Revolutions in Warfare: Theoretical Paradigms and Historical Evidence—The Napoleonic and First World War Revolutions in Military Affairs

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Abstract

This article provides an alternative view for examining Revolutions in Military Affairs (RMAs), perceiving them both as sociopolitical institutions and as war-fighting models. The weaknesses in the ways in which the RMA theory has been approached are analyzed, resulting in the formation of three different, but parallel, paradigms of the RMA phenomenon (the Social Wave, the Radical Transformation, and the Continuity and Evolution). Two historical case studies, the Napoleonic RMA and the First World War RMA, are used in order to draw out the lessons learned regarding past revolutions and to examine the validity of the paradigms.

As the literature on the Revolution in Military Affairs (RMA) has expanded rapidly in the last decade, RMA has turned out to be a hugely contestable concept. The rationale behind the RMA was originally a grand strategy developed during the Cold War.¹ In the early

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¹ For a review of the military-technological developments that took place in the post–World War II period and led to the current Revolution in Military Affairs, see

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1970s, Andrew W. Marshall was appointed as the head of the U.S. Department of Defense's Office of Assessment and Strategic Planning. Marshall's work involved efforts to measure the military balance between the superpowers and plan a strategy that would shift the balance in favor of the United States. For Marshall the centre of change in warfare lay in sensors and information systems. By utilizing the benefits of information technology, the United States could gain an operational advantage on the future battlefield. In 1976, U.S. Secretary of Defense Harold Brown and Undersecretary William J. Perry initiated a program by which the United States and its North Atlantic Treaty Organization (NATO) allies would be able to use Western technological superiority to neutralize the overwhelming advantage in size that the Soviet Union and the Warsaw Pact armies had over NATO forces in Europe. This "offset strategy," a precursor to the U.S. Revolution in Military Affairs, was pursued by five administrations during the 1970s and 1980s and consisted of the following elements:\(^2\) the design of a "stealth aircraft" that would be nearly invisible to Soviet radar systems; and a program called "assault breaker," an effort to defeat Soviet armored forces with a variety of command, control, and intelligence systems, as well as advanced communications and precision-guided munitions.\(^3\)

The "offset strategy" was carefully observed by the Soviet Union. In the early 1980s, Soviet officials first referred to a "military technical revolution" that would fully exploit the benefits of computers, space surveillance, and long-range missiles. Chiefs of the Soviet General Staff Nikolai Ogarkov (1977–84) and Sergei Akhromeyev (1984–88) argued that not only was the pace of technological change becoming more significant in itself, but also new conventional weapons were becoming as effective as small nuclear devices against armored assaults. Soviet plans for a potential war in Europe rested on a massive and organized armored offensive. Yet, the new conventional technologies provided NATO with reconnaissance strike abilities that would easily identify and destroy armored columns.\(^4\)

Although the core technologies that are associated with the current revolution, like precision guidance, remote guidance and control, mun-

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2. By the early 1980s, the idea of transformation was incorporated in U.S military planning, and this led to ambitious strategic scenarios like Air-Land Battle, Follow on Forces Attack (FOFA), and The Maritime Strategy.


tions improvements, target identification and acquisition, and command and control, existed from the late 1970s, the revolution took more than a decade to fully mature and overcome the political constraints operating against it. Not until the Gulf War in 1991 did U.S. military thinkers come to understand the remarkable increase that had occurred in military capability. The appointments of William Perry as Secretary of Defense and Admiral William A. Owens as vice chairman of the Joint Chiefs of Staff in 1994 allowed RMA proponents to materialize their vision of an information-intensive military force.

Before making detailed reference to past RMAs, it is important to identify the difficulties in describing and analyzing such a complex phenomenon. To begin with, the precise meaning of the term remains problematic. After the Gulf War, the RMA debate attracted scholars with a wide range of expertise. On the one hand, this has offered inspiration to the debate, but on the other hand, no common intellectual approach has emerged about certain issues. Lawrence Freedman points out the confusion over whether the RMA represents a stage in the historical process, or a vision that cannot be realized unless the visionaries seize the initiative. Should the RMA be viewed as a single step change, a movement to a new paradigm, or a continuous process that demands constant change? According to Andrew Latham, three key conceptual weaknesses characterize the existing literature.

First, part of the scholarship reflects an ahistorical understanding of military revolutions. A historical approach to the study of war (and therefore to the study of Revolutions in Military Affairs) would treat war as a social phenomenon, focusing on periodical transformations in the social, political, and cultural forces. According to Latham, despite the fact that many scholars cite historical examples to prove their arguments, they use them quite often to explore the technological and tactical innovations that took place in the past and not to examine the


broader changes in the social, political, and cultural structures. The emphasis on technical and tactical aspects of the past offers a profoundly one-dimensional and misleading understanding of what is a complex phenomenon. In fact, the historical record suggests that technological change per se represents a relatively small part of the equation. The crucial element in most RMAs is conceptual in nature and not technological.

