
This is the **submitted version** of the journal article:

Noordam, Barend. «Chinese Volley Fire and Metanarratives of World History». *Journal of World History*, Vol. 34 Núm. 3 (September 2023), p. 329-368. University of Hawaii Press. DOI 10.1353/jwh.2023.a902024

This version is available at <https://ddd.uab.cat/record/282735>

under the terms of the  ^{IN}
COPYRIGHT license

Chinese Volley Fire and Metanarratives of World History

Barend Noordam

Abstract

Volley fire with gunpowder weapons is often seen by modern scholars as one of the important innovations which allowed Europe to politically dominate other cultures and societies. Many historiographical theories, of the kind Lyotard termed *metarécits*, “metanarratives”, have attempted to explain this phenomenon. Recently, compelling evidence has emerged that other civilizations also practiced the technique, most notably China. This article brings together existing and new evidence that volley fire with firearms was developed and practiced in China long before it appeared in Europe and challenges several of the grand narratives of European exceptionalism. This new evidence shows that the volley fire technique arose in China primarily as a reaction to domestic and foreign (semi-)nomadic cavalry threats, belying geographically deterministic accounts, which suggest that sophisticated infantry tactics with firearms would not arise in states bordering the steppe. This article will also challenge the claim that volley fire in Europe benefitted from its emergence in a competitive system of states undergoing a tradition-challenging Renaissance. I call for a reconsideration of the innovative potential of Eurasian land empires bordering the steppe, and stress the importance of studying political contingencies and cultures of innovation in shaping world history.

Introduction

The rise of postmodern scepticism has cast doubt on many older metanarratives, which arose within the scholarly study of history to explain the “Rise of the West”. Two genres within the discipline have bucked this trend: world history understandably kept alive a penchant for universalizing explanatory schemes, and military history has been largely immune because of its still prevalent Eurocentrism. It should come as no surprise, then, that scholars working at

the intersection of both fields have tended to propose overarching theories of causation, more often than not advancing European exceptionalism.¹ Continuous volley fire with gunpowder weapons and its associated drill, creating an uninterrupted barrage of projectiles maintained by multiple rows of soldiers who shoot and reload in turns, is a kind of totem around which many of the resulting historical metanarratives revolve.² Whether believed to have been invented by

¹ Callum G. Brown, *Postmodernism for Historians* (Harlow: Pearson Longman, 2005), 97–99; Georg G. Iggers and Q. Edward Wang, *A Global History of Modern Historiography* (Harlow: Pearson Longman, 2008), 301–2; Jean-François Lyotard, *La condition postmoderne: Rapport sur le savoir* (Paris: Les Éditions de Minuit, 1979); Stephen Morillo, ‘Bullets in Motion’, in *A Companion to World History*, ed. Douglas Northrop (Chichester: Wiley-Blackwell, 2012), 376–78; Barbara Weinstein, ‘History Without a Cause? Grand Narratives, World History, and the Postcolonial Dilemma’, *International Review of Social History* 50, no. 1 (2005): 71–72; Although the torch of the metanarrative is now often carried by a heterogenous group of scholars who do not use the label ‘world historian’: Peer Vries, ‘Review Essay. The Prospects of Global History: Personal Reflections of an Old Believer’, *International Review of Social History* 64, no. 1 (2019): 5.

² Harald Kleinschmidt, ‘Using the Gun: Manual Drill and the Proliferation of Portable Firearms’, *The Journal of Military History* 63, no. 3 (1999): 601–30; William H. McNeill, *Keeping Together in Time: Dance and Drill in Human History* (Cambridge, Massachusetts: Harvard University Press, 1995); Stephen Morillo, ‘Guns and Government: A Comparative Study of Europe and Japan’, *Journal of World History* 6, no. 1 (1995): 75–106; Geoffrey Parker, ‘The Limits to Revolutions in Military Affairs: Maurice of Nassau, the Battle of Nieuwpoort (1600), and the Legacy’, *The Journal of Military History* 71, no. 2 (2007): 331–72; Geoffrey Parker, *The Military Revolution: Military Innovation and the Rise of the West*,

the Spanish in 1522 or 1586, the English in 1579, or the Dutch in 1594, its appearance on the battlefields of early modern Europe for many scholars heralded the eventual dominance of western militaries over the world.³ Outside of Europe, until quite recently only Japan received

1500-1800 (Cambridge: Cambridge University Press, 1996); Michael Roberts, 'The Military Revolution, 1560-1660', in *The Military Revolution Debate: Readings on the Military Transformation of Early Modern Europe*, ed. Clifford J. Rogers (Boulder: Westview Press, 1995), 13–35; Philip Smith, 'Meaning and Military Power: Moving on from Foucault', *Journal of Power* 1, no. 3 (2008): 275–93. Unless otherwise noted, when using the term "volley fire" in this article I generally mean its continuous variant, made possible by a theoretically unlimited cycle of loading and firing implemented by different ranks of soldiers. This could be achieved by countermarching tactics, different ranks in turns standing up to fire and kneeling to reload, or the cycling of firearms through several ranks of reloading soldiers to a front rank which would then fire them. Limited volley fire was of course possible as well, by prepared ranks of soldiers who had made no tactical adjustments for organized continuous reloading.

³ Tonio Andrade, 'The Arquebus Volley Technique in China, c. 1560: Evidence from the Writings of Qi Jiguang', *Journal of Chinese Military History* 4, no. 2 (2015): 115–20, 134–35; Although Andrade dismissed the 1522 claim made by González de León on the basis of inconclusive source material, there is better evidence the Spanish used volley fire during the battle of La Bicocca (1522). In this case four ranks of harquebusiers were used which stood up to fire and kneeled to reload in turns, protected by a ditch and a rampart instead of pikemen. This was recorded by contemporary historian Paolo Giovio (1493-1552) and cited by Mallett and Shaw. Andrade seems to have missed this latter source. See: Paolo Giovio, *Le vite del gran capitano e del marchese di Pescara*, ed. Costantino Panigada, trans. Ludovico

the bulk of attention from western scholars for developing volley fire with firearms independently from Europe in the late sixteenth century, a development which was then cut short by the conscious decision of Japanese rulers to demilitarize the country after centuries of destructive civil war.⁴ In the meantime, newer research has suggested that volley fire with firearms was also developed independently in China and the Ottoman Empire, and that it was practiced in Korea.⁵

Domenichi (Bari: Gius. Laterza & Figli, 1931), 290; Fernando González de León, 'Spanish Military Power and the Military Revolution', in *Early Modern Military History, 1450-1815*, ed. Geoff Mortimer (New York: Palgrave MacMillan, 2004), 28; Michael Mallett and Christine Shaw, *The Italian Wars, 1494-1559: War, State and Society in Early Modern Europe* (London and New York: Routledge, 2012), 143–44.

⁴ Delmer Brown's claim even predated the entire debate around the world historical significance of volley fire. See: Delmer M. Brown, 'The Impact of Firearms on Japanese Warfare, 1543-98', *The Far Eastern Quarterly* 7, no. 3 (1948): 245; Parker, *The Military Revolution: Military Innovation and the Rise of the West, 1500-1800*, 140–45; The Japanese are thought to have first used the technique in 1576 during the Battle of Nagashino, albeit using three ranks firing from behind obstacles and against enemy cavalry. At present some scholars have doubts about this interpretation of the battle, but it is clear that Japanese forces did use this technique before 1600. See: Gyūichi Ōta, *The Chronicle of Lord Nobunaga*, ed. J.P. Lamers and J.S.A. Elisonas (Leiden: Brill, 2011), 42; Kenneth M. Swope, *A Dragon's Head and a Serpent's Tail: Ming China and the First Great East Asian War, 1592-1598* (Norman: University of Oklahoma Press, 2009), 76.

⁵ Gábor Ágoston, 'Firearms and Military Adaptation: The Ottomans and the European Military Revolution, 1450-1800', *Journal of World History* 25, no. 1 (2014): 95–98; Gábor

This study will not be a plea for military and world history to altogether abandon metanarratives, of the kind surrounding volley fire. To loosely paraphrase Peer Vries, world history should be the kind of history which dares put forward risky hypotheses based on big units of analysis, because what would its *raison d'être* be otherwise?⁶ However, as James Belich and others have argued, the existing metanarratives can be refined and critiqued by

Ágoston, *Guns for the Sultan: Military Power and the Weapons Industry in the Ottoman Empire* (New York: Cambridge University Press, 2005), 24; Andrade, 'The Arquebus Volley Technique in China, c. 1560: Evidence from the Writings of Qi Jiguang'; Tonio Andrade, *The Gunpowder Age: China, Military Innovation, and the Rise of the West in World History* (Princeton: Princeton University Press, 2016), 144–87; Tonio Andrade, Hyeok Hweon Kang, and Kirsten Cooper, 'A Korean Military Revolution? Parallel Military Innovations in East Asia and Europe', *Journal of World History* 25, no. 1 (2014): 67–70; Günhan Börekçi, 'A Contribution to the Military Revolution Debate: The Janissaries' Use of Volley Fire during the Long Ottoman-Habsburg War of 1593-1606 and the Problem of Origins', *Acta Orientalia Academiae Scientiarum Hungaricae* 59, no. 4 (2006): 407–38; Hyeok Hweon Kang, 'Big Heads and Buddhist Demons: The Korean Musketry Revolution and the Northern Expeditions of 1654 and 1658', *Journal of Chinese Military History* 2 (2013): 127–89; Laichen Sun, 'Military Technology Transfers from Ming China and the Emergence of Northern Mainland Southeast Asia (c. 1390-1527)', *Journal of Southeast Asian Studies* 34, no. 3 (2003): 500.

⁶ Vries, 'Review Essay. The Prospects of Global History: Personal Reflections of an Old Believer', 5, 9–11.

expanding our reliance on a primary and secondary source base in a variety of languages.⁷ Thus, I will use the example of the innovation of volley fire to demonstrate the validity of the recent awareness among some world historians that a kind of middle ground has to be sought, on the one hand recognizing and working with metanarratives in the secondary literature, while critically testing them based on detailed case studies that draw upon primary source materials in a variety of languages. Moreover, a balance should be achieved between detecting and positing large scale patterns, and taking heed of political contingencies and cultural idiosyncrasies.⁸

By introducing fresh evidence culled from Chinese military sources dating back to the Ming dynasty (1368-1644), critically reappraising older research and building on new insights which have been uncovered by non-Europeanists, this article will challenge two of the fundamental narratives about the development of continuous volley fire and the conduct of military innovations in world history. These two metanarratives can best be labelled as respectively the “geographic determinist” and “Renaissance geopolitical” explanations of early

⁷ James Belich, John Darwin, and Chris Wickham, ‘Introduction: The Prospect of Global History’, in *The Prospect of Global History*, ed. James Belich et al. (Oxford: Oxford University Press, 2016), 11–12; Richard Drayton and David Motadel, ‘Discussion: The Futures of Global History’, *Journal of Global History* 13 (2018): 8.

