

Military Revolutions and Revolutions in Military Affairs: Accurate Descriptions of Change or Intellectual Constructs?

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Abstract

The Revolution in Military Affairs (RMA) became a common term in military and defence circles in the early 1990s when the Gulf War seemed to indicate a dramatic shift in the nature of modern warfare. This idea has roots in the concept of the Military Revolution (MR) which was used by historian Michael Roberts in the 1950s to describe phenomena dating to the 16th C. Although the exact nature of RMAs was debated over the course of the 1990s, the concept itself quickly gained widespread acceptance. The questions were more about how RMAs could be exploited and controlled rather than whether the phenomenon itself holds weight at all. Before engaging in debates as to the peculiarities of MRs or RMAs, one must first determine the validity of the concepts themselves. This is especially true for those interested in policy-making where real world decisions must be made based, in part, on historical trends and observable facts. Perhaps the most important question in assessing the validity of such military change is whether it occurs in revolutionary spasms or as incremental evolutions. Understanding these issues, as well as what conditions drive certain kinds of change, is incredibly valuable for defence policy-makers attempting to assess current and future strategic positions. This paper does not seek to weigh in on the particular debates surrounding these concepts but attempts to examine the literature in an effort to understand their true value as explanatory tools in the history of military change.



For many strategists the Gulf War seemed to indicate that a new era had begun in the military sphere. The swift victory of the Coalition forces over the Iraqi forces seemed to confirm the superiority of Western military technology and the role that it could play in being the decisive factor in achieving military success in modern warfare. It appeared that the key technologies of the Gulf War—stealth, precision weapons, advanced sensors, C4I,¹ and real time space systems—represented a fundamental shift in warfare in favour of those who could harness these new technologies. For many, the Gulf War was the first real testament to the current revolution in military affairs (RMA).

The debates with regards to the concept of military revolutions (MR) or revolutions in military affairs (RMA) are largely an issue of semantics. Unable to agree if they represent cataclysmic and revolutionary events, or merely an incremental process of change, many scholars disagree over their cause and nature. The debates are largely confused because MRs/RMAs can be defined in a number of ways, and thus certain aspects can be stressed or omitted in order to fit each historian's definition. In the process of attempting to bring different perspectives together, the debate can fall apart due to open ended interpretation. Understanding the historical foundations of the concept helps shed light on aspects of MRs/RMAs, but provides only a few concrete lessons due to its elusive conceptual nature and controversial characteristics. The evidence does however, suggest certain momentous changes in strategic history (whether the result of so-called revolutionary or incremental change) and thus has some explanatory value as a historical concept. What is more, certain concepts that appear contradictory might in fact be reconcilable. Despite the academic shortcomings, the concept holds significance for policy-makers and thus an understanding of the various debates and interpretations become more relevant when trying to apply concepts in the real world.

1. Command, control, communications, computers, and (military) intelligence.

Part one of this paper introduces the concept of the revolution in military affairs, its relevance in explaining the success of Coalition forces during the Gulf War, and a brief overview of the policy issues that emerge from the implications of RMAs. Part two looks at the evolution of the theory of military revolutions in the historical literature starting with its earliest articulation by Michael Roberts in 1955. Part three provides an overview of the different paradigms that have been used to describe the nature of military revolutions, and highlights the major interpretations used by leading authors. Although at first glance the various paradigms leave little room for cooperation in their assessment of MRs/RMAs, this section attempts to show how each paradigm might in fact be valid under certain circumstances as well as how they share commonalities despite rhetoric that points to the contrary. Part four provides some general lessons that can be garnered from the literature and which are generally agreed upon despite the seemingly contradictory viewpoints. Finally, part five provides some conclusions from a policy perspective about how both the strengths and limitations of the history can inform policy-making. Current and future policy-making must be aware of the history but must also be skeptical of arguments that suggest understanding MRs/RMAs is straightforward. Ultimately, policy must be based on analysis of previous revolutions but will have to accept a certain degree of risk in judging how current and future ones will proceed.

The Revolution in Military Affairs and the Gulf War Debate

An RMA can be defined as “a major change in the nature of warfare brought about by advances in military technology which, combined with dramatic changes in military doctrine and organizational concepts, fundamentally alter the character and conduct of military operations.”² The popular term carries

2. Elinor Sloan, "Canada and the Revolution in Military Affairs: Current Response and Future Opportunities," *Canadian Military Journal* 1, 3 (2000): 7.

with it a heavy interpretive load as descriptions of the RMA—its nature, characteristics, and relevance—are varied and plentiful.