A second weakness is that there is no common understanding of what constitutes a Revolution in Military Affairs. Although analysts agree that an RMA involves a radical change or some form of discontinuity in the history of warfare, there is no consensus regarding how and when these changes or discontinuities take place, or what causes them. Therefore, some scholars analyze RMAs on the basis of battlefield technologies, such as gunpowder, or on war-fighting techniques, such as the Blitzkrieg doctrine. Others, however, look beyond battlefield technologies and techniques, arguing that since war is diachronically a complex social, political, and cultural phenomenon, more emphasis should be given to the broader sociopolitical changes that a revolution involves.

From this point of view, Revolutions in Warfare are seen as a process from the Age of Tools to the Age of Automation. Likewise, they can be seen through the prism of major shifts in social structures, from Second Wave to Third Wave, or from modernity to postmodernity.

The third shortcoming is the tendency to categorize the history of revolutions in warfare in certain temporal periods, each of which has a

9. Ibid., 232.
11. Murray, “Thinking about Revolutions in Military Affairs,” 70.
12. Even the definition of the term seems problematic, especially since various terms (Revolution in Military Affairs, Military Revolution, Military Technical Revolution, and Military Transformation) are used to describe similar notions.
distinctive character and is triggered by a revolution. Latham argues that this periodisation, although helpful for organizing the history of warfare, entails the danger that war-related phenomena will be conflated in order to fit certain eras. Organized political violence in any period of history is not a single-dimensional phenomenon, but a multidimensional one. Each dimension of warfare, whether it concerns a war-fighting technique or the political and cultural aspects of war, evolves at a separate historical speed and under a separate set of rules and logic.\textsuperscript{19}

To sum up, there is little agreement regarding the definition of the RMA, the periodisation of relevant military history, and the causes of military innovation. Nevertheless, the RMA literature raises a number of important questions. Can there be radical change in the conduct of war without the application of new technologies? Even if new technologies are present, how important are they compared to other factors, such as societal structures, organizing principles, and military culture? Even if such revolutions take place, to what degree do they actually affect warfare? What is their importance, given the complexity of warfare?

\textbf{Constructing the RMA Paradigms}

In order to answer the above questions, a two-phase process will be adopted. The first phase involves an alternative way of approaching the RMA theory, based on three different, but at the same time parallel, paradigms. The term paradigm is used here to describe a theoretical framework, a set of hypotheses that will serve as an organizing principle for the research. Note that there is no widely accepted school of thought regarding the RMA phenomenon, but the attempt here is to categorize the most influential approaches into three working groups that sufficiently cover the literature. The appropriate way to use these paradigms is to treat them as arguments. They are not valid as prescriptions; rather, they describe categories of thinking. They instruct the scholar in what to think about, but not what to conclude. The second phase involves the implementation of these paradigms in past cases of military transformation. The demonstration of the theoretical framework and the evaluation of the historical record will be important to the credibility of the paradigms. Therefore, based on the existing literature, three main approaches can be identified.

\textbf{The Social Wave Paradigm}

The first approach, the \textit{Social Wave} paradigm, explores the broader social, political, and economic changes that affect military transforma-

\textsuperscript{19} Latham, “Warfare Transformed,” 234.
tion, i.e., the way in which a society organizes for and conducts war. The Social Wave paradigm examines the changes brought about by events like the French Revolution, or the Industrial and the Information Revolutions, as well as the shift from one type of warfare to another, like the shift from modern war to postmodern war. Alvin and Heidi Toffler argue in terms of the relationship between the three waves of civilization (the Agrarian, the Industrial, and the Information Waves) and warfare, and the shift from one wave to another. They argue that the socio-economic waves are boosted by productivity and by the resources of wealth creation and power (agriculture, industry, and, most recently, knowledge), which also in turn affect warfare. The way a society makes war reflects the way it makes wealth. Starting with the very invention of agriculture, every revolution in the system for creating wealth triggered a corresponding revolution in the system for making war.

According to this approach, military revolutions are perceived as the inevitable outgrowth of basic changes in the form of economic production, a military-focused variant of the explanation of political change in history presented by Karl Marx. The Industrial Revolution, for example, is regarded as the driver behind a mid-nineteenth-century transformation of warfare, which was induced by the substitution of machine for animal power and the introduction of mass production to war. By 1914, industrialized total warfare had emerged out of a long-term process of transformation. Just as mass production was becoming the defining principle of industrial economies, mass destruction was emerging as the defining principle of industrialized total warfare. Mass production corresponded in military affairs to the levée en masse, the conscription of mass armies paid by the modern nation-state.

The thesis that military revolutions are the product of deep social, political, and economic changes and have profound implications for the conduct of war is widely cited in the RMA literature. Despite that, certain drawbacks are apparent. In particular, cause and effect are not always distinguishable in the history of military innovations. Whether

20. For this approach, see mainly the works of Alvin Toffler, Third Wave (New York: Bantam Books, 1990), and Future Shock (New York: Bantam Books, 1990).
the military revolution is the outcome or the agent of complex economic, political, and social changes is not always clear. The proposition that military revolutions are dependent on socioeconomic changes succeeds in connecting organized political violence and society. On the other hand, the three-wave theory of the Tofflers and other similar views risk overemphasizing certain dimensions that affect the conduct of warfare. In particular, apart from the economic, there are also other factors that affect the way a nation perceives threats and wages war. History, military culture, time, geography, alliances, and technology are just some of the elements that shape a nation’s decision to conduct war. Axiomatic beliefs regarding the images of them and us, as well as institutionalized perceptions of the nature of the enemy’s military forces, should also be taken into consideration.