⁸ Jeroen Duindam, ‘Prince, Pen, and Sword: Eurasian Perspectives’, ed. Maaïke van Berkel and Jeroen Duindam (Leiden and Boston: Brill, 2018), 544; Vries, ‘Review Essay. The Prospects of Global History: Personal Reflections of an Old Believer’, 4, 7–10 Though, as Peer Vries suggests, the lack of attention to political factors is also present among those world (or: global) historians who tend to stress the importance of connections and therefore downplay the importance of political units.

modern European military superiority. For geographic determinists volley fire was a symptom of the largely unique geopolitical experience of (Western) Europe and Japan, divorced as they were from a steppe teeming with enemy cavalry, allowing the Europeans and the Japanese to focus on the development of infantry and artillery weapons and tactics. Eurasian empires facing the steppe only developed their firearms and tactics to deploy them if they also concurrently faced a sedentary opponent on another frontier, like the Ottomans and the Russians.⁹ Entangled with this geographically deterministic model is the narrative that innovations, like volley fire, owed their existence to the uniquely competitive system of European sedentary states, which

⁹ The key work here is Kenneth Chase, *Firearms: A Global History to 1700* (Cambridge: Cambridge University Press, 2003); This view has become influential in the pages of the recent Cambridge World History, see: Jack A. Goldstone, 'Political Trajectories Compared', in *The Cambridge World History. Volume VI: The Construction of a Global World, 1400-1800 CE. Part 1: Foundations*, ed. Jerry H. Bentley, Sanjay Subrahmanyam, and Merry Wiesner-Hanks (Cambridge: Cambridge University Press, 2015), 456; Jos Gommans, 'Continuity and Change in the Indian Ocean Basin', in *The Cambridge World History. Volume VI: The Construction of a Global World, 1400-1800 CE. Part 1: Foundations*, ed. Jerry H. Bentley, Sanjay Subrahmanyam, and Merry Wiesner-Hanks (Cambridge: Cambridge University Press, 2015), 186–87; See also: Jos Gommans, 'Warhorse and Post-Nomadic Empire in Asia, c. 1000-1800', *Journal of Global History* 2 (2007): 5; Philip T. Hoffman, *Why Did Europe Conquer the World?* (Princeton and Oxford: Princeton University Press, 2015), 67–103; Victor Lieberman, *Strange Parallels: Southeast in Global Context, c. 800-1830. Volume 2: Mainland Mirrors: Europe, Japan, China, South Asia, and the Islands* (Cambridge: Cambridge University Press, 2009), 626; Kaushik Roy, *Warfare in Pre-British India: 1500 BCE to 1740 CE* (London and New York: Routledge, 2015), 102, 147.

relied on armies consisting predominantly of infantry. Implicit is the understanding that nomadic threats, which Eurasian empires like the Ming often faced, could not have stimulated the same kind of innovation.¹⁰ For adherents of the Renaissance geopolitical explanation, volley fire is considered to be a conscious revival of antique military precedents and proof of the decisive contribution this uniquely European revival of classical learning made towards world domination. Moreover, the Renaissance was thought to have fostered military humanism, encouraging a readiness to challenge ingrained notions with insights derived from classical learning, and was also thought to have featured a “scientific” culture of innovation, characterized by a certain openness to participation by a diversity of actors, contributing to its fertility. This openness was necessary because the capital-intensive ways of European military innovation usually prohibited a single state from funding and accomplishing it, while at the same time the complexities of these innovations required the cooperation of multiple specialist groups. Other societies, apparently lacking openness and diversity, labouring under fundamentalist belief systems and micromanaging states, like Ming China, were only able to support one-off “singleton” innovations with limited development potentials.¹¹ In the guise of

¹⁰ Graeme Donald Snooks, *The Dynamic Society: Exploring the Sources of Global Change* (London and New York: Routledge, 1996), 301–23; Peer Vries, *State, Economy and the Great Divergence. Great Britain and China, 1680s - 1850s* (London: Bloomsbury Publishing PLC, 2015), 302–5.

¹¹ Thomas F. Arnold, ‘War in Sixteenth-Century Europe: Revolution and Renaissance’, in *European Warfare, 1453-1815*, ed. Jeremy Black (Houndmills: Palgrave MacMillan, 1999), 35–44; Parker, ‘The Limits to Revolutions in Military Affairs: Maurice of Nassau, the Battle of Nieuwpoort (1600), and the Legacy’, 366–69; For a more sceptic take on the value of the Renaissance for military innovation, see: Donald A. Neill, ‘Ancestral Voices: The Influence

military history and applied to cultures of innovation, these notions seem indebted to the older idea of “oriental despotism”. This is the assessment, again often uttered with the empires bordering the steppe in mind, that many Eurasian polities not belonging to the dynamic and competitive European state system suffered from innovation-stifling despotism. This despotism manifested itself in the shape of absolute rulers aided by monolithic bureaucracies inculcated with a singular belief system, that brooked no political competition and saw innovation as a potential danger to the established order. Again, early modern (Western) Europe escaped this state of affairs by the virtue of possessing multiple competing power centres and the Renaissance, which offered a challenge to established authority and tradition. These factors combined then offered incentives and possibilities for the survival and dissemination of innovations. Whereas the explicit image of the oriental despot ruling a stagnant land empire has been criticized and mostly abandoned by modern scholars, its reflection is implicitly - if often unconsciously - kept alive in the still widely embraced mirror constituted by its counterpart: the competitive plural European system of Renaissance states. The determinism of the “Renaissance geopolitical” thesis thus seems to hold in common with the geographic determinists that unitary land empires bordering the steppe lacked incentives and political scope to innovate in (military) affairs.¹²

of the Ancients on the Military Thought of the Seventeenth and Eighteenth Centuries’, *The Journal of Military History* 62, no. 3 (1998): 487–520.

¹² The ur-example in modern scholarship is of course: Karl August Wittfogel, *Oriental Despotism: A Comparative Study of Total Power* (New Haven, Connecticut: Yale University Press, 1957), 366–67; Important echoes of this view can be found in: Thomas F. Arnold, *The Renaissance at War* (London: Cassell & Co, 2001), 19; Jared Diamond, *Guns, Germs, and Steel: The Fates of Human Societies* (New York and London: W.W. Norton & Company,

I will advance two main claims, based on the historical experience of the Ming Empire, that challenge these Eurocentric interpretations. First of all, volley fire with firearms arose during the Ming primarily as a response to the challenge nomadic cavalry posed, and not as a result of infantry warfare. Moreover, there are strong indications that the challenge posed by cavalry in general, of both “barbarian” nomadic and domestic Chinese origin, spurred the even earlier development of volley fire with bows and, especially, crossbows. There are also signs that this causation not only held true for Ming China, but other Eurasian empires bordering the steppe as well. Second, I will show that the process of volley fire development during the Ming dynasty saw the participation of actors from different socio-cultural and political backgrounds,

2017), 533–35; Jack A. Goldstone, ‘Divergence in Cultural Trajectories: The Power of the Traditional with the Early Modern’, in *Comparative Early Modernities, 1100-1800*, ed. David Porter (New York: Palgrave MacMillan, 2012), 165–92; Eric Jones, *The European Miracle: Environments, Economies and Geopolitics in the History of Europe and Asia*, 3rd ed. (Cambridge: Cambridge University Press, 2003), 112; David S. Landes, *The Wealth and Poverty of Nations: Why Some Are So Rich and Some So Poor* (New York: W.W. Norton, 1992), 27–28, 38, 57–58; Thomas Maissen and Barbara Mittler, *Why China Did Not Have a Renaissance - and Why That Matters: An Interdisciplinary Dialogue* (Berlin and Boston: De Gruyter Oldenbourg, 2018), 127; Pak Hung Mo, ‘Effective Competition and Economic Development of Imperial China’, *Kyklos* 48, no. 1 (1995): 100–101; Joel Mokyr, *A Culture of Growth: The Origins of the Modern Economy* (Princeton and Oxford: Princeton University Press, 2017), 119–224; Geoffrey Parker, ‘The Western Way of War’, in *The Cambridge Illustrated History of Warfare*, ed. Geoffrey Parker (Cambridge: Cambridge University Press, 1995), 5–8.

aided by a lively print culture, which suggests the existence of a culture of military innovation characterized by openness and diversity as well.

The weighty claims surrounding volley fire advanced by Europeanist scholars prompted a search for signs of volley fire practice within other world regions and generated a wealth of new data and revisionist insights generated by historians of the non-European world in response. In 1526, for example, harquebus volley fire might have been practiced by the Ottomans during the Battle of Mohács against the Hungarians.¹³ We have also learned more about Chinese infantry tactics and evidence has been found that volley fire with projectile weapons, with both (cross-)bows and firearms, has had a long pedigree there. Peter Lorge posited Chinese armies were already capable of volley fire with arrows prior to the introduction of firearms.¹⁴ Tonio Andrade argued that the technique was already invented using crossbows during the Warring States period (475 – 221 BCE) and eventually adapted to the harquebus by general Qi Jiguang 戚繼光 (1528-1588) in the sixteenth century and used against the infantry forces of the Sino-Japanese *Wokou* pirates. According to Andrade, Qi benefitted from a continuous tradition of drilling passed down from the classical period of the Warring States (475-221 BCE) in China. In contrast, the early modern Europeans did not benefit from a similar continuity and had to rediscover and reapply classical Greek and Roman precedents, which

¹³ Ágoston, 'Firearms and Military Adaptation: The Ottomans and the European Military Revolution, 1450-1800', 95–98; Ágoston, *Guns for the Sultan: Military Power and the Weapons Industry in the Ottoman Empire*, 24; Börekçi, 'A Contribution to the Military Revolution Debate: The Janissaries' Use of Volley Fire during the Long Ottoman-Habsburg War of 1593-1606 and the Problem of Origins'.

¹⁴ Peter A. Lorge, *The Asian Military Revolution: From Gunpowder to the Bomb* (Cambridge: Cambridge University Press, 2008), 31.

was made possible by the Renaissance.¹⁵ The superiority claim of the Renaissance geopolitical explanation was thus put on its head: instead of being a European military advantage the Renaissance was really a sign of backwardness, since China simply did not need a Renaissance to reform its armies along classical precedents. The revisionist insights have also started nibbling away at the claims buttressing the metanarrative proposed by the geographic determinists. Besides positing a continuous Chinese tradition of volley fire, Andrade convincingly showed that hand-held firearms were used in great numbers against China's nomadic enemies. Nevertheless, he considered the southern maritime areas of China as a key site of competition between indigenous and foreign ideas and a crucible of military innovation, and therefore important new technologies and techniques often spread from the south to the north.¹⁶ Likewise, Kai Filipiak and Peter Lorge have argued that both cannon and hand-held

¹⁵ Andrade, 'The Arquebus Volley Technique in China, c. 1560: Evidence from the Writings of Qi Jiguang', 118, 135; Andrade, *The Gunpowder Age: China, Military Innovation, and the Rise of the West in World History*, 144–87; Sun, 'Military Technology Transfers from Ming China and the Emergence of Northern Mainland Southeast Asia (c. 1390-1527)', 500.

¹⁶ Tonio Andrade, 'Maritime China in Global Military History: Some Reflections on the Chase Model', in *Early Modern East Asia: War, Commerce, and Cultural Exchange. Essays in Honor of John E. Wills, Jr.*, ed. Tonio Andrade and Kenneth M. Swope (London and New York: Routledge, 2018), 100–118; Tonio Andrade, 'How Yongle Learned to Stop Worrying and Love the Gun: Perspectives on Early Ming Military History', in *The Ming World*, ed. Kenneth M. Swope (London and New York: Routledge, 2020), 166–201; Stephen Morillo and Kenneth Swope have similarly criticized Chase for not paying enough attention to the geographic diversity of Ming warfare. See: Stephen Morillo, 'Firearms: A Global History to 1700, and: Battle: A History of Combat and Culture (Review)', *Journal of World History* 15,

firearms, respectively, were effective against nomadic opponents along the northern frontier of the Ming Empire.¹⁷ Siegmund Felix has also argued that the geographic model does not hold for Chosŏn Korea (1392-1897), where the deployment of firearms along the northern frontier was initially stimulated by cavalry threats.¹⁸ The deployment of these weapons was thus not hindered by vicinity to the steppe. In addition, such a prominent world historian as William McNeill recognized long ago that the crossbow, the functional predecessor of the hand-held firearm, was China's main advantage vis-à-vis the nomad threat.¹⁹ Many ancient Chinese held a similar appreciation of the weapon's worth against nomadic forces.²⁰ It is thus at least surprising that this geographic setting was apparently not thought by other modern scholars to have led to any noteworthy tactical innovations. This article will build on this revisionist

no. 4 (2004): 527; Kenneth M. Swope, 'Firearms: A Global History to 1700 by Kenneth Chase', *Journal of the Economic and Social History of the Orient* 47, no. 2 (2004): 285.

¹⁷ Kai Filiipiak, 'Technological Advance in the War against the Mongols', in *Chinese and Indian Warfare - From the Classical Age to 1870*, ed. Kaushik Roy and Peter Lorge (London and New York: Routledge, 2015), 122–27; Peter Lorge, 'The Martial Arts in Qi Jiguang's Military Training', in *The Maritime Defence of China: Ming General Qi Jiguang and Beyond*, ed. Y.H. Teddy Sim (Singapore: Springer, 2017), 63, 68–69.

¹⁸ Felix Siegmund, *Theorie und Praxis militärischen Wissens zwischen China und Korea im langen 17. Jahrhundert: Qi Jiguangs militärische Schriften und die nordöstliche Grenzregion* (Wiesbaden: Harrassowitz Verlag, 2018), 145–48.

¹⁹ William H. McNeill, *The Pursuit of Power: Technology, Armed Force, and Society since A.D. 1000* (Chicago: The University of Chicago Press, 1982), 33–34.

²⁰ David Curtis Wright, 'Nomadic Power, Sedentary Security, and the Crossbow', *Acta Orientalia Academiae Scientiarum Hung.* 58, no. 1 (2005): 21–29.

research and considerably modify the causal geographic scopes of its conclusions. Through the lens of Chinese - in particular Ming - history we will see the crucial role cavalry threats and the northern frontier played in stimulating innovation in infantry volley fire tactics, and the way the culture of military innovation benefitted from the transmission of the classical tradition and the input of diverse groups of actors to ensure continuity of this military praxis.

