rebel troops (Kessler 1976, 88). In the aforementioned account of Zengshou there is not a shred of contempt or criticism directed at the performance of Chinese troops, while there is much of both directed at the Manchu commanders, who are described as grasping, tyrannical, insensitive to the sufferings of both soldiers and civilians. While it is to be expected that a soldier would criticize his superiors, it may be significant that ethnic affiliations do not play any role in Zengshou's description of his and his fellow soldiers' roles in the campaign. Moreover, while Zengshou does his best to behave honourably - or at least this is the way he comes across in his own diary - he is far from displaying the martial ardour attributed to the Manchu soldier. Quite to the contrary,

he wishes to go back home, is totally disenchanted towards the military service, fears for his life, is horrified at the wanton violence and his chief preoccupation is to come out of his ordeal alive. Although we cannot generalize on the basis of a single personal experience, Zengshou's witness account goes to show that it is not possible to generalize in the other direction either. While not all Manchus experienced war in the same way as Zengshou, surely not all Manchus were prone to spending their life in a condition of perpetual warfare.

4 The classic work on the anti-military orientation of Chinese culture is : Lei Haizong, *Zhong-gu wenhua yu Zhongguo de bing* [Chinese Culture and Chinese Military] (Changsha, 1940). Note also Ho Ping-ti's statement to the effect that military careers were sought mainly by people who were illiterate and could not achieve a position of prominence by the normal channels of literary examinations (Ho Ping-ti 1964, p. 217-19). On the other hand, anti-Qing leaders came also from the ranks of the dispossessed and of those people who had failed the examinations, and the subversive potential of this class during the late Qing is well known.

The realization that Chinese were not all useless in battle and that the Manchus were not all self-sacrificing heroes may help put in the right perspective the rulers' weariness about consenting wider access to firearms, especially in light of the omnipresent threat of anti-Manchu rebellions and uprisings. It stands to reason that limiting the use of firearms to a single centralized body of people specially trained and easily controlled, and keeping the production of weapons under direct state control, could be measures meant as much to rationalize the deployment of artillery in military campaigns as to prevent the proliferation of a type of weaponry that might give potential Chinese rebels an edge against the Qing forces. While this point is speculative, and as yet unsupported by specific evidence, one may recall that in the nineteenth century it was Chinese literati of the caliber of Wei Yuan that advocated military modernization, and that Li Hongzhang equipped anti-Taiping troops with modern European rifles after the Taipings had themselves acquired a large number of modern firearms.

All the factors mentioned above, from the lack of integrated scientific knowledge to the absence of a militarily competitive environment, from the Qing desire to limit military expenses to the enactment of measures that inhibited access to and circulation of firearms can be brought to bear to illustrate the declining state of Chinese military technology after Verbiest's innovations.

Conclusion

This paper has attempted to retrace the introduction of firearms in China, and to examine the genesis and evolution of the "encounter" between European technology and China's military needs. As preliminary conclusions, we can say the following.

First, when discussing the transmission of "European" knowledge to China one needs to consider the web of relations and interests that linked together not just China and Europe, but also the Muslim world, south Asia, Japan, and even Central Asia. The diffusion of firearms shows that this was the case, although I suspect that future research may further clarify the nature of the links between the Ottoman empire and China, and between India and China.

A second aspect refers to the actual effectiveness of cannon and musket in the military context of the Manchu conquest of China. In this respect, a position of particular interest is represented by the period immediately following the death of Nurhaci, which saw the rapid ascent and rule of Hong Taiji (1627-1643). During this period the Manchu army grew in size and sophistication, as it was transformed by the formation of Mongol and Chinese (Han) Banners and by the adoption of firearms. While it would be far-fetched to claim that the military innovations that took place in the Later Jin and Qing (from 1636) dynasties were key to the conquest of China, I have argued that their role in the process cannot be easily dismissed either.

Thirdly, the analysis of seventeenth century military technology in China shows that although advancements owed much to the involvement of Europeans, the general development of firearms was driven by internal factors, which determined the nature and the aims of the European involvement. Rather than due to mere diffusion, advanced arms were developed by using European scientific knowledge

adapted to the special requirements presented by the military circumstances, and produced thanks to the mature metallurgical capabilities of China. Although I have not yet been able to compare technical characteristics, it is possible that good cast-iron cannon were easier to produce in China than in Europe.

Finally, we have considered some of the possible causes that led to the end of the efforts to improve firearms. These are: (1) the centralization of the firearm corps achieved in 1691 with the creation of the Firearm Battalion (*huoqi ying*), (2) the absence of demand for more and better guns, and the related absence of commercial opportunities for ordnance trading; (3) the absence of warfare in such a scale that would justify constant financial investments in the production of ever more sophisticated firearms; (4) the achievement, by the end of the seventeenth century, of the state-of-the-art technology in East Asia, which was not seriously challenged by any enemy until the arrival of Europeans; (5) possibly, the Manchu rulers of China wished to keep firearm circulation to a minimum both as a means to limit the militarization of Qing society, intended as an excessive growth of the military establishment, and as a preventive measure to limit the possibility that anti-government rebels may gain access to a weaponry that had been typically the preserve of Chinese soldiery.

Some of these conclusions remain speculative at the present stage, but the range of factors goes to show that questions of how war relates to social and intersocietal developments in the early modern period - many of which are encompassed by the term "military revolution" - require close attention to local conditions even when considered on a global scale, as those conditions are, in the last instance, the arbiters of what societies accept from the outside. On the other hand, to exclude the broader perspective from the study of seventeenth century Chinese history and to ignore the important influence of foreign science and technology as a factor that played an active role in "internal" historical events would be extremely shortsighted.

For me, one of the most important outcomes of the study of European weaponry in seventeenth century China is that it shows beyond doubt that the Manchu soldiers, although usually brave and highly motivated, were not an invincible race. Flexibility, the capacity to organize and coordinate different types of soldiers and military expertise, the willingness to utilize a wide range of resources, and reliance on a chain of command unhampered by extreme factionalism seem to have been, in the long run, greater advantages than the "natural" predisposition of the Manchu soldiers to war. Attacking fortified strongholds defended by cannon and musket was not an everyday experience for either Manchus or Mongols, or a skill acquired in childhood, and the conquest of China was carried on often on terrain unsuitable to cavalry tactics against seasoned Chinese troops. Without taking anything away from Manchu bravery, the "story" of firearms shows that the Manchu army was, especially under Hong Taiji, a very complex machine. The Banner system had made the whole society function according to the military requirements of the war against China, and that system was subject to constant changes and modifications as new banners were created and new people, such as allied Mongols and surrendered or conquered Chinese, were incorporated. Its flexible organization included, among other things, the educational structures to make Manchus literate, the financial and logistic support to feed troops under constant mobilization, and the technical resources to manufacture large quantities of war materials. Perhaps the military side of the Qing conquest can be better explained by examining its sophistication than by insisting on the inborn martial qualities of the Manchu soldiers. By weaving together the destinies of Chinese mandarins, Manchu generals, Portuguese cannoners, European missionaries, and many other people, the history of firearms also links closely the history of the Manchu conquest of China with the broader currents of world history.

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