The Radical Transformation Paradigm

The second approach, the Radical Transformation paradigm, puts emphasis on issues like military technology, doctrines, and organizational forms and the impact they have on the war-fighting model. Therefore, this paradigm views military revolutions as a series of radical transitions from the Blitzkrieg doctrine to Network Centric Warfare and from the artillery revolution to the stealth revolution. The radical innovation proponents argue that only when far-sighted innovators see unrecognized potential in new technologies and create new doctrines, will revolutions take place. Change is not enough; revolutions demand innovation of extraordinary scope and speed. A characteristic example that is used to support the above argument is the development of Blitzkrieg by Nazi Germany. The tank, the airplane, and the radio were available to all the great powers prior to World War II, but only the Germans understood their full potential and introduced a new doctrine in order to fully exploit it.

24. Linking military transformation to the state formation of modern Europe proves the above point. Did political change lead to military revolution or was it the other way around? See Clifford Rogers, ed., The Military Revolution Debate: Readings on the Military Transformation of Early Modern Europe (Boulder, Colo.: West-view Press, 1995), 340–41.


26. Contrary to the conventional wisdom about the emergence of the Blitzkrieg doctrine, Biddle argues that the doctrine that the Germans took into the Second World War was an incremental adaptation of the methods they had used at the end of the First World War; Biddle, “The Past as Prologue,” 44–55.
Regarding radical innovation, certain points should be taken into consideration. Military organizations usually tend to be conservative in their approach to technological innovation. Most of the time, their unwillingness to adapt to a new situation reflects fears concerning the impact that new technology will have on the structure of the organization, its military effectiveness, and the way it will affect the personnel involved. A decision to go for a novel technology that will prove its handiness (if indeed it ever does) in the future and may then be ready for the wrong kind of war, might actually be a risky and wrong decision.\(^{27}\) In addition, RMAs often take a long time to come to fruition. The U.S. Navy began experimenting with aircraft in 1910 and then took almost three decades to fully develop carrier warfare. Similarly, the German Army began experimenting with tanks in the early 1920s and took almost two decades to develop Blitzkrieg. Therefore, the "revolution" in Revolution in Military Affairs should not be taken to mean the change will necessarily occur rapidly, but just that the change will be profound.\(^{28}\) Finally, military organizations can rarely replicate in times of peace the actual conditions of war. The absence of the complexity, ambiguity, and friction of war predetermine military institutions to develop concepts and doctrines that meet the standards of peacetime efficiency rather than wartime effectiveness. On the contrary, transformation efforts conducted in wartime enjoy a pace and pragmatism in field-testing which eliminates much of the debate that peacetime innovation brings about.\(^{29}\)

**The Continuity and Evolution Paradigm**

In contrast, the Continuity and Evolution paradigm views military innovation and transformation as a continuous process intended to deal with the chaotic nature of war. The Continuity and Evolution paradigm argues that superior technology and new organizational concepts are always important, but are just parts of a complex equation that rules strategy and warfare, an equation where friction and the human element are always present.\(^{30}\)

\(^{27}\) Van Creveld, *Technology and War*, 223.

\(^{28}\) Richard O'Hundley, *Past Revolutions, Future Transformations: What Can the History of Revolutions in Military Affairs Tell Us about Transforming the U.S. Military?* (Santa Monica, Calif.: RAND, 1999), 16.


This more balanced approach towards the phenomenon of military revolutions recognizes the importance of military innovation and change, but at the same time encourages a healthy skepticism towards the irregularly paced process of innovation. The proponents of this view do not reject the idea that transformations in war occur, nor that the pace can vary, but rather view military innovations as a continuous process of coping with the challenges of warfare.\textsuperscript{31} The argument is that there are no revolutionary discontinuities, but instead, a continuous evolution of military innovation and change. In this process of continuous change, the ability to cope with an increasingly complex battlefield has been a more important determinant of success or failure than radical innovation.\textsuperscript{32} Revolutions of any type, whether great or small, tend to overlay rather than literally succeed each other. For example, the aviation revolution, either as a Military Revolution or even a Military Technical Revolution, is still going on, alongside the nuclear and information-led revolutions.\textsuperscript{33} The rationale behind the Continuity and Evolution paradigm is that military transformation is the end result of an evolution in military innovation and that history proves that there are several paths to military success.\textsuperscript{34}

An obvious problem with this paradigm is that there is no clear difference between innovation that is just innovation and innovation that leads (or might lead) to revolution. By attributing every attempt at innovation and change to a continuous process that deals with complexity and the chaotic nature of war, there is the danger of oversimplifying the history of military revolutions. Continuity is not the only value in military affairs. Sometimes it is necessary to implement widespread change in doctrine, training, education, and technology. Facing up to the inevitability of change and appreciating the benefits of change is often required if a military institution is aiming to prevail in a new era.