Geographic Determinism

According to Kenneth Chase, one of the main proponents of the geographic thesis, the large empires which surrounded the Eurasian arid zone in the early modern period faced a persistent nomadic threat emanating from the steppe. These nomads relied on nimble and mobile horse archers, which fought from a distance and were able to outmanoeuvre slower infantry formations. Therefore, the adjacent empires in response mostly relied on cavalry themselves, and their infantry fought from behind *ad hoc* field fortifications to protect them from enemy cavalry charges. These fortifications often took the shape of wagon forts (also referred to as “wagon fortress” or “wagon laager” by scholars); wooden carts and artillery pieces chained together from behind which infantry with handheld firearms could operate. All Eurasian empires surrounding the steppe developed a version of these infantry tactics, including the Chinese Ming Empire (1368-1644), the Ottoman Empire (1299-1923), and the Tsardom of Russia (1547-1721). Western Europe and Japan, by contrast, did not use the wagon fort, but relied on pikemen to protect their gunners. Because infantry was therefore more important, numerous, and could not fall back on solid field fortifications, more sophisticated tactics and formations were developed, such as continuous volley fire, to maximise the firepower of the infantry. Complicated countermarching formations were developed in Western Europe, featuring up to ten ranks of musketeers, which would fire and counter march to the back of the

formation to reload in turns.²¹ Chase's thesis therefore also neatly explains why Japan, as the only non-European society, developed infantry volley fire with firearms. Although Chase was aware the Chinese practiced volley fire for a long time (although he does not specify if this was with bows, crossbows, or firearms), he stated that they never developed drilled bodies of infantrymen capable of the technique with firearms, but instead tried to increase the rate of fire of the weapons themselves. This was done by introducing breech-loading handguns, which could be quickly reloaded with pre-prepared chambers filled with the appropriate amount of gunpowder and a projectile. This obviated the need for complicated tactics featuring countermarching formations and rotating ranks. Multi-barrelled handguns were similarly effective: "If the Mongols charged, there was no time to get off more than one volley with muskets, even for trained infantry. In the north, multiple-barreled [*sic*] weapons provided the most firepower in the least period of time, since all the barrels could be fired at once."²² The development of firearms in China thus fit a general pattern Chase noted for polities bordering nomadic threats: "Development was slower to the extent the threat came from nomads."²³ He furthermore concluded: "The regions where pikes dominated were also the regions where firearms were the most effective."²⁴ Eurasia could therefore be roughly divided in two parts: societies facing a significant nomadic threat that deployed their infantry gunners and artillery behind wagon fortresses, and societies primarily facing infantry armies that used pikemen to

²¹ Chase, *Firearms: A Global History to 1700*, 205–10; Jos Gommans, *Mughal Warfare:*

Indian Frontiers and High Roads to Empire, 1500-1700 (London and New York: Routledge, 2002), 157–62.

²² Chase, *Firearms: A Global History to 1700*, 147–48.

²³ Chase, 197.

²⁴ Chase, 206.

defend their infantry gunners and artillery.²⁵ Firearms made wagons useful fighting platforms in lieu of simply obstacles, even if they were tactically inflexible compared to mobile formations of pikemen and infantry gunners. However, even when using infantry gunners behind wagons, empires facing the steppe should have regarded it as an inferior solution to simply deploying more cavalry themselves, as Chase argues in the case of the late Ming. In comparison with the early Ming army, its sixteenth century successor lacked enough cavalry to counter the nomads and was forced to rely more on the slower and more defensively oriented wagon fortresses and firearms.²⁶ The implications are far-reaching: endemic nomadic cavalry threats would not only slow down the development of firearms and their effective use, but the presence of a large enough friendly cavalry labour reservoir should have similarly provided incentives to limit the deployment of infantry gunners and wagon fortresses.

In the following section I will review the existing evidence documenting the emergence of infantry volley fire in Chinese history from the Warring States until the eve of the Ming dynasty, and show that not only in the case of the Ming response to the Mongols, but in almost all documented earlier cases it seems to have arisen as a response to cavalry threats. This did not only hold true for the firearms-equipped foot soldiers of the Ming, but also their crossbow-wielding predecessors, who similarly had to overcome slow reloading speeds facing both domestic Chinese cavalry units and foreign “barbarians” versed in mobile steppe warfare. Moreover, the wagon fortress-firearms combination was not merely an emergency measure implemented by the late Ming, but was preceded by the wagon fortress-crossbow combination, which appeared on Chinese battlefields almost as soon as the first Chinese cavalry appeared during the Warring States period. It would thereafter periodically make reappearances

²⁵ Chase, 205–7.

²⁶ Chase, 162–67.

throughout history, including during Chinese dynasties that were considerably less starved of cavalry units, until it was superseded by a version sheltering gunners capable of continuous volley fire by the early sixteenth century.

Cavalry, Crossbows, and Wagons

Possible descriptions of crossbow volley fire can be found in two military treatises dating back to the Warring States. Tonio Andrade in the past already extracted evidence from Sun Bin's *Bingfa* (*Art of War*), but another contemporary manual, the *Liu tao* (*Six Secret Teachings*), provides similar tentative evidence. More importantly, both treatises probably reflected late fourth century battlefield conditions, just when cavalry had started appearing on the battlefield.²⁷

The *Bingfa* explains how to deploy troops in the event that they are confronted by an enemy of greater size. Sun Bin advises the positioning of long contact weapons (perhaps spears) in the front, with short contact weapons (perhaps swords) behind them, while the crossbows “flow”, or “circulate” (流 *liu*) to aid them in emergencies.²⁸ The *Liu tao* is more explicit and explains how infantry should deploy when it is faced with chariots and cavalry. The infantry

²⁷ Ralph D. Sawyer and Mei-chün Sawyer, eds., *The Seven Military Classics of Ancient China* (Boulder: Westview Press, 1993), 367–68.

²⁸ Andrade, *The Gunpowder Age: China, Military Innovation, and the Rise of the West in World History*, 149, 351; Edmund Elliot Balmforth, ‘A Chinese Military Strategist of the Warring States: Sun Pin’ (PhD diss., New Brunswick, New Jersey, Rutgers University, 1979), 168; For the original text in literary Chinese and another interpretation, see Bin Sun and Wu Sun, *Sunzi: The Art of War; Sun Bin: The Art of War*, ed. Rusong Wu and Xianlin Wu, trans. Wusun Lin (Beijing: Foreign Languages Press, 1999), 21–25, 130–31.

should make use of naturally uneven terrain, like hills and ravines, and deploy the long contact weapons and strong crossbows in front, and the short contact weapons and weak crossbows in the rear. These should “fire and rest in turn” (更發更止 *geng fa geng zhi*).²⁹ Both passages seem to suggest the crossbows should keep up a continuous fire, and the latter even explicitly mentions enemy cavalry. Besides hinting at volley fire, both manuals also contain the earliest descriptions of a wagon fort, which would become a common Eurasian defensive tactic against cavalry in the early modern period, and as such provides additional evidence of the rising significance of the mounted warrior during the Warring States. According to the *Liu tao*, if the enemy attacked with cavalry and chariots on level ground, it was advised to make an *ad hoc* fortress, with chariots deployed as ramparts, supported by hastily dug trenches and set up caltrops. Soldiers, including the strong crossbowmen, were to defend the left and right flanks.³⁰ A similar makeshift battlefield fortress constructed by using chariots and placing obstacles is described by Sun Bin.³¹ We can consider these to be the ancestors of the later wagon fort. The chariot, originally an offensive battlefield arm, was here in the process of being replaced by the more mobile cavalry, but found a new function as a mobile field fortification.

Following the Warring States, it takes a millennium for the next evidence of the practice of volley fire to present itself. The Tang (618-907) and the Song (960-1279) bequeathed both prescriptive and descriptive evidence of the volley fire tactic combined with the crossbow. Two

²⁹ Many thanks to Gordon Tsang for pointing out this passage to me.

³⁰ Deqi Kong, ed., *Six Strategies*, trans. Songlai Nie (Beijing: Military Science Publishing House, 2004), 3, 262–65; Sawyer and Sawyer, *The Seven Military Classics of Ancient China*, 35–37.

³¹ Balmforth, ‘A Chinese Military Strategist of the Warring States: Sun Pin’, 232–33; Sun and Sun, *Sunzi: The Art of War; Sun Bin: The Art of War*, 142–45.

eighth-century writings dating from the Tang dynasty and cited by Andrade prescribe the technique explicitly. In both the crossbowmen are depicted as deploying in three rotating ranks, the front one firing and the two ranks behind it loading.³² There is also a description of a battle taking place in 756, cited by David Graff, which depicts crossbow volley fire once again in use against cavalry. In this example, a Tang general named Li Guangbi 李光弼 (708-764) faced a rebel army consisting of cavalry near a town named Changshan. During the battle Li sent out 1000 crossbowmen, divided in four groups, who shot at the enemy in succession (發發相繼 *fa fa xiangji*), which the latter could not face.³³ Notable is the gap between theory and praxis, as the division was in four ranks, not the three prescribed in the manuals.

Crossbow volley fire is also prescribed and described during the Song dynasty. It is depicted in the military encyclopaedia *Wujing zongyao* (*Comprehensive Essentials of the Military Classics*), dating from 1044, as Tonio Andrade and Peter Lorge have noted. However, a close reading reveals that the Song authors were apparently unaware of the Tang precedent of volley fire, and this challenges the notion that volley fire techniques always benefitted from a continuous classical tradition. According to the *Wujing zongyao*, Tang military thinkers prescribed the deployment of crossbowmen in front of a formation behind large shields. Once the enemy drew close, the crossbows would be discarded in favour of swords and staffs. These tactics, which were indeed similar to the tactics proposed by the famous early Tang general Li

³² Andrade, *The Gunpowder Age: China, Military Innovation, and the Rise of the West in World History*, 149–50.

³³ David A. Graff, *Medieval Chinese Warfare, 300-900* (London: Routledge, 2002), 219–20; Sima Guang 司馬光, *Zi zhi tong jian* (1084) 資治通鑑 (1084), vol. 29 (Taipei shi: Taiwan guji, 2001), 6954–55.

Jing 李靖 (571-649), dispensed with volley fire altogether.³⁴ Therefore, the *Wujing zongyao* appears to present crossbow volley fire as a new solution to overcome the slow loading speed of the weapon when faced with a cavalry charge. Rather than showing continuity between the Tang and the Song eras, the encyclopaedia therefore arguably provides evidence of the independent reinvention of crossbow volley fire during the Song dynasty.³⁵³⁶ It is notable that

³⁴ Ding Du 丁度 and Zeng Gongliang 曾公亮, 'Wujing zongyao (1044)' 武经总要 (1044), in *Chuanshi cangshu - zi ku - bingshu* 传世藏书-子库-兵书, ed. Zhang Xinqi 张新奇 (Hainan: Hainan guoji xinwen chubanshe, 1995), 224; David A. Graff, *The Eurasian Way of War: Military Practice in Seventh-Century China and Byzantium* (London and New York: Routledge, 2016), 52.

³⁵ The relevant section of the *Wujing zongyao* is translated and cited in Andrade's *The Gunpowder Age*, but I interpret the passage slightly differently. The fragment 陣外射之,進則蔽以旁牌 is translated and interpreted by Andrade as "[...] those on the outside of the formation should shoot, and when [the enemy gets] close, then they should shelter themselves with small shields [...]." The character *jin* 進 can indeed be translated as "to get close to", and can refer to the enemy formation. However, in this case I think it more likely the author was using the character 進 in its alternative meaning, "to enter", intending to convey that those crossbow men who were outside of the formation should enter the formation behind the small shields. See: Andrade, *The Gunpowder Age*, 150-54; Ding and Zeng, 'Wujing zongyao (1044)', 224.