The roots of the current RMA lay before the Gulf War and the term itself has origins in the Soviet Union. The early influences lay in the work of military theorists in the 1960s. Marxist-Leninist doctrine made the Red Army receptive to the idea of revolutionary change and Soviet theorists were pioneers in analyzing the impact of World War I on military techniques of the interwar period.³ It was observed that the German *Blitzkrieg* of 1941 demonstrated the possibility for revolutionary changes in war. Moreover, in the postwar period Soviet development of nuclear weapons and missile systems came to rival that of the West, ushering in another seemingly revolutionary era of military history. In the 1970s, Soviet military thinkers writing about a ‘Military Technical Revolution’ (MTR) argued that computers, space surveillance, and long-range missiles “were merging into a new level of military technology, significantly enough to shift the correlation of forces between East and West.”⁴ By the mid 1980s, the Chief of the Soviet General Staff, Marshal Nicolai Ogarkov, had become the leading advocate of the concept, arguing that the Soviet position in Europe was threatened by the United States which had pulled ahead in this technologically based revolution. In the early 1990s, Andrew W. Marshall of the Office of New Assessment was aware of the Soviet writings on the MTR but felt that the emphasis on the technological aspect of the ongoing military changes was a narrow reading of what qualified as a true revolution. As such, the term MTR was replaced with the now broader concept of an RMA which emphasizes doctrinal aspects of military transformation in addition to the technical/technological.

Analysts disagree on how to approach the current RMA as well as which are the most important questions to answer in order to best inform policy-making. Some of these questions include: What are the characteristics

3. Macgregor Knox and Williamson Murray, eds., *The Dynamics of Military Revolution, 1300-2050* (Cambridge: Cambridge University Press, 2001), 2.

4. James R. Blaker, “Understanding the Revolution in Military Affairs,” *The Officer* (May 1997), <http://global.factiva.com/>.

of the current RMA? How can it transform warfare? Is it possible to direct and control an RMA? Will the new technology simply be grafted onto existing platforms and systems? What is the role of technology in relation to the role of strategy? But before attempting to address these issues, a more fundamental question is whether a current RMA is in fact taking place at all — did the Gulf War truly give evidence of a new RMA?

Neil MacFarlane explains in *Security, Strategy and the Global Economics of Defence Production* (1999) that understanding the RMA (or MTR/MR) and its relationship to modern warfare is essential to “analysis and policymaking with regard to the restructuring of armed forces and defence industries and to the issue of how much of what to procure.”⁵ MacFarlane’s assessment of the Gulf War is that although it appeared to confirm a transformation in the capacity to wage warfare based on information technology, a closer look suggests it was not quite the case in 1991. Taking a skeptical view of the RMA, he feels that the kinds of threats faced today—including terrorism, drugs and international crime, proliferation of weapons of mass destruction (WMDs)—do not quite fit with the high technology and massive applications of force envisaged by RMA advocates, undermining its relevance.

Similarly, S. D. Biddle argues that many strategists misread the result of the Gulf War. In a 1994 article published in *International Security* he argues that the standard explanations for the outcome of the Gulf War are wrong.⁶ Instead of viewing the war as a one-sided contest of Coalition strength, Biddle incorporates a more complex set of factors into his explanation of victory. He argues that Iraqi errors and military shortcomings (poor training, morale, leadership, and numerical inferiority) exposed their forces to higher casualties. Without mistakes which provided the openings to Coalition success, victory would have been different and the coalition forces would not have prevailed

5. S. Neil MacFarlane, “International Security and the RMA,” in *Security, Strategy and the Global Economics of Defence Production*, ed. David G. Haglund and S. Neil MacFarlane (Montreal: McGill-Queen’s University Press, 1999), 29.

6. S. D. Biddle, “Victory Misunderstood: What the Gulf War Tells Us About the Future of Conflict,” *International Security* 21, 2 (Fall 1996): 139–79.

with such low losses. For him, victory was as much a result of Iraqi *ineffectiveness* and Coalition *skill*, as a show of technological superiority. Thus, battlefield skill imbalance will be a crucial aspect to military success in modern war.⁷ Rather than a revolution through information dominance and precision strike, the Gulf War really suggests the need to exploit mistakes. Conversely, if opponents acquire new technologies that are traditionally associated with the current RMA, then the threat is smaller than expected as long as quality and skill of forces and organizations are maintained. Therefore, the benefits of change and costs of continuity are lower than might be assumed by RMA advocates. Biddle concludes that the war's failure to provide clear evidence for an RMA has policy ramifications for modernization policy and defense budget priorities.

Throughout the 1990s, the idea of an RMA continued to be a popular topic of discussion. As awareness grew over the potential of the internet and information revolution, strategists and policy analysts scrutinized the ways in which the armed forces could be transformed in order to harness the possible advantage. However, much of the debate seemed to assume from the outset the validity of the concept of military revolution, disagreeing only on how to assess the possibility of a *current* revolution. But do MRs in fact exist? Are MRs an interchangeable concept with RMA? Does the evidence of history give weight to the idea that change in the 'way of war' is a radical process?