\textsuperscript{32} Biddle, "The Past as Prologue,"5.

\textsuperscript{33} It has been argued that the full maturing of airpower during the 1980s and 1990s is the real revolution of today. See Benjamin S. Lambeth, "The Technology Revolution in Air Warfare," \textit{Survival} 39 (Spring 1997): 65–83.

\textsuperscript{34} For a similar approach, see the Essential Continuity Theory in Biddle, "The Past as Prologue," 11–32.
The Napoleonic Revolution in Military Affairs

During the Revolutionary and Napoleonic wars, the small professional armies of the eighteenth century quickly gave way to large national armies composed of conscripts. This same period saw artillery transformed from a specialized profession overseen by mechanics into a major service branch capable of dominating battlefields. The wars Napoleon waged were wars of conquest on a grand scale and were fought by huge armies, which consisted of professional soldiers, mercenaries, and patriotic French conscripts. The levée en masse adopted in France enabled Napoleon to keep under arms hundreds of thousands of soldiers, with his opponents following closely.35

At the end of the eighteenth century the rise of nationalism, the institution of universal conscription, the comprehensive economic mobilization of society, and the creation of the “nation in arms” combined to constitute a Revolution in Military Affairs. Napoleon’s contribution was to bring together these elements in order to achieve his policy goals.36 It was a revolution driven more by politics than by technology. Neither Napoleon’s conquests nor his subsequent defeat can be explained in terms of technological factors. The Grande Armée and its opponents possessed very similar arsenals, and given the character of war in this period, it is not surprising that all armies imitated technical advances that were made by the others.37

The revolutionary system of command employed by Napoleon was not the result of any radical technological advances, but of superior organization and doctrine. Napoleon’s enemies sought to maintain control by keeping their forces closely concentrated, whereas Napoleon chose the opposite path, reorganizing and decentralizing his army. In order to achieve that he had to organize the army in self-contained, mission-oriented units, the corps; to institute a system of regular reports from the corps to the General Headquarters, and of orders from the latter to the corps; and to organize a headquarters staff capable of dealing with the bureaucratic traffic generated.38 This enabled the various parts of the army to operate independently for a limited period of time and consequently tolerate a higher degree of uncertainty.39 The system of corps d’armée was a major innovation and enabled Napoleon to conduct opera-

37. Van Creveld, Technology and War, 167.
39. Ibid., 100–102.
tional maneuver with a very large force. An army organized on the corps system had an organizational framework that resisted collapse and provided a structure for quick reorganization after a defeat.40

The Napoleonic revolution might be limited to a period of two decades, but a long period of preparation reaching back to the 1740s can be identified. The demographic and economic expansion that occurred during that period provided nations with the necessary resources for protracted warfare. Adding to that, the emphasis of the Enlightenment on rationality and novelty, as well as the extensive military experience acquired, helped to prepare the ground for radical transformation.41 A number of reforming efforts occurred after the Seven Years’ War (1756–63)42 and prepared the ground for the Napoleonic RMA. Marshal Maurice de Saxe, Jean-Charles Folard, Jean de Mesnil-Durand, and Jean-Pierre du Teil, just to name a few, developed ideas to enhance battlefield performance and stressed the importance of logistics.43 The modernity and organizational flexibility of the French Army of the 1790s was not the result of a rapid transformation, but of more than thirty years of inspired and systematic reform and improvement. At the end of the Seven Years’ War, the French realized that their armies did not perform well and therefore were open to reformist proposals. It would be fair to argue that most of the preparatory work that later enabled Napoleonic France to conduct a number of successful campaigns was undertaken by the Old Regime during the period from the 1740s to the 1780s.44 Coming back to the paradigms, the above point would apply more to the Continuity and Evolution than to the Radical Transformation paradigm. In tactical and strategic matters the Revolution built on the achievements of the eighteenth century, most notably by Guibert in infantry tactics and Gribeauval in the deployment of the artillery. But the work of the prerevolutionary reformers could not implement a revolution on its own. Two vital elements were required, the dynamism of the French Revolution and the leadership of Napoleon.

French efforts to reform the army did not stop with doctrines, organization, and tactics. There was a sociopolitical change, triggered by the

42. See Williamson Murray’s argument that the Seven Years’ War acted as a preshock to the Napoleonic Revolution. Murray, “Thinking about Revolutions in Military Affairs,” 72–76.
French Revolution. The monopolizing of the commissioned ranks by the aristocracy in Bourbon France and the inability of the crown to pay for the needs of the army were threatening the political survival of the military institution. By successfully marrying professional competence to political enthusiasm, the Revolution allowed the emergence of a new military elite and succeeded in raising large armies on the claim that the French nation was in danger. The French Revolution invested in ideology and nationalism. Even though the existence of a sociopolitical revolution is not considered a precondition for any RMA, in the case of Revolutionary France, it is reasonable to argue that the Napoleonic RMA developed within a sociopolitical context. Therefore, the Napoleonic RMA can be interpreted under the Social Wave paradigm, meaning that the political turbulence of the French Revolution was the driving force for the military revolution. Faced with foreign invasion, the leaders of 1793 declared a levée en masse, which placed citizens and their property at the disposal of the state. The result was that the French tripled the size of their army in less than a year, and although they remained less effective in battle than their opponents on a unit-to-unit basis, they could accept casualties and fight on a scale like no other military formation.