³⁶ Stephen Selby holds that the authors of the *Wujing zongyao* used an inaccurate rendition of the depiction of Tang dynasty volley fire with crossbows culled from a Tang encyclopaedia, indicating they were aware of the use of this technique in the previous dynasty. Although the

the crossbow volley fire tactic is once again deployed against a hypothetical charging enemy cavalry formation in the example depicted in the military encyclopaedia.³⁷ In a passage from the Song dynastic history describing the practical use of volley fire against Jürchen Jin (1115-1234) forces in the early 1130s, both bowmen and crossbowmen were deployed in groups to shoot by turns during a field battle. The description leaves it unclear whether counter marches were used, nor the exact composition of the enemy force. However, the Jürchen Jin normally relied heavily on cavalry.³⁸ Volley fire was used again against a besieging enemy force the following year, this time however consisting of armoured infantry. The recorded hybrid volley fire practice with bows and crossbows diverges from the prescription recorded in the *Wujing zongyao*, hence continuity between theory and praxis is once again difficult to establish.³⁹

Tang and Song writings cited by Selby indeed seem similar, the structure of the argument in the *Wujing zongyao* seems to suggest the authors were arguing for the novelty of the technique in their time. See: Stephen Selby, *Chinese Archery* (Hong Kong: Hong Kong University Press, 2000), 243–45.

³⁷ Andrade, *The Gunpowder Age: China, Military Innovation, and the Rise of the West in World History*, 150–54; Ding and Zeng, ‘Wujing zongyao (1044)’, 224.

³⁸ Peter Lorge, *War, Politics and Society in Early Modern China, 900-1795* (London and New York: Routledge, 2005), 64; Tseng-yü Wang, ‘A History of the Sung Military’, in *The Cambridge History of China. Volume 5, Part Two: Sung China, 960-1279*, ed. Denis Twitchett and John W. Chaffee, trans. David C. Wright (Cambridge: Cambridge University Press, 2015), 232–33.

³⁹ Andrade, *The Gunpowder Age: China, Military Innovation, and the Rise of the West in World History*, 154–55. It is of course possible that no longer extant military manuals documented the hybrid technique, but in their absence I prefer to err on the side of caution.

A final piece of evidence of the practical implementation of crossbow volley fire stems from the official Song dynastic history (*Song shi*), specifically the chapter on military training procedures. During the reign of the Song Emperor Renzong (r. 1022-1063) around 1040-1041, the emperor reviewed the troops and their formations. One exercise entailed dismounted cavalry together with crossbowmen practicing coordinated fire. The dismounted horse archers were drawn up in three ranks according to the draw-weight they could handle, followed by the crossbowmen drawn up in four ranks according to the same criterion. They were then to fire in sequence. Such a formation would make sense to answer an enemy cavalry charge, with the furthest ranging archers firing first, followed by succeeding ranks whose reach decreased in sequence. The passage does not provide evidence of rotating ranks and continuous volley fire, but it constitutes compelling evidence that early Song dynasty troops were at least trained to be capable of limited volley fire.⁴⁰

Meanwhile, the compilers of the *Wujing zongyao* included descriptions of wagon fortress warfare in the encyclopaedia, including recorded historical events in which they were used. The compilers noted that cavalry replaced the chariot as an offensive arm in the course of the Qin and Han dynasties (221-206 BCE and 202 BCE – 220), but Han general Wei Qing 衛青 (d. 106 BCE) used them to form a defensive ring to protect his troops against northern Xiongnu nomads in 119 BCE. Another Han general named Li Ling 李陵 (d. 74 BCE) used the same tactic against the same nomads in 99 BCE, and ordered his troops to fire a crossbow volley. General Ma Long 馬隆 (dates unknown) of the Jin dynasty (266-420) and Tang general Ma Sui 馬燧 (726-795) also utilized the wagon fortress against cavalry opponents. More

⁴⁰ Tuo Tuo 脫脫, *Song shi* (1346) 宋史 (1346) (Beijing: Zhonghua shuju chubanshan, 1977),

4853–54. The author wishes to thank Peter Lorge for pointing out this quote.

recently, a Song literatus named Wu Shu 吳淑 (947-1002) suggested the use of wagon fortresses as a protection against the cavalry charges of the northern *Hu* “barbarians” (by which he probably meant the Khitan Liao), with every wagon carrying four crossbowmen in protected enclosures. On the sound of beating drums they were to fire by section (擊鼓為節以射之 *jigu wei jie yi she zhi*) once the enemy came. This would make it impossible for the *Hu* to attack, after which the own cavalry would exit the wagon fortress and attack them. This section provides a strong hint that volley fire with crossbows was already conceptualized in conjunction with the wagon fortress against cavalry opponents during the early Song. The use of these kinds of tactics in practice awaits further research, but the idea seems to have been alive around the year 1000. The chariot therefore did not seem to have disappeared, it simply evolved by Han times into an element of a larger mobile field fortification, as the authors of the *Wujing zongyao* already acknowledged in their prescription of tactics: “These plans are all predicated on using chariots to defend; it appears that this is not the method of speeding chariots and offensive battle of the Xia, Shang, and Zhou dynasties [c. 2070-256 BCE], but it is self-sufficient to resist the enemy and gain the upper hand.”⁴¹

Up to the Song dynasty, volley fire was always performed by crossbows, occasionally supported by normal bows. However, the dynasty’s demise at the hands of the Mongols in 1279 more or less coincided with the development of the true gun, a new hand-held projectile weapon

⁴¹ Ding and Zeng, ‘Wujing zongyao (1044)’, 231–32; This tactic was also used by southern Chinese forces in the early fifth century, when China was fragmented in several polities. See: Graff, *Medieval Chinese Warfare, 300-900*, 125.

competing with the crossbow and sharing a similar drawback: slow reloading times.⁴² The handgun was eventually deployed in conjunction with volley fire tactics by the fifteenth century, but there is no evidence of a smooth transfer of practices from the crossbow. The state of the field concerning the Mongol Yuan Empire (1273-1368) and its use and integration of firearms into its armies is at present lacking in clear data. Besides documentary indications that guns were used from the late thirteenth century to the dynastic transition period starting in the 1350s, we know little about their mode of deployment.⁴³ We also do not know whether Yuan and early Ming infantry formations used volley fire tactics with bows and crossbows based on Tang and Song precedents. *Pace* Andrade, there are (still) few indications that the technique was simply transferred to the guns from the crossbows, which will become clear when we will consider the trial-and-error developmental pattern of infantry volley fire with firearms during the Ming. The differences between written prescriptions in military treatises and the battle descriptions from the Warring States to the Song dynasty also suggest discontinuities between textual transmissions and military praxis. So how was the continuity in military traditions, posited by Andrade, ensured in China? As we have seen above and shall see below, it seems that the continuity in volley fire tactics in practice owed more to a recurrent reliance of Chinese dynasties on drilled standing armies facing an endemic threat of northern enemies relying on cavalry. The former factor probably owed a lot to the enduring strength of classical culture, as

⁴² Benjamin Avichai Katz Sinvany, 'Notes on the Invention of the First Gun: Conflict and Innovation in the Song Warring Period (960-1279)', *Journal of Chinese Military History* 8 (2019): 2, 6–9, 22.

⁴³ Liu Xu 刘旭, *Zhongguo gudai huoyao huoqi shi* 中国古代火药火器史 (Zhengzhou: Daxiang chubanshe, 2004), 57–59.

suggested by Andrade.⁴⁴ Additionally, classical learning in the shape of a transmitted corpus of military writings might at least have played a role in ensuring some continuity in the outward forms of volley fire, as is suggested by the eventual similarities between some Song and Ming tactical solutions, as we shall see below.

Harnessing the Gun: A Tradition of Trial and Error

When we survey the documentary evidence of the use of guns during the rise of the Ming, it appears the integration of guns into infantry tactics took the form of a gradual evolution towards continuous infantry volley fire, largely independent of pre-existing textual transmissions, and primarily spurred by the continual “crisis” posed by the threat of nomadic incursions. Prior to 1450, for example, there is a lack of definitive proof that handguns were deployed in rotating ranks capable of continuous volleys, as had been the case with Tang and Song crossbow archers. The first recorded use of limited volley fire with firearms dates from 1388, albeit not against regular cavalry but war elephants. Ming commander Mu Ying 沐英 (1344-1392) divided his troops armed with gunpowder weapons into three lines, which all fired in sequence, defeating the elephants. The weapons they used ranged from cannon and hand-held guns, to rockets and fire-arrows. Bows and crossbows were not in evidence, although the fire arrows might have been launched from them. It is notable that a mixture of different weapon systems was used, which would become a hallmark of Ming volley fire tactics. There is no evidence of a rank-by-

⁴⁴ Andrade, ‘The Arquebus Volley Technique in China, c. 1560: Evidence from the Writings of Qi Jiguang’, 135.

rank reloading taking place, either by countermarching or otherwise, indicating Ming tactical formations were not yet capable of continuous handgun volleys.⁴⁵

During the imperial civil war that brought the Yongle emperor (r. 1402-1424) to power, his enemies seemed to have faced his cavalry with firearms and wagon forts sheltering gunners and crossbow archers on occasion, though we lack evidence they fired in volleys. In general, Yongle's forces suffered grievously from firearms during the war and this led him to start using these weapons against Mongol cavalry.⁴⁶ Perhaps inspired by Mu Ying's example, Yongle initiated a sustained development of volley fire tactics, culminating in the arquebus innovations of Qi Jiguang 150 years later. It was, however, Yongle's personal experience using his cavalry against fronts of gunners and archers in lieu of inspiration from written sources or pre-existing drilling regimes, that seems to have put him on the path of developing volley fire tactics.

In 1410 and 1414 Yongle fought two engagements against the Mongols, during which Yongle deployed his gunners directly in front to repel Mongol cavalry charges with their fire. A description of the second battle in the *Veritable Records* of the Ming describes the fire of the guns as “continuous”, or “one after another” (連發, *lianfa*). Andrade, following Chinese scholar Wang Zhaochun, interprets this as proof that volley fire was used. Yet there is no

⁴⁵ Andrade, *The Gunpowder Age: China, Military Innovation, and the Rise of the West in World History*, 157–58; Sun, ‘Military Technology Transfers from Ming China and the Emergence of Northern Mainland Southeast Asia (c. 1390-1527)’, 500.

⁴⁶ Andrade, ‘How Yongle Learned to Stop Worrying and Love the Gun: Perspectives on Early Ming Military History’; Weicong Duan, ‘Ming China as a Gunpowder Empire: Military Technology, Politics, and Fiscal Administration, 1350-1620’ (PhD diss., St. Louis, Missouri, Washington University, 2018), 34–37.

evidence of reloading and counter marching taking place, as Andrade himself admits. For Andrade, the absence of its explicit description was probably owing to the deep familiarity the contemporaries had with the technique.⁴⁷ A second description by a participant of the same battle, cited by John Dardess, describes how the Ming army deployed in lines (整列 *zhenglie*) before the Mongols charged down the slope of the hill. The Ming gunners then fired four times (火銃四發 *huotong si fa*), startling their enemies and causing them to flee back up the hill. This description does not support the notion that continuous volley fire was practiced, but it is clear that four separate volleys were fired, probably by four different ranks of gunners.⁴⁸ A final snippet of information on the evolution of Yongle's tactics appears in the *Veritable Records* of 1424. In a decree the emperor stipulated that the gunners should be backed up by strong crossbows in case of an enemy attack.⁴⁹ This could perhaps be an indication that the handguns were not considered reliable enough to stand against an enemy cavalry charge by themselves, and were thought to need back-up by older projectile weapons.

We lack definitive proof Yongle implemented continuous volley fire, but it is clear he considered guns useful against cavalry, frequently deploying them in the vanguard in an exposed position. As such he appears to have confidence in the efficacy of the weapons and

⁴⁷ Andrade, *The Gunpowder Age: China, Military Innovation, and the Rise of the West in World History*, 158.

⁴⁸ Jin Youzi 金幼孜, 'Jin Wenjing gong Bei zheng lu er juan' 金文靖公北征錄二卷, in *Xu xiu Siku Quanshu. Shibū. Zashi lei*; 433 續修四庫全書. 史部. 雜史類; 433 (Shanghai: Shanghai guji chubanshe, 1997), 124.

⁴⁹ Andrade, *The Gunpowder Age: China, Military Innovation, and the Rise of the West in World History*, 158–59; Duan, 'Ming China as a Gunpowder Empire: Military Technology, Politics, and Fiscal Administration, 1350-1620', 39–40.

the ability of his soldiers to stand firm in the face of a cavalry charge.⁵⁰ There is evidence that Yongle had at the very least conceived of continuous volley fire-tactics, sustained by countermarching rotating ranks. Dardess and Zhou Weiqiang discovered a report dating from 1450, written by military officer Wang Chun 王淳 (dates unknown). Wang had observed battles along the northern frontier and noted that Ming gunners were firing in a haphazard fashion, which afforded the Mongols a chance to advance. He therefore advocated a return to Yongle's "old system", consisting of units of 33 gunners, backed up by 22 bowmen. The gunners would fire and reload in three ranks rotating around shields and covered by swordsmen and spearmen at the flanks. The gunners would open fire within 100 paces (around 150 meters) and the bowmen, deployed in two alternating ranks, would join them when the enemy came within a range of 50 paces (around 75 meters).⁵¹ There are similarities with the crossbow tactics described in the Song-era *Wujing zongyao*: three ranks cycling in front and behind shields in turns. Nevertheless, although classical examples might have provided inspiration, Yongle's prescriptions seem like a logical further development of a trajectory started a few decades earlier. Wang's advice also shows how rapidly Yongle's innovations of the 1410s and 1420s were discontinued and suggest the difficulty in maintaining these carefully drilled techniques over time, even for comparatively centralized polities.