Michael Roberts and the Military Revolution: The Roots of the Debate

The current debates about the concept of the military revolution can be traced back to Michael Roberts' inaugural lecture, the "Military Revolution, 1560–1660," given at the Queen's University of Belfast in 1955. Roberts argued that the way war was fought was radically transformed during this hundred-year period. This transformation was rooted in a tactical revolution that was based on linear formations of drilled musketeers which led to a massive increase in

7. Ibid., 157.

the size and scale of armies, and thus the size and scale of the impact that wars had on society.⁸ These new armies were characteristic of Maurice of Nassau and Gustavus Adolphus, who took advantage of the new tactical concepts and were able to command larger armies as well as execute more complex strategies than had previously been seen. The changes implemented by these two men required skilled and disciplined soldiers, leading to the adoption of drills, uniforms, and armies that were organized into smaller and more standardized units. This laid the foundation for the ever-increasing size of armies and had impacts beyond the military realm. There was a considerable societal impact as larger and more permanent armies—and the resources they required—led to an increase in the authority of the state.⁹ This new authority of the state, backed by the armies, was used to impose heavier burdens of taxation than before, and a host of new officials were needed in order to direct resources. According to Roberts, the centrally organized, bureaucratically governed nation-state was born from the seeds of tactical reforms of the 16th century.

Roberts' thesis was well received and the concept of the military revolution gained acceptance in historical thinking, partly as a result of Sir George Clark's incorporation of the concept into his 1958 work *War and Society in the Seventeenth Century*.¹⁰ The concept lay unchallenged until 1976 with Geoffrey Parker's article "The Military Revolution, 1560–1660 — a myth?"¹¹ Here Parker critically examined Roberts' thesis, finding the core of his argument sound but disagreeing with certain points of emphasis. Parker posited that a more appropriate starting date for the revolution is in fact half a century earlier. He argued professional standing armies, regularly called upon

8. Clifford Rogers, "The Military Revolutions of the Hundred Years' War," *Journal of Military History* (April 1993): 241.

9. Clifford Rogers, "The Military Revolution in History and Historiography," in *The Military Revolution Debate*, Clifford J. Rogers, ed. (Boulder, Colorado: Westview Press, Inc., 1995), 2.

10. *Ibid.*, 3.

11. Geoffrey Parker, "The 'Military Revolution,' 1560-1660 — a myth?" *Journal of Modern History* 48, 2 (June 1976): 195–214.

and organized into small units with uniform armament and (sometimes) uniform dress, were maintained by many Italian states in the 15th century.¹² Thus Parker modified Roberts' thesis, agreeing with the importance of growing army size, but instead arguing that the growth started earlier than Roberts suggests. He also argued that it was the result of more complicated factors than just tactical reforms. Parker argued that the growth of army size was driven by the increased manpower needed to besiege and defend the *trace italienne*.¹³ The ability of this type of fortress to resist sieges tipped the balance of strategy in favor of defence. As battles lost relevance, war became about successful siege and defence, which demanded money. The growth of European populations facilitated this, as did changes in military technology. Moreover, the resulting increase in army size and emphasis on technology required not only expanded government bureaucracies, but also improved technologies of food production and transportation as well as expanding financial institutions.¹⁴

Parker continued with his examination of the military revolution with his 1988 book, *The Military Revolution: Military Innovation and the rise of the West, 1500–1800*.¹⁵ Taking inspiration from Daniel Headrick's work *The Tools of Empire*, which examined the technological changes that paved the way for Western imperialism in the 19th century, Parker expanded the topic of the military revolution in order to assess the issue of the rise of the West. Acting

12. Geoffrey Parker, "The 'Military Revolution,' 1560–1660 – a myth?" 197.

13. A star-shaped fort with triangular bastions designed to allow better protective cover and which is better able to withstand canon fire.

14. Alex Roland, "Technology and War: The Historiographical Revolution of the 1980s," *Technology and Culture* 34, 1 (January 1993): 123. Other works that examine the military revolution and emphasize the connection between the revolution and the formation of states, bureaucracies, and professionalism include: Colin Jones' "The Military Revolution and the Professionalization of the French Army under the Ancien Regime" in Clifford J. Rogers, ed., *The Military Revolution Debate* (Boulder, Colorado: Westview Press, Inc., 1995) and other articles in Michael Duffy's *The Military Revolution and the State, 1500–1800* (Exeter: University of Exeter Press, 1980).

15. Geoffrey Parker, *The Military Revolution: Military Innovation and the rise of the West, 1500-1800* (Cambridge: Cambridge University Press, 1988).

as a complement to