The above factors were essential, but not adequate for transforming French military power. Napoleon's charismatic leadership, operational brilliance, and vision were the missing ingredients. In particular, the development of a more mobile artillery park and the assembling of divisions into corps d'armée are his major contributions to the art of war. Napoleon made use of the work of early reformers that had not been completely understood or that had not been exploited fully. Napoleon was not just a part of the equation; he recognized the full potential of the transformation in war and saw how its components could be made to work together. As far as his strategic vision is concerned, he did not regard war (major war in his case) as a last resort, but as the central element of his foreign policy.

After 1789 the French artillery service was state-of-the-art for its time. The end result was more aggressive battlefield tactics that ushered artillery away from a supporting position into a decisive and highly destructive role of its own. By 1805, the corps system had matured, and
Napoleon was strong enough politically to insure the execution of his operational plans. The army corps system made large forces easier to command and control and ensured the flexible execution of combined army tactics. The victories at Austerlitz (1805), Jena (1806), and Friedland (1807) were achieved by a modern nineteenth-century French Army, against the archaic armies of the Austrians, Prussians, and Russians.

Napoleon dominated the European continent for more than a decade because his opponents were initially hesitant in adjusting to the new style of warfare. This stemmed from the fact that some of the aspects of the revolution were not products of a sudden innovation, but of the utilization of institutions and methods that had existed for decades, and therefore would not demand radical adjustment. In addition, there was the belief that adoption of reforms like universal conscription and open access to commissions would mean changing one's social and political system. Prussia, for example, adopted these changes in order to defeat Napoleonic France, but after 1815 abandoned them as subversive. The reason that the Austrian Empire failed to copy the French methods early on was the sociopolitical implications of the levée en masse. The Hapsburgs feared providing military training to various ethnic groups within their borders.

Nevertheless, the French victories between 1805 and 1807, victories of flexible tactics and superior command and control, triggered a reaction to the Napoleonic revolution. When the Allies raised modern nineteenth-century armies and used them against Napoleon, warfare changed again. The Austrians and Prussians exploited German nationalism and developed an expandable army, relying on the mobilization of trained reserves and Landwehr. In contrast to the French case, modernization in Austria and Prussia did not require support by a sociopolitical revolution. The authoritarian regimes of both Austria and Prussia were able to impose radical innovations. The different responses to the Napoleonic revolution derive from different needs and capabilities. For example, Prussia was a continental power with extensive land combat experience, whereas Britain was a naval power that chose not to reform and was therefore constrained to conduct land warfare on the eighteenth-century model.

49. Regarding the organization of the infantry and cavalry, see Rory Muir, Tactics and the Experience of Battle in the Age of Napoleon (New Haven, Conn.: Yale University Press, 2000), 68–76 and 105–13.
50. Epstein, “Patterns of Change and Continuity,” 377.
53. Regarding the Austrian, British, and Prussian responses to the Napoleonic Revolution in Warfare, see Epstein, “Patterns of Change and Continuity,” 378–86;
Wagram in that year, it was obvious that Napoleon's enemies had learned the art of modern warfare. The period of Austerlitz, where Napoleon was fighting obsolete armies of the eighteenth century, and defeating his opponent in decisive battles, was long gone. The war became protracted, the battles lasted for days, and the Allies proved able to mobilize greater resources.

Seen under a holistic prism, the Napoleonic RMA was the result of a combination of many factors. First of all, the ground was prepared by the reforming efforts of the Old Regime. By the 1790s, the French artillery park was the most modern, French tactics were superior, and their military equipment was as good as any in Europe. Second, the French Revolution provided the context within which social and political changes could coexist synergistically with military reforms. Human and material masses, mobilized by nationalism and the emergence of a new military elite, allowed the Grande Armée to wage wars where mass was the decisive element for victory. Third, brilliant leadership seized the opportunity and carried out the military revolution.

But paradoxically enough, it was these factors that led to Waterloo (1815) and the failure of Napoleon's strategy. His opponents sooner or later adopted the military tactics, ideas, and weapons that Napoleon had used to materialize his revolution. After all, evolutionary developments like the corps and divisions had their roots in eighteenth-century warfare and were not exclusive products of Revolutionary France. The Austrians and Prussians learned their lessons and reacted successfully. The Revolution allowed Napoleon to mobilize the necessary human and material resources, but at the same time its aggressive nationalism triggered countervailing nationalisms. In particular, the Austrians and Prussians appealed to German nationalism within their German-speaking territories, with the hope of creating a rival movement. The result was the creation of a German-speaking Landwehr.