⁵⁰ Andrade, *The Gunpowder Age: China, Military Innovation, and the Rise of the West in World History*, 158–59.

⁵¹ John W. Dardess, *More Than the Great Wall: The Northern Frontier and Ming National Security, 1368-1644* (Lanham, Maryland: Rowman & Littlefield, 2020), 183–84; Zhou Weiqiang 周維強, 'Mingdai zhanche yanjiu' 明代戰車研究 (PhD diss., Taipei, Guoli Qinghua daxue, 2008), 76–79.

For 1450, then, we finally avail of an unequivocal prescription of continuous volley fire with handguns in conjunction with bows, designed for use against cavalry. Nevertheless, we still lack definite evidence pre-harquebus handguns were indeed deployed in conjunction with volley fire-tactics and counter marching. Fortunately, there is a mid-sixteenth century military treatise that provides just this kind of information.

Tang Shunzhi and the *Wu bian*

The *Wu bian* is a large military encyclopaedia written and compiled by Tang Shunzhi (1507-1560), a Ming literatus and civil official. It contains detailed prescriptions of volley fire with handguns based on historic battles, which have gone mostly unnoticed by modern scholars. They depict an intermediate stage between Yongle's ideas and practices, and the laterarquebus tactics of Qi Jiguang. Tang was a civil official hailing from Nanzhili (present-day Jiangsu), who was deeply involved in military affairs.⁵² His broad learning in the latter was consolidated in his voluminous *Wu bian* (*Military Compilation*), which included chapters on recruitment, siege craft, tactics, training, and weapons. The format of the *Wu bian* follows the precedent of the early Song encyclopaedia *Wujing zongyao*, discussed above, but Tang updated the sections with contemporary information.⁵³ Tang's use of the *Wujing zongyao* as a model should not surprise us, as it was produced by civil bureaucrats to provide information on military affairs at a time when civilian bureaucratic oversight of the military was increasing.

⁵² Benjamin A. Elman, *Classicism, Politics, and Kinship: The Ch'ang-Chou School of New Text Confucianism in Late Imperial China* (Berkeley, California: University of California Press, 1990), 77–79.

⁵³ Yong Rongdeng 永瑢等, ed., *Siku quanshu zongmu* 四庫全書總目 (Beijing: Zhonghua shuju chuban, 1965), 839.

The same was happening during Tang's heyday as an official during the mid-sixteenth century.⁵⁴ He was mostly active against Sino-Japanese *Wokou* pirates, and on occasion he led troops from the front on horseback.⁵⁵ He was therefore no mere armchair strategist but possessed practical experience as well. As the central government was directing its military efforts towards containing the nomadic threat along the northern frontier, the maritime piracy crisis was mostly left to civil officials and local elites.⁵⁶ In this context, Tang compiled the *Wu bian* to prepare himself for his tenure as a civil official, and this indicates the extent to which he expected to encounter military complications..⁵⁷ In addition to his work combating the pirate threat, Tang Shunzhi was also cognizant of military affairs on the northern frontier. In 1558,

⁵⁴ Kai Filippiak, 'The Effects of Civil Officials Handling Military Affairs in Ming Times', *Ming Studies* 66, no. 66 (2012): 1–15; Peter Lorge, 'Confucian Statecraft and the Production of Saltpeter and Sulfur in Song Dynasty China', in *Science and Confucian Statecraft in East Asia*, ed. Francesca Bray and Jongtae Lim (Leiden: Brill, 2019), 34.

⁵⁵ Ray Huang, 'T'ang Shun-Chih', in *Dictionary of Ming Biography, 1368-1644, Part 2*, ed. L.C. Goodrich and Chao-ying Fang, vol. 2 (New York: Columbia University Press, 1976), 1253–55.

⁵⁶ Marilyn Fitzpatrick, 'Local Interests and the Anti-Pirate Administration in China's South-East 1555-1565', *Ch'ing-Shih Wen-T'i* 4, no. 2 (1979): 1–50; Kenneth M. Swope, 'Clearing the Fields and Strengthening the Walls: Defending Small Cities in Late Ming China', in *Secondary Cities and Urban Networking in the Indian Ocean Realm, c. 1400-1800*, ed. Kenneth R. Hall (Lanham: Lexington Books, 2008), 129–30.

⁵⁷ Xu Baolin 许保林, *Zhongguo bingshu tonglan* 中国兵书通览 (Beijing: Jiefangjun chubanshe, 1990), 399–402.

for example, he was dispatched to a garrison north of Beijing to survey the defences there.⁵⁸ Perhaps he also obtained knowledge about firearms and their tactical uses against nomads at that time.

Tang's *Wu bian* contains a series of tactical scenarios with firearms in question-and-answer format, in which the proper deployment and usage of these weapons is explained with the relative position and elevation of the enemy forces vis-à-vis Ming units varying per case. Significant for the purposes of tracking the development and practical application of volley fire in Chinese history, these scenarios include three geographic names, indicating that they were based on real battles. The geographical names afford that rare opportunity for military historians of China to assume detailed tactical prescriptions reflected concrete historical events. The three named battles took place at Xiaosuanjian (小蒜澗 “Little Garlic Ravine”), Erguyuan (二姑原 “Second Aunt’s Origin”), and Dishuikuang (滴水匡 “Dripping Water Bend”). After consulting the *Veritable Records*, the battle at Xiaosuanjian can be tentatively linked to a recorded event taking place on 1 April 1472. All three descriptions yield detailed information about the use of firearms against nomads, suggesting infantry volley fire was implemented after Yongle’s reign. Furthermore, the tactics were developed further by integrating volley-firing formations of hand gunners with light field artillery.

The Battle of Xiaosuanjian, 1 April 1472

The *Veritable Records* make a short note of Lu (虜, the common term used to designate northern frontier nomads) crossing into Ming territories in 1472. The action at Xiaosuanjian seems to have been an ambush set by about 2000 Ming soldiers who suddenly rushed the Lu

⁵⁸ John D. Langlois, ‘The Reversal of the Death Verdict against Wang Shizhen’s Father’,

Ming Studies, no. 1 (2006): 76.

on their return trip. The Lu unsuccessfully charged the Ming forces, and eventually broke off after another Ming unit entered the fray.⁵⁹ If the *Wu bian* is referencing the same event, it seems that the Ming forces, despite having the element of surprise, found themselves on a mountain slope with enemy cavalry attacking them from above and below.

If the bandits occupy the mountain top, and come to attack you from above and below, you are in an emergency and your battalion is not able to form ranks. Nevertheless, firearms are beneficial for uphill and bows and arrows for downhill. You must quickly order the unconventional forces (see below) [to use] handle guns (*shoubachong*) to attack uphill and the archers to carry small divine spears (*xiaoshenchiang*) to attack downhill, as well as to put forth the shields and deploy the handle guns to fire in turns. Many [volleys] will be able to attain victory. This is the topography of Xiaosuanjian.⁶⁰

It seems from this example that the handguns were counted as part of the “unconventional” (奇 *qi*) forces, as opposed to their “conventional” (正 *zheng*) counterparts. This binary presupposed a division into military units deployed in predictable “by-the-book”-ways to distract and pin down the enemy, while special flexible detachments surprised the enemy and delivered a *coupe*

⁵⁹ *Ming shilu* 明實錄, *Xianzong shilu* 憲宗實錄, juan 101, 1971-1972.

⁶⁰ Tang Shunzhi 唐順之, ‘Wu bian (before 1560)’ 武編 (before 1560), in *Chuanshi cangshu - zi ku - bingshu* 传世藏书-子库-兵书, ed. Zhang Xinqi 张新奇 (Hainan: Hainan guoji xinwen chubanshe, 1995), 1250.

de grâce.⁶¹ This classification with the *qi*-forces means these firearms were considered the special ingredient enabling the Ming to defeat their nomadic opponents, and this becomes clear from the description. The Mongols charged a hastily assembled front of firearms firing in volleys (輪番放打 *lunfan fang da*, “in turns fire and attack”), but were not able to break through the Ming lines with multiple cavalry charges. Of note is the division of handguns according to firepower, with the more powerful ones firing uphill, and the remainder downhill. The handle gun is described in an entry of the *Veritable Records* dating from 1457 as a gun barrel at the end of a wooden stick of around seven *chi*, or two-and-half meters, long.⁶² The small divine spear might refer to one of two *shenqiang* handguns described in the late Ming military encyclopaedia *Wubei zhi* (*Record of Military Preparation*) (1621).⁶³ It is clear that volley firing handguns had a great utility in defeating cavalry opponents, vindicating Yongle’s innovations. Two other battles recorded in the *Wu bian* show an even further evolution of these tactics with the inclusion of light artillery capable of bombarding the enemy from a long distance. It is possible, although it is not made clear in the text, that the gunners fought like dragoons. These were firearms-equipped troops that used horses for mobility and transportation, but they dismounted to fight like infantry.⁶⁴ The *Wu bian* unfortunately does not provide us with clarifications.

⁶¹ Tzu Sun and Pin Sun, *The Complete Art of War*, trans. Ralph D. Sawyer and Mei-chün Lee Sawyer (Boulder: Westview Press, 1996), 39–40; Benjamin A. Wallacker, ‘Two Concepts in Early Chinese Military Thought’, *Language* 42 (1966): 295–99.

⁶² *Ming shilu* 明實錄, *Yingzong shilu* 英宗實錄, juan 189, 3887–3888.

⁶³ Mao Yuanyi 茅元儀, *Wubei zhi* (1621) 武備志 (1621) (Taipei: Hua shi chubanshe, 1984), 5144–46, 5176–77.

⁶⁴ Chase, *Firearms: A Global History to 1700*, 68–69.

The Battles of Dishuikang and Erguyuan

The second named battle in the *Wu bian*, that of Dishuikang, is used as a didactic example to explain how to deploy firearms in cases where the Ming army occupied a high position and the enemy was situated below it. In such cases, a distance of 400 to 500 paces (approx. 610-770 meters) should be kept from the Mongols. In this battle the Ming army was at an advantage and the handguns were deployed as a protective screening force, whilst the rest of the battalion established itself. Again, it seems that handguns were considered to be effective enough by themselves to deter or hold off Mongol assaults for some time at least. The hand gunners were protected by shields and a kind of frame (架 *jia*). Under the protective firepower of the handle guns and small divine spears, the *zhankoujiangjun* (盞口將軍 “cup-mouthed general” and *dalianzhu* (大連珠 “large rapid succession”) were deployed, both types of light field artillery.

First take the cup-mouthed general [gun] and large rapid succession [gun] and place each of them simultaneously in front of the shields, frames, and handle guns; the cup-mouthed general [guns] on the ground. The front of the large rapid succession [guns] should also be on the ground. But behind [them] dig a ditch and elevate [them] to discharge level, each [gun] fires at the enemy camp. The enemy will probably send flying cavalry to come attack and lure us away: the rapid guns and bullets ought to await orders and the government troops should be careful to not fire rashly. If they approach our troops, the power of the cup-mouthed general [gun] and large rapid succession [gun] is high and surely far-ranging, but [they] cannot be fired gently. However, order the shields, frames, and handle guns to bypass them and proceed to the front, and again send out the unconventional troops. Handle guns should be lined up at the front and the two groups should take turns to load and fire. Also send out the bows and arrows and

the small divine spears and [have them] make a concerted effort to strike. The enemy will crumble and disperse. Exploit the victory by sending out the unconventional forces to pursue and behead [them]. This was [what happened at] the battle of Dishuikuang.⁶⁵

The cup-mouthed general gun was at most around half a meter long and could weigh up to 25 kilograms. Whereas the cup-mouthed general gun was a native development dating from the early Ming, the second type is harder to identify. The term *lianzhu*, indicating some kind of firearm capable of rapid and continuous fire, was used for many different types of ordnance. It could, for example, refer to a type of breech-loading *folangji* (“Frankish”) cannon first attested around 1544, probably a design inspired by Portuguese breech-loaders.⁶⁶ The artillery’s task seems to have been to pummel the enemy at long-range and perhaps entice them to attack. Once this occurred, a front of volley-firing hand gunners and archers was expected to break the enemy charge, opening them up to a *coup de grâce* delivered via a counterattack.

The integration of artillery units with fronts of volley firing hand gunners created a deadly *catch-22* situation for the nomad cavalry. Once the Ming forces had deployed their units, they would be subjected to a long-range bombardment by artillery, making their position untenable. If they decided to attack the artillery and charged, the horsemen would run into the concentrated firepower of the handguns and suffer heavy losses. The only safe option would be to sound a retreat. The tactical initiative remained with the more mobile Mongols, but apparently a Ming force equipped with firearms and well-trained soldiers could win an

⁶⁵ Tang, ‘Wu bian (before 1560)’, 1250.

⁶⁶ Wang Zhaochun 王兆春, *Zhongguo huogishi* 中国火器史 (Beijing: Junshi kexue chubanshe, 1991), 86–87, 133.

engagement and even force the enemy to give up their position thanks to the long-range striking power of their light artillery.

The third battle named in the *Wu bian*, the battle of Erguyuan, saw the opposing armies both occupying level ground. As usual, the handle gunners with shields provided cover while the rest of the units deployed. Then the light artillery started firing in volleys according to a certain method (依法裝換 *yifa zhuang huan*):

Elevate and fire the *jiangkoujiangjun* and *dalianzhu*, and, according to the method load and exchange them.⁶⁷

The description of this battle in the *Wu bian* yields one more aspect of Ming volley fire: the offensive use of countermarching ranks of gunners to slowly creep the projectile barrage forward in the direction of the enemy.

If [the enemy] surges forward from all around, then put forth shields and deploy handle guns to protect the army battalion a little from the front. If the bandits circle around, or come to attack from left and right, send the unconventional forces with handle guns to the shields and deploy the handle guns again in front. In turns load and fire; in addition, the archers and small divine spears work as one loosing and firing. The bandits must run away. Large sections in turns load and fire: suitable for advancing, but unsuitable for retreating. Even if you call a little retreat of a few steps, it is hard to avoid disorder and hasty mistakes. If the bandits exploit this mistake and rush in and fling themselves at you, it is indebted to this action. This is [what happened at] the battle of Erguyuan.

⁶⁷ Tang, 'Wu bian (before 1560)', 1250.

You must by turns advance gradually and await the bandits making a small retreat, to indeed be able to unhurriedly return to the originally established position.⁶⁸

This kind of offensive use of countermarching gunners significantly predates the similar aggressive use of musketeers to defend a position by King Gustavus Adolphus of Sweden (1594-1632) during the European Thirty Years' War (1618-1648). Interestingly, the manoeuvre was not considered suitable in reverse for a fighting retreat as it was conceived by the Dutch at the end of the sixteenth century: it was expected to have been too prone to disorder and subsequent exploitation by the enemy.⁶⁹

The pedagogical narration of the battles Xiaosuanji, Dishuikang, and Erguyuan clearly describe the features of Ming firearms deployment on the northern frontier against nomadic opponents. Key elements were the aggressive employment of volley firing and countermarching hand gunners, in cooperation with archers and light field artillery, fighting from behind shields and other improvised field fortifications. It is possible they were protected by cavalry and infantry wielding spears and swords as well, but these are not explicitly mentioned in the text. It is clear, however, that the firearms were accorded an important, if not decisive, role in defeating nimble and mobile steppe opponents relying on cavalry. This characteristic of the enemy forces therefore did not preclude the development of sophisticated infantry tactics with gunpowder weapons. On the contrary, infantry tactics reached a high degree of sophistication in their conceptualization as well as implementation. The *Wu bian*, however, also provides evidence that another response to mobile steppe cavalry, the wagon

⁶⁸ Tang, 1250.

⁶⁹ Jeremy Black, *A Military Revolution? Military Change and European Society 1550-1800* (Houndmills, Basingstoke: MacMillan Press Ltd, 1991), 3.

fort, could also be employed in conjunction with volley fire and counter marches. The wagon fort was the paradigmatic response of Eurasian empires to an enemy threat predominantly emanating from the steppe in the shape of horsemen. It could shelter infantry with firearms, which sacrificed their tactical mobility on the battlefield in favour of protection, and therefore possibly hindered the development of volley fire. The *Wu bian* provides proof that this was not the case during the Ming dynasty. This discovery has also led me to reconsider the timing and context of the appearance of volley fire and wagon fortresses in other Eurasian empires. As we shall see below, in the case of both the Ottomans and the Tsardom of Russia there are strong indications that infantry volley fire emerged first in conjunction with the wagon fortress as a response to cavalry opponents as well.

Volley Fire and the Wagon Fort

The *Wu bian* records elaborate descriptions of battle wagons capable of being deployed on the steppe as mobile fortresses. The description includes charts of the tactical formations these combat wagons were to assume in different combat situations, as well as the numbers of wagons, soldiers, and weapons needed. The *Wu bian* prescribes a military unit consisting of a core of 160 “thunderclap camp wagons” and “thunderclap battle wagons” (霹靂駐車 *pilizhuche* and 霹靂戰車 *pilizhanche*) and 1,664 soldiers. When encountering the enemy, the wagons would be deployed as a double row of walls enclosing a rectangular open square, where infantry and cavalry could shelter. The inner rectangle would be formed of thunderclap camp wagons linked together, and the outer rectangle consisted of thunderclap battle wagons buttressed by shield bearers. The firearms and other projectile weapons would be deployed in between both rectangles and await the enemy:

The shield bearers holding the shields place them in the gaps between the vanguard wagons, each gap on all four sides. The large and small succession [guns], handle [guns], cup-mouthed general [guns], other firearms, bows and arrows are simultaneously loaded and form neat lines drawn up in three ranks, deployed behind the battle wagons and in front of the camp wagons.⁷⁰

Afterwards all these weapons deployed in three lines would rotate and keep up an unceasing cycle of volleys:

If the Lu come and charge, then the first firearms go out in front of the vanguard wagons, welcome the opportunity and light and fire. The second group of firearms goes out to reach the frontline when the first group returns. The third group of firearms goes out to reach the frontline when the second group returns. By turns they alternately go out and circulate without limit.⁷¹

These instructions predate Qi Jiguang's similar wagon fort tactics performed witharquebuses dating to the 1570s. It is once again unclear whether Tang Shunzhi himself conceived of these battlefield innovations, or if he merely recorded ideas that were already circulating. The reference to the battle wagons as *piliche* does seem to point to the first half of the sixteenth century as the provenance of these ideas. A description of the *piliche* and the wagon fort turns up in the *Veritable Records* in 1503 as an idea put forward by an official named Fan Ji 范吉

⁷⁰ Tang, 'Wu bian (before 1560)', 1282–83.

⁷¹ Tang, 1282–83.

(1444-?).⁷² A later proposal by Zeng Xian 曾銑 (1499-1548), Shaanxi Supreme Commander at the northern frontier, put forward in 1547 describes them as well.⁷³ Once more in evidence is the mixed nature of the projectile weapons used: light artillery pieces take part in the manoeuvre, along with handguns and bows.

The evidence in the *Wu bian* of the use of volley fire, even in combination with the wagon fortress, and especially when seen together with its Chinese precedents in *longue durée* perspective, shows the centrality of recurring cavalry threats as its *raison d'être*. The similarities between the prescriptions in the *Wujing zongyao* and the *Wu bian*, two isomorphic treatises compiled more than half a millennium apart, make this threat as the cause of the continuity clear as well. Nor was Ming China alone in responding to cavalry threats with these innovative tactics. The Ottoman Empire and the Tsardom of Russia, despite not lacking cavalry forces themselves, also provide strong indications that volley fire in combination with wagon fortresses was first employed against nomads and other opponents primarily relying on cavalry.

The Ottoman Turks in the fourteenth century had already developed an infantry army by enlisting children from non-Muslim Balkan families as slave soldiers, the *janissaries*.⁷⁴ In the beginning they fought with the recurved bow and various contact weapons, but later they would also include arquebusiers. Nevertheless, like Ming soldiers, they never entirely gave up the bow either. The development of their tactics and deployment on the battlefield in

⁷² *Ming shilu* 明實錄, *Xiaozong shilu* 孝宗實錄, juan 202, 3757-3758.

⁷³ Dardess, *More Than the Great Wall: The Northern Frontier and Ming National Security, 1368-1644*, 411–12; Zhou, 'Mingdai zhanche yanjiu', 106, 134–41.

⁷⁴ Gábor Ágoston, 'The Ottoman Janissaries: Household Infantry of the Sultan', in *Elite Fighting Forces: From the Praetorian Guard to the Green Berets*, ed. Jeremy Black (London: Thames & Hudson, 2011), 72–77.

conjunction with firearms shows many similarities with the case of the Ming. In the 1440s the janissaries wielding crossbows and firearms were initially deployed behind ditches, shields, and other makeshift obstacles against Eastern European enemies. By the 1470s wagon fort tactics had been copied from the latter and deployed in conjunction with janissaries against Turcoman cavalry in Anatolia. This conflict provides the first tentative evidence of Ottoman volley fire. In 1476 the Ottomans defeated the Turcomans during the battle of Başkent using a wagon fort. Apparently the Turcoman cavalry had encountered the wagon fort before in battle, but were surprised and decisively defeated this time by the unprecedentedly effective fire of the Ottoman firearms wielded from behind its cover.⁷⁵ For the 1526 battle of Mohács against the Hungarians and another battle in 1605, there are records describing janissaries using volley fire with arquebuses from behind a wagon fort, sequentially firing in nine rows and three rows respectively. In both instances the janissaries apparently did not employ a counter march, but the ranks kneeled to reload after firing, allowing the ranks behind to fire in turn. This tactic was also used against the cavalry armies of the Safavids.⁷⁶ It should also be understood that the Eastern European armies which the Ottomans faced, were not dominated by the emblematic disciplined infantry formations of Western European states, but relied more on cavalry. The

⁷⁵ John E. Woods, *The Aqquyunlu: Clan, Confederation, Empire* (Salt Lake City: The University of Utah Press, 1999), 118–20.

⁷⁶ Ágoston, 'Firearms and Military Adaptation: The Ottomans and the European Military Revolution, 1450-1800', 91–98; Ágoston, *Guns for the Sultan: Military Power and the Weapons Industry in the Ottoman Empire*, 16–28; Börekçi, 'A Contribution to the Military Revolution Debate: The Janissaries' Use of Volley Fire during the Long Ottoman-Habsburg War of 1593-1606 and the Problem of Origins'.

Hungarian army at Mohács, for example, was almost equally constituted by cavalry and infantry.⁷⁷

In addition to the Ottomans, the Russian Tsardom also recruited an infantry force which fought with harquebuses behind moveable wooden walls that formed mobile battlefield fortresses. These were the *streltsy*, and a few modern scholars have raised the likelihood that they were capable of firing in volleys using two rotating ranks behind these wooden walls.⁷⁸ Although the *streltsy*'s emergence is sometimes seen as a response to an increasing engagement with sedentary European enemies, it appears the first massive expansion of their numbers and initial largescale deployment was against the nomadic Crimean Tartars in the sixteenth century.⁷⁹ They were also useful against the cavalry of European opponents. During a battle against Polish cavalry in 1605, *streltsy* deployed behind their walls in combination with infantry deployed in the open field, both firing in volleys, were instrumental in defeating their

⁷⁷ Gábor Ágoston, 'War-Winning Weapons? On the Decisiveness of Ottoman Firearms from the Siege of Constantinople (1453) to the Battle of Mohács (1526)', *Journal of Turkish Studies* 39 (2013): 140; László Veszprémy, 'The State and Military Affairs in East-Central Europe, 1380-c. 1520s', in *European Warfare, 1350-1750*, ed. Frank Tallett and D.J.B. Trim (Cambridge: Cambridge University Press, 2010), 105–9.

⁷⁸ Richard Hellie, *Enserfment and Military Change in Muscovy* (Chicago and London: The University of Chicago Press, 1971), 161–62, 165; Michael C. Paul, 'The Military Revolution in Russia, 1550-1682', *The Journal of Military History* 68, no. 1 (2004): 20–23.