In addition, the early political gains of the Revolution outside France were soon broken down by Napoleon's foreign policy. Napoleon's campaigns for conquest and loot nullified the sympathy produced by the ideals of the French Revolution. In contrast to Frederick II of Prussia and Catherine II of Russia, whose actions were compatible with some sort of European order, Napoleon's insistence on waging major wars proved a strategic mistake, since he did not use military success to achieve peace and political survival. In certain cases (like the decision to invade Rus-


54. Black, "Eighteenth-Century Warfare Reconsidered."
his policy was unrealistic and driven by his psychological need for conquest and absolute domination.\textsuperscript{56} Even in a period where war was accepted as a legitimate instrument of policy, Napoleon's campaigns were judged illegitimate and intolerable.\textsuperscript{57} The enterprises of Napoleonic France were too many and too vast. As the size of the armies increased and operated in several theatres, even Napoleon's genius was not enough to cope with the clamor and confusion of battle.\textsuperscript{58}

**The First World War Revolution in Military Affairs**

Warfare at the beginning of the First World War (1914–16) differed little from that practiced in the eighteenth century. Warfare in 1914 was a linear affair, and its doctrines emphasized flank attack, envelopment, and annihilation.\textsuperscript{59} By 1917 the industrial version of the Napoleonic War paradigm had been shown to be the wrong one. A new way of warfare was developed, where industrial mobilization, technological improvements in military methods, and the emergence of new weapons played a crucial role in changing the character of war.\textsuperscript{60} Machine guns, trenches, and barbed wire brought maneuver to a halt, and the European armies were unable to achieve decisive victories.\textsuperscript{61} From 1917 on, indirect artillery fire enabled decentralized combined-arms combat teams of infantry to seize and hold bite-sized chunks of the enemy's defended zone. Tanks were used to crush barbed wire and eliminate machine guns. Aircraft proved useful for collecting information and providing tactical support.\textsuperscript{62} Light machine guns were one of the key weapons to emerge from the First World War. While heavy machine guns were a major cause of trench warfare, making dug-in troops very difficult to defeat, light machine guns helped to restore mobility to the battlefield.\textsuperscript{63}


\textsuperscript{57} Schroeder, "Napoleon's Foreign Policy," 158.

\textsuperscript{58} Rothenberg, *Napoleonic Wars*, 216–17.


\textsuperscript{60} Gary Sheffield, *Forgotten Victory. The First World War: Myths and Realities* (London: Headline, 2001), 105–33.


The revolution was technical, tactical, and conceptual, but many of the components that led to the artillery-led revolution were not new. Elements of indirect fire appeared in the nineteenth century, but the armies of that era failed to realize its full potential. In particular, early signs of the effectiveness of indirect fire appeared in the Franco-Prussian War (1870–71) and the Russo-Japanese War (1904–5), but the commanders failed to realize the tactical and operational necessity of adopting it. All armies before the Great War planned to conduct fast-moving operations in which artillery would be unable to keep up. There was no concept of field artillery being used at the operational level to aid in breaking through enemy lines.64 After all, longer-range guns would have been heavier, less mobile, and thus less relevant to the prevailing concept in which range was sacrificed for mobility. Deficiencies in mapping, ballistic calculation, and communication postponed innovation in the use of artillery at the beginning of the Great War.65 But the prime reason for failing to exploit indirect fire was lack of imagination and doctrinal laziness. According to Jonathan Bailey, once the brutal necessity of adopting the new method presented itself, technical and tactical problems stemming from the conservative military culture were soon overcome.66

The German model, which dominated the second half of the nineteenth century and had been adopted by every army in Europe, was based on excellence in staff work, short-range logistics, and envelopment. Victory would go to the side with the best-trained and most-disciplined army. As a result, the opening battles were closer in conception and execution to those of the Napoleonic era than to the battles from 1916 onwards.67 Prior to 1914 the generals in Europe were under the illusion that a war would be short and were willing to offer a human solution to the technological problems of the battlefield.68 The military institutions believed that a prolonged war would cause massive social upheaval and therefore rejected fighting such a war, despite the inapplicability of their doctrines.69 The military professionals were not blind to the changes that had taken

65. Ibid., 9.
66. Ibid., 10.
place in command and control, firepower, and logistics. They correctly anticipated the increased lethality of the battlefield and therefore adopted doctrines and tactics that would bring war closer to an end, because they feared that society would collapse under the massive and continuous demands of the modern battlefield. But, while the military professionals succeeded in understanding the new war-fighting model, they misunderstood the sociopolitical context of warfare. Their error at the beginning of the war was not to fail to understand the outcomes on the battlefield, but to underestimate the ability of the state to mobilize and maintain control over society during a prolonged war. Industrialization permitted advanced nations to engage in protracted and hugely costly conflicts.