⁷⁹ Brian L. Davies, *Warfare, State and Society on the Black Sea Steppe, 1500-1700* (London and New York: Routledge, 2007), 44; Charles J. Halperin, 'Ivan IV's Professional Infantry, The Harquebusiers (Strel'tsy): A Question of Numbers', *The Journal of Slavic Military Studies* 30, no. 1 (2017): 114–15.

charge. In this case the technique might have been implemented at the urging of Western European mercenary officers though. It is unknown whether rotating ranks were used, or the Ottoman solution of ranks that were kneeling to reload and standing upright to fire in turns.⁸⁰ Brian Davies concludes that the various incarnations of the wagon fortress were especially successful in resisting enemy cavalry with firepower, be they Tartars or Polish cavalry. The tactic of the wagon fortress, including its emphasis on coordinated firepower, thereafter diffused across the Eastern European planes and to other states like the Polish-Lithuanian Commonwealth, where encounters with large enemy cavalry forces were much more likely than in Western Europe.⁸¹ Davies also points out that the Danubian frontier, separating sedentary Europe from the part of Europe more exposed to the steppe, has received very little attention as a “[...] laboratory for new expressly Eastern European military innovations.”⁸² Similar to the northern frontier of Ming China, the European frontier separating the steppe from the sown has been underestimated as a possible source for tactical innovations with firearms.

⁸⁰ Davies, *Warfare, State and Society on the Black Sea Steppe, 1500-1700*, 52; Chester S.L. Dunning, *A Short History of Russia's First Civil War: The Time of Troubles and the Founding of the Romanov Dynasty* (University Park, Pennsylvania: The Pennsylvania State University Press, 2004), 114; Oleg Rusakovskiy, ‘The Russian Edition of Johann Jacobi von Wallhausen’s »Kriegskunst Zu Fuß« (1649): The History of A Failure?’, *Militär-geschichtliche Zeitschrift* 79, no. 1 (2020): 15–16; Carol B. Stevens, *Russia's Wars of Emergence: 1460-1730* (London and New York: Routledge, 2013), 72–73.

⁸¹ Brian Davies, ‘Guliai-Gorod, Wagenburg, and Tabor Tactics in 16th-17th Century Muscovy and Eastern Europe’, in *Warfare in Eastern Europe, 1500-1800*, ed. Brian Davies (Leiden and Boston: Brill, 2012), 98–103.

⁸² Davies, 100.

Like Ming China, the Ottoman Empire and the Tsardom of Russia faced both enemies primarily relying on infantry and mobile cavalry opponents. As with the latter two, the Ming innovation of volley fire also seems to have been transferred from the frontier facing cavalry-based threats to areas where the opposition was mainly constituted by infantry forces. This transfer process also allows us to take a closer look at the openness and diversity which underpinned the Ming culture of innovation.

Cultures of Military Innovation: Volley Fire Moves South

“War, it was assumed by the middle of the sixteenth century, could be organized and analysed; it was reducible to theory and formula, it could be made into a science and set down in treatises. [...] The proliferation of gunpowder weapons was a component of this military revolution but not its cause – the real cause was the deep Renaissance habit of rethinking anything and everything, including war. And that habit, of course, was applied to the possibilities and problems of gunpowder as a tool of war.”⁸³

This quote, written by military historian Thomas Arnold describing the effects of the Renaissance on European military developments, could be equally applied to conditions pertaining to the Ming Empire. “Openness” and “diversity”, two of the buzzwords purporting to describe a superior European culture of military innovation, were very much in evidence as well in sixteenth-century China. They come forward when we consider the adaptation of volley fire tactics to the harquebus during the struggle of the Ming armies against the infantry of the *Wokou* pirates during the mid-sixteenth century. As I will argue, Tang Shunzhi played a

⁸³ Arnold, *The Renaissance at War*, 19.

crucial role transmitting the volley fire tactics recorded in his manual to the southern battlefields and adapting them to the new harquebus. Qi Jiguang then most likely based his volley fire innovations on Tang Shunzhi's ideas, considering the personal relation between both men and the eventual similarities between their recorded solutions.

The late Ming field of military knowledge was a fertile site of circulation and production. Despite attempts by the state to restrict the flow of military knowledge, the sheer number of published military treatises testifies to the general failure of this policy by the sixteenth century.⁸⁴ According to one bibliographical survey, in excess of 1,000 military treatises were produced during the Ming, the vast majority during the sixteenth and seventeenth centuries.⁸⁵ This peak was no doubt indebted to simultaneous flourishing of the commercial printing press and the incidences of military crises plaguing the late Ming.⁸⁶ A need for the literacy and managerial qualities of the civilian officials also invited incremental intrusion into military affairs.⁸⁷ This efflorescence of military knowledge production was capable of escaping the gravitas of tradition and incorporate recent developments. Tang Shunzhi, for example,

⁸⁴ Chase, *Firearms: A Global History to 1700*, 152; Duan, 'Ming China as a Gunpowder Empire: Military Technology, Politics, and Fiscal Administration, 1350-1620', 93, 159–60.

⁸⁵ Xu Baolin 许保林, *Zhongguo bingshu zhijian lu* 中国兵书知见录 (Beijing: Jiefangjun chubanshe, 1988), 132–271.

⁸⁶ Cynthia J. Brokaw, 'On the History of the Book in China', in *Printing and Book Culture in Late Imperial China*, ed. Cynthia J. Brokaw and Kai-wing Chow (Berkeley and Los Angeles, California: University of California Press, 2005), 24–25; Filipiak, 'The Effects of Civil Officials Handling Military Affairs in Ming Times', 7.

⁸⁷ Duan, 'Ming China as a Gunpowder Empire: Military Technology, Politics, and Fiscal Administration, 1350-1620', 32–51, 83–109.

clearly updated the sections of his encyclopaedia in comparison with the older *Wujing zongyao* in response to the availability of new gunpowder weapons. Wu Shu's detailed proposal to combine crossbow volley fire with the wagon fortress was mostly replaced by the insertion of more contemporaneous historical examples and the newer Ming ideas featuring a mixture of guns and bows.⁸⁸ Furthermore, the Song section describing crossbow volley fire around shields was omitted in the newer *Wu bian*, presumably because the pedagogical descriptions of Ming troops using guns and bows against the Mongols were now considered the state of the art. Transmitted classical learning thus could have served as a source of inspiration ensuring some continuity in practice, but innovation was not weighed down by its authority. When necessary, civil officials like Tang Shunzhi pragmatically omitted or updated sections of older military treatises in order to depict the latest (preferred) practice. This openness of innovative knowledge circulation was further enhanced by the diversity of actors that participated in it. As we have seen, civil officials, military officers, and even the emperor himself, at one point or another contributed to the evolutionary development of volley fire tactics. Even civilians could play a role in the process of dissemination: the largest Chinese premodern military encyclopaedia, Mao Yuanyi's (1594-1640) *Wubei zhi* (*Record of Military Preparations*), was written by a civilian serving on the private staff of a civil official.⁸⁹ The flow of knowledge between civil official Tang Shunzhi and military officer Qi Jiguang fits this established pattern, no doubt facilitated by the fact that by the sixteenth century imperial military affairs were

⁸⁸ Tang, 'Wu bian (before 1560)', 1354–61.

⁸⁹ For more background information, see: Sarah A.G. Basham, 'The Book Multiple: Treatise on Military Preparedness (1621) and Encyclopedic Practice in Seventeenth-Century China' (PhD diss., Vancouver, University of British Columbia, 2019).

dominated by a mixed civil-military elite who shared an interest in martial and military arts.⁹⁰

The historical example of the Ming closely resembles the civil-military model of military innovation articulated by modern scholars, which assumes a top-down flow of innovative ideas resulting from a cooperation between interventionist civilian statesmen and “maverick” military officers.⁹¹ We should of course not underestimate the role of oral transmission of innovative ideas, especially within the hereditary military, which was mostly illiterate and presumably transferred expertise from one generation to the next in this form.⁹² Unfortunately, because of its nature this form of transmission, this form of knowledge circulation is nigh impossible to chart. The original hereditary military in the south of the empire had mostly declined and disappeared due to corruption and desertion. Civil and military officials fighting the *Wokou* therefore relied on mercenaries, aboriginal levies, and local militia. In such a fragmented institutional context, it must have been nearly impossible to guarantee the oral transmission of skills, like volley fire, from generation to generation of soldiers. Three thousand elite gunners were transferred from the capital Beijing in 1555 and these could have transferred the ever-evolving volley fire tactics with them to the south-east.⁹³ Yet, textual

⁹⁰ Filipiak, ‘The Effects of Civil Officials Handling Military Affairs in Ming Times’, 8–12.

⁹¹ Adam Grissom, ‘The Future of Military Innovation Studies’, *The Journal of Strategic Studies* 29, no. 5 (2006): 908–10, 919–20.

⁹² The author would like to thank Kenneth Swope for this crucial insight.

⁹³ Kai Filipiak, *Krieg, Staat Und Militär in Der Ming-Zeit (1368-1644): Auswirkungen Militärischer Und Bewaffneter Konflikte Auf Machtpolitik Und Herrschaftsapparat Der Ming-Dynastie* (Wiesbaden: Harrassowitz Verlag, 2008), 263–64; Kenneth M. Swope, ‘Cutting Dwarf Pirates Down to Size: Amphibious Warfare in 16th-Century East Asia’, in

evidence suggests that the duo of Tang Shunzhi and Qi Jiguang played a key role in adapting these tactics to the harquebus.

Although Qi Jiguang would certainly have been aware of firearms in general, as his father had been a military officer in charge of them, he first used bows and arrows against the *Wokou* pirate threat, and only considered the harquebus after several defeats.⁹⁴ Is it possible that Qi learned how to use the harquebus in volley fire-enabling formations from Tang Shunzhi? We know from Qi's own writings that Tang taught him a certain method of spear-fighting, so the two were no strangers to the exchange of martial techniques.⁹⁵ Further circumstantial evidence can be found in the way Tang Shunzhi's soldiers used the harquebus in the late 1550s, when he was in charge of a military force suppressing the *Wokou*. By this time, the harquebus was still a relatively new weapon, as the Chinese only acquired and copied this Portuguese-derived Japanese-style weapon in the 1540s, although there are indications Ottoman-style harquebuses reached Ming China even earlier. The involvement of Tang Shunzhi in the struggle against the *Wokou* did coincide with an increase of the numbers of harquebuses employed by the Ming forces. His memorials from 1558-1559 mention the aggressive use of up to 500 harquebusiers on two occasions, who served as the vanguard charging the enemy.⁹⁶ This

The Maritime Defence of China: Ming General Qi Jiguang and Beyond, ed. Y.H. Teddy Sim (Singapore: Springer Nature, 2017), 166–70.

⁹⁴ Andrade, 'The Arquebus Volley Technique in China, c. 1560: Evidence from the Writings of Qi Jiguang', 121–22.

⁹⁵ Filipiak, 'The Effects of Civil Officials Handling Military Affairs in Ming Times', 9–10.

⁹⁶ Laichen Sun, 'The Military Implications of Zhu Wan's Coastal Campaigns in Southeastern China: Focusing on the Matchlock Gun (1548-66)', in *Early Modern East Asia: War*,

aggressive use of hand-held firearms is certainly reminiscent of the way the *Wu bian* recorded their use at the northern frontier. In a report about the northern frontier Tang also waxed lyrical about the advantages of using the newer harquebus against the *Wokou* and the Lu in the north.⁹⁷

A final string of evidence that might indicate a transfer of practical knowledge between Tang and Qi are the overall similarities Qi Jiguang's tactics and techniques assumed with those recorded by Tang. One of those techniques was a gun loading song Qi Jiguang had recorded for loading the harquebus in a manual. The significance of this song is that it divided the complicated loading process of the firearm in discrete memorisable steps, allowing its practice to be drilled to automation. This was important, because the soldiers had to be able to perform all these steps under stressful battlefield conditions.⁹⁸ However, another one recorded by Tang Shunzhi seems to predate it. It was composed for the gunners using the handle gun, the handgun which played a role in all of the descriptions of volley fire in the *Wu bian* above. Whereas the harquebus song was divided in eleven steps, the *shoubachong* had to be content with nine:

One, load the gun.

Two, pick up the fuse.

Three, load the powder.

Four, horse chip.

Commerce, and Cultural Exchange. Essays in Honor of John E. Wills, Jr., ed. Kenneth M. Swope and Tonio Andrade (Abingdon, Oxon: Routledge, 2018), 120–26.

⁹⁷ Tang Shunzhi 唐順之, *Tang Shunzhi ji* 唐順之集, ed. Ma Meixin 馬美信 and Huang Yi 黃毅, vol. 2 (Hangzhou: Zhejiang guji chubanshe, 2014), 821–22.