In contrast to the Napoleonic RMA, no long period of preparation and evolution existed. In a way, the experience of 1914–16 was a short but efficient period of education for all the parties involved. These three years of trial and error provided both sides with new tactics for combined arms warfare and the type and quantity of machines and munitions needed to apply the new tactics. Mass was again a significant factor for victory. Modern war led to a demand for more men, more weapons, and more ammunition. The material solution to the problems of the First World War battlefield favored the Allies. The Entente Powers were in a position to mobilize more national resources. This had to do with the effectiveness of the liberal political institutions of France and Britain and the quality of their civilian morale. Also, both France and Britain could draw on the human and material resources of their colonies. The First World War RMA lacked a central figure (like Napoleon) who could trigger or push the military revolution. This revolution thus was never pursued according to a clearly articulated, unified vision. Instead, despite a number of leading artillery colonels and generals who played an important role, it would be fair to argue that the tactical reeducation of the armies was driven from below. As a result, the RMA of the First World War showed extreme institutional and doctrinal adaptation. The military institutions had to adapt to a style of war for which they were not prepared. Moreover, the executors of the revolution had only three years to test their ideas and doctrines, which had to be proved in action on the battlefield and under the pressure of unprecedented casualties.


71. Regarding the issue of national mobilization as a factor in determining the outcome of the war, see John Horne, ed., State, Society and Mobilization in Europe during the First World War (Cambridge: Cambridge University Press, 1997).

72. For the process of mutual adjustment, see Dennis Showalter, "Mass Warfare and the Impact of Technology" in Great War, Total War: Combat and Mobilisation on the Western Front, 1914–1918, ed. Roger Chickering and Stig Förster (Cambridge: Cambridge University Press, 2000).
Artillery was the tool that, more than any other element, contributed to the First World War RMA. But it would be misleading to argue that artillery was the decisive weapon. It was the means by which Allied competence (in resources and overall strategy) was translated into military effectiveness. The artillery revolution of 1917–18 (among both the Central Powers and the Allies) was the result of an effort by the army, the society, and the government. The balance in these factors favored the Allies. The artillery-led revolution could not guarantee victory alone. After all, none of the combatants established a superior technique to defeat their opponent in a decisive way.

The turning point for the revolution was the battle of Cambrai in November 1917. By then, both parties had learned how to use machine guns in large numbers, to conduct trench warfare, to use gas cylinders and gas shells, to lay indirect artillery fire, and to wage air warfare. However, the way the two parties responded to the new challenges was different. In particular, the German Army developed an infantry-artillery, less-mechanized response to the needs of the battlefield, and the British Expeditionary Force (BEF), a more-mechanized one. The reason was that the Germans lacked adequate resources to produce a mechanized alternative.

Each national army (the BEF and the German Army) produced a reaction that was compatible with its technical, material, economic, and military-cultural elements. The fact that Germany and Britain, employing the same military technology, produced two different responses (because of different military cultures, available means, and needs)

73. Note that the First World War RMA is synonymous to a certain degree with the Artillery Revolution. According to Trevor Wilson and Robin Prior, the revolution involves mainly land warfare. Despite new technological developments, the war at sea was not strikingly different from the naval war of the Napoleonic era, and the air war, even though a new phenomenon, had not reached a state of development where it could fundamentally alter the face of battle. See Wilson and Prior, “Conflict, Technology, and the Impact of Industrialization: The Great War 1914–18,” Journal of Strategic Studies 24 (September 2001): 128–57.

74. Regarding the German version, see Bruce Gudmundsson, Stormtroop Tactics: Innovation in the German Army, 1914–1918 (New York: Praeger, 1989); and Timothy Lupfer, The Dynamics of Doctrine: The Changes in German Tactical Doctrine during the First World War, Leavenworth Papers no. 4 (Fort Leavenworth, Kans.: Combat Studies Institute, U.S. Army Command and General Staff College, July 1981).

seems to confirm the criticism of the Continuity and Evolution paradigm (about the complexity of war) and weaken the dominant role of military technology that the Radical Transformation paradigm supports. Each side had to adjust in two directions, to the problems that its own army faced and the domestic context, and to the behavior of the enemy. The BEF adjusted to its growing manpower crisis in 1917–18 by adopting a style of firepower and mechanized warfare that rationally played to its industrial strengths. On the other hand, Germany adjusted by adopting a style of elite infantry-led warfare, which lacked the quantity of firepower that the adversary possessed. The German Army did not despise firepower, but the combination of relative disadvantage in material resources and a great tradition in victory through operational maneuver in combined-arms combat, led to a style of warfare less dependent upon firepower than that of the BEF.76

Regarding the changes in command, the Germans’ choice was devolution, whereas the British preferred to keep a firm control from above. Taking into account the doctrinal development, the intense training, and the tough selection for troop leadership positions that characterized the German Army, it is clear that a decentralized style of command offered a significant advantage to the Germans. The weakness of the BEF in battlefield command was counterbalanced by its material strength. At the end of the day, the difference was that the BEF better matched available means to ends than the German Army did.

Many scholars believe that the German Army waged the better war technically, even though it lost in the end. A closer look at doctrine, military operations, and command proves that the performance of Wilhelmine Germany in certain areas was superior. But coming back to our point about a holistic understanding of the RMA phenomenon, the First World War was not exclusively won (or lost) on the battlefield. Both German and British societies had to adjust to the unprecedented demands of a total war. Even though both sides proved able to adjust to the massive technological needs of the modern style of warfare, the relative advantage was in favor of the Allies by the end of the war. There is no doubt who won the competition in mobilization in terms of quality, quantity, and appropriate choices.77 German superiority in logistical planning, organization, and mobilization could not overcome the demands of a two-front war. In common with the Napoleonic case in its latter phase, the Germans in the First World War took on too many commitments; they tried to do too much with too little and were unable or unwilling to adapt policy to military reality. In addition, the Central Powers had to fight against a global sea power that dominated the sea-lanes

and had access to the resources of its colonies. Britain, even though lacking the experience of conducting continental warfare on a large scale, proved capable of mobilizing its resources for the war effort.

The outcome of the conflict was not determined technologically, since technology, even though a vital element, could not produce tactical success on its own. The First World War is not a case where extremely radical ideas were applied, since most of the elements for the change already existed, but a case where battles demonstrated the necessity of combining the available means under a novel concept.78 In this case the feedback and the everyday lessons from the battlefield proved to be the driving force of the revolution. Bearing in mind that during the First World War no side possessed decisively superior technology, it seems that this particular RMA fits more the Continuity and Evolution paradigm and the Social Wave paradigm, than the Radical Transformation one. The novel use of the artillery in the last two years of the war stemmed from practical and technological problems faced on the battlefield and it was this that caused the concept of indirect fire to be implemented, rather than a radical technological innovation. The war was decided by mass and attrition; therefore, the side that was more willing and capable of providing its armies with ever more resources would eventually win.

Concluding Remarks

The above analysis of past Revolutions in Military Affairs illustrates the complexity of the issue and the difficulty faced in examining a phenomenon with social, military, and technological dimensions. Both the Napoleonic and First World War RMAs succeeded in creating a new style of warfare and therefore bringing about a change in warmaking, but neither succeeded in overcoming the complexities of warfare. The analysis given here enables us to reach certain conclusions about the nature of revolutions in warfare and the credibility of the paradigms.

First of all, the cases under examination (both as military-technical enterprises and as tools for military effectiveness) needed a sociopolitical context. Whether it is a sociopolitical revolution (like the French Revolution in the Napoleonic case and the Industrial Revolution prior to the First World War), or the perception (or even misperception) of who the enemy is to be, a complex process such as the Revolution in Military Affairs cannot succeed unless it is translated into politically defined goals.

Second, the concept of radical innovation proved not to be that radical after all. Many elements of the revolutions were already present and

long known in principle, and many of the techniques and tactics had actually been employed in the past. Even in the situation where the military transformation profited from strong leadership (as in the Napoleonic case), the other side soon proved capable of adapting in some way, and as the First World War teaches us, that can be done in a short period of time by a process of parallel discovery and re-education. The BEF transformed itself from an army ill-equipped for large-scale continental warfare in 1914–15, into the most effective instrument of land warfare in 1918. In addition, the time when victory could be achieved in a decisive battle was long gone and had given way to attrition warfare, where any initial advantage would sooner or later be counterbalanced. Clausewitz’s dictum that “war does not consist of a single short blow” applied in both cases examined.

Thirdly, technology is just one dimension of the RMA phenomenon. In both cases, technology was an important factor, but it did not decide the outcome of the war. In the Napoleonic case, aspects like road building, map-making, and printing technologies helped the revolution take place and mature, but did not translate into military effectiveness. Similarly, during the First World War novel technologies (U-boats, torpedoes, floating mines, poison gas, tanks, light machine guns, aircraft, and aerial photography) altered the way war was waged, but none of these technologies could produce a decisive strategic advantage on its own. The Allies achieved victory not because they possessed superior technology by the end of the Great War, but because they managed to perform better in putting together all the necessary elements: industrial mobilization, national resources, morale, and operational art.

Regarding the paradigms, both cases clearly demonstrate that the Radical Transformation paradigm lacks certain credibility. Military technology played an important, but not a dominant, role in the Napoleonic Wars and the First World War. The unfolding of the RMAs under examination seems to confirm the main arguments of the Social Wave and Continuity and Evolution paradigms. The French and the Industrial Revolutions influenced or even shaped the sociopolitical context under which the military revolutions took place, but the most valuable insights derive from the Continuity and Evolution paradigm. The intention of Napoleon and his enemies, as well as of the German and the British armies, was to make the best of the available military technology and doctrines in order to counter the complexity of war. In their efforts, technology was one of many tools, only an element of the art of war, one of many.

Finally, anyone trying to understand a past military revolution (or even plan for a future military transformation) should realize that it is a complex phenomenon and not a linear (technological) undertaking. The fact that almost every actor responded in a different way to the same
sociopolitical and military-technical challenges makes this clear. The human, the political, the ethical, the geopolitical, and the temporal should also be included in any analysis of a military revolution. Therefore, a holistic approach that takes into account the complexity of war and uses historical evidence has more to offer than an uncritical technology-led partition of military history. Getting back to the current information-technology-driven revolution, such an approach might engender some healthy skepticism regarding the uses and limits of optical and infrared sensors, stealth aircraft, and precision-guided munitions.