⁹⁸ Andrade, 'The Arquebus Volley Technique in China, c. 1560: Evidence from the Writings of Qi Jiguang', 125–26.

Five, insert [the horse chip] into the powder chamber.

Six, hammer three times.

Seven, insert arrow.

Eight, proceed with the gun.

Nine, listen for the *haotou*'s "ba ba" and turn.⁹⁹

Only deploy when the gong is sounded.

Light the fire and when the cymbals are struck, turn.

The unit assembles together.¹⁰⁰

It is clear how important the cooperation with musical instruments was to coordinate the movements. The horse chip (馬子 *mazi*) was a small piece of wood that was hammered into place in front of the gunpowder chamber, but behind the projectile, in order to prevent gas leakages and hence increase the power and range of the gun.¹⁰¹

The existence of these loading songs in the works of both Tang and Qi show how easily existing practices were adapted to the newer harquebus and that a fertile line of transmission and innovation extended between them. Using this technique is another demonstration of how older ideas were repurposed for newer weapon systems by Ming innovators. Mnemotechnical rhymes had already been used for memorizing gunpowder recipes during the early Ming, and

⁹⁹ The *haotou* is a kind of trombone, used in Chinese traditional opera and military displays.

¹⁰⁰ Tang, 'Wu bian (before 1560)', 1349.

¹⁰¹ Andrade, 'How Yongle Learned to Stop Worrying and Love the Gun: Perspectives on Early Ming Military History', 184; Wang, *Zhongguo huoqishi*, 101.

even earlier for archery training during the Han dynasty.¹⁰² The gun loading songs were unprecedentedly terse, however, and appear optimized for combat.

Other indications of links and continuities between Tang and Qi's ideas also existed: the occasional deployment of gunners behind shields and wagon forts for one. The expansion of the number of ranks of gunners to five - in lieu of the usual three or four seen earlier in Chinese history - advocated in Qi Jiguang's work might also have been the result of Tang Shunzhi's possible familiarity with Zeng Xian's ideas as with the wagon fortress seen above. In 1547 Zeng Xian published a proposal for revamping the northern frontier military in his region containing a suggestion by his subordinates to deploy gunners in ranks of five, shooting, withdrawing, and reloading in turns, in order to give off gunfire without cease. In their opinion this would smash the enemy cavalry hordes and break their resistance.¹⁰³ This might have given Qi Jiguang the inspiration to use five ranks as well, with Tang Shunzhi functioning as the intermediary. A third element, the mixing together of different projectile weapons in one integrated formation capable of continuous volley fire, has received little scholarly attention. Perhaps this has escaped the attention of modern scholars, because it does not fit the early modern European practice of only using gunners. However, it is evident that even Qi Jiguang's *harquebusiers* were to be backed up by crossbows and rockets. The *harquebusiers* would start firing when the enemy came within 100 paces (150 meters), the crossbows and rockets would start when the enemy advanced to within 60 paces (90 meters):

¹⁰² Andrade, 'How Yongle Learned to Stop Worrying and Love the Gun: Perspectives on Early Ming Military History', 199; Selby, *Chinese Archery*, 375–78.

¹⁰³ Zhou, 'Mingdai zhanche yanjiu', 136.

Ordinarily the crossbowmen and [rocket] shooters wait until the harquebus' firing will have ended. If the enemy comes within 60 paces, the [projectiles] are lit on fire and released just when it is permitted to continue to shoot arrows in the wake of the guns. Without the command it is not allowed to act without authorization.¹⁰⁴

A second passage by Qi Jiguang describes the same tactics after the harquebusiers have fired.

Moreover, if the enemy is further than 50 paces (approx. 75 meters) away, light on fire and release one projectile: every shooter releases an arrow, fires a crossbow, or sets off a rocket and ceases.¹⁰⁵

After this barrage Qi Jiguang would order the infantry with contact-weapons and shields to storm the enemy formation.

Qi Jiguang thus definitely did not innovate a singleton: his ideas were a logical progression of an evolutionary development which had started already during the early Ming mostly in response to the continual cavalry “crisis” posed by the northern nomads. There is, moreover, strong circumstantial evidence that Qi benefitted enormously from the knowledge Tang Shunzhi was able to transmit from the northern frontier. Tang's tactics with the harquebus against southern *Wokou* pirates resemble those he recorded with handguns on the northern frontier in the *Wu bian*, he was personally acquainted with Qi, who was initially reluctant

¹⁰⁴ Qi Jiguang 戚继光, ‘Ji xiao xinshu (1560)’ 纪效新书 (1560), in *Chuanshi cangshu - zi ku - bingshu* 传世藏书-子库-兵书, ed. Zhang Xinqi 张新奇 (Hainan: Hainan guoji xinwen chubanshe, 1995), 982–83.

¹⁰⁵ Qi, 997.

towards giving up the bow, and he was known to have taught Qi martial techniques. Last, but not least, Tang Shunzhi, like Qi Jiguang, was in a position to put his northern ideas into practice in the south, and evidence suggests he did. And this makes a strong case for innovations having passed from the northern steppe frontier to the south, instead of the other way around.

Conclusion: Steppe Frontiers as Sites of Innovation

Issues that occupy vast stretches of temporal and spatial coordinates, like those that are normally the subject of world history, also elicit a desire for large explanatory frameworks and patterns of causation. Unfortunately, these analyses are often marred by Eurocentrism when the domains of military history and world history intersect. Eurocentrism in military history is compounded by a lack of quantitative data culled from non-European sources, leading to a regionally skewed perspective on issues of world historical scope. All these factors are in play when we consider the glorification of volley fire as an important factor in explaining the Rise of the West.

Yet, as this article has shown, an extended survey of the development of the technique across Chinese history unearths many inconvenient data that undermine some of the metanarratives and exceptionalist claims build around the emergence of volley fire in European history. An abundance of mounted enemies did not hinder the development of this technique in Ming China, and this is further corroborated by a preliminary investigation of the Ottoman and Russian cases. Neither did the relative safety of the wagon fort preclude the emergence of sophisticated tactics to discipline the fire power of the infantry operating behind it. When sedentary Western European and Japanese armies, who relied on infantry, finally started firing their guns in volleys on the battlefield, they were more than a century behind Ming China, and probably the Ottoman Empire as well. This is not to deny infantry equipped with firearms were

unable to decisively defeat nomadic armies at this time, but their utilization in this context did not hamper the development of associated tactics and technology.

Furthermore, we have seen that the lack of a European-style Renaissance culture of innovation and multi-state system also did not prevent the volley fire technique's continuous development in Ming China. Although a certain openness and social inclusivity were indeed preconditions for the continued evolution and transmission of volley fire tactics, these factors were not unique to early modern Europe. In any case, an ongoing process of evolutionary innovation in response to military crises, especially nomadic cavalry threats, was probably more important to the development of volley fire in China than continuous transmission via classical learning. At the same time we should be cautious about emphasizing Chinese continuities in cultures of drill and warfare in general. The analysis above has uncovered many clues that the practice of volley fire was not always an unbroken tradition and often relied on the resurgence of cavalry challenges for its periodic reinvention.

Another important takeaway of studying early modern tactics with firearms is the enormous variety of manifestations the practice of volley fire could assume in different circumstances, questioning the unique status of the supposed gold standard set by the Western Europeans. Sometimes it was performed with a counter march, sometimes by kneeling and rising in turns. Sometimes the soldiers operated in unshielded formations supported by pikemen, sometimes from behind shields and other obstacles. Sometimes it was a limited succession of volleys, sometimes a continuous human machinegun. Yet, analysing these differences might prove to be a more fruitful direction in explaining divergences between Western European and broader Eurasian military developments. One question we might ask is whether these differences have consequences for the validity of the metanarratives that are traditionally connected with the emergence of volley fire. Did it matter, for example, that European gunners fought with pikemen instead of from behind wagon forts, shields, and field obstacles? One

argument that could conceivably be made is that volley firing in rotating ranks from behind wagon forts required less drilling, because the soldiers could perform their tasks in relative safety and did not need to have the same degree of discipline and automatization inculcated by rigid training regimes. In that case, Western European and Japanese gunners, operating more exposed to harm on the battlefield than their Eurasian colleagues, could have required superior drilling techniques. But then the next problem would be how to objectively ascertain and measure the differences between traditions of drill. Still, operating behind wagon forts might have reduced the tactical complexity of battlefield manoeuvres for Ming infantry, but this was compensated by a more complex cooperation between handguns and other projectile weapons on the battlefield, with each having their own niche. In contrast, European armies very quickly discarded bows and crossbows in favour of matchlocks, harquebuses and muskets, which probably simplified tactics in other ways. So here again, we need to be wary of asserting new Eurocentric metanarratives.

This is one phenomenon that would be worth revisiting in future research. Another would be critically investigating other non-European case studies, thereby increasing our pool of data about global cultures of innovation. The Mughal rulers of India and the Safavids of Persia also created infantry forces armed with handheld firearms and employed them in their wagon forts modelled on Ottoman practices, but at present we lack indications they used volley fire. These cases would provide valuable comparative perspectives, which could provide an even more balanced assessment of the importance of geographic, scholarly-cultural, and politico-institutional factors behind the emergence and transmission of volley fire and its significance to world history.

To close off this essay, I would like to make a plea for redirecting our gaze to the steppe-frontiers of unified Eurasian land empires as sites of important innovations. For a long time, first the idea of oriental despotism, and then its partial and implicit survival in the competitive

European states paradigm, has conditioned many modern scholars towards disregarding the innovative potential of these frontier zones and the larger polities they partially delimited. Yet, *Wokou* originating from the dynamic maritime world were blasted away with volley fire tactics perfected on the northern frontier of the Ming Empire. The Ottomans and Russians were apparently also quick to conclude that these tactics were useful against European infantry.

This is not a plea to replace one deterministic metanarrative celebrating exceptional European conditions with a radical reappraisal of the benefits of the presence of a steppe frontier, but rather an imploration for a more balanced and open-minded treatment of the “traditional” land-based empires of early modern Eurasia, especially their potential for innovation. World history often has a social scientific impulse: we try to find elucidation in large impersonal processes and objective starting conditions and try to reduce the messy individual agency of human beings wherever possible as an explanatory factor. Yet, the result is that world historical explanations often hinge too much on overly simplified chains of causalities. An illustration of the importance of human agency are the political contingencies behind the divergent fates of the Ottoman janissaries and the Russian *streltsy*. Their fates had less to do with geographic or geopolitical factors, and owed more to internal political squabbling. Despite both the janissaries and *streltsy* practising sophisticated tactics early in their history, their manner of institutionalization seems to have led to a loss of volley fire skills. Both forces had a strong collectivist identity and ethos coupled with a tendency towards hereditary service. Burak Kadercan has argued that with the growing indispensability of their skillsets to their courts, the janissary and *streltsy* consciousness of their respective political clouts increased as well. This manifested in their intervention in succession disputes of the Ottoman sultans and Russian tsars and in their resistance to reforms and reorganization. In the course of time these forces became strong corporatist interest groups, who were unwilling to update their tactics and training and also blocked the organization of new forces to replace

them. In the end, both the janissaries and the *streltsy* had to be disbanded by force in order to replace them with new formations. However, the Russians committed to this process already in the seventeenth century and continued to evolve their volley fire tactics. The Ottomans only got rid of their ineffectual janissaries in the nineteenth century and in the meantime lost its military lead in this area.¹⁰⁶ The later development of volley fire in China awaits further research, along with many other regions of the globe. They await the exploration of the political contingencies and cultures of innovation which shaped their military histories, which will no doubt add to a richer and more nuanced understanding of world history.

Acknowledgements

This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement No 758347). The author would like to thank Tonio Andrade, Peter Lorge, Kenneth Swope, and the two anonymous reviewers for their many helpful suggestions and comments, which have immeasurably improved the original manuscript. Furthermore, I would like to thank Rebekah Clements and my two ARNI companions, Michael Facius and Lisa Hellman, for inspiring me to think big and aim high.

Author Bio

Barend Noordam is a historian of Ming China, specialising in global military history, the history of science and technology, and early modern interactions between East Asia and Europe. He is currently part of the ERC-funded Horizon 2020 Aftermath of the East Asian War of 1592-

¹⁰⁶ Burak Kadercan, 'Strong Armies, Slow Adaptation: Civil-Military Relations and the Diffusion of Military Power', *International Security* 38, no. 3 (2014): 125–38, 149.

1598 project hosted by the Universitat Autònoma de Barcelona and tracing the development, textual consolidation, and diffusion of military technology in Ming China and Chosŏn Korea after 1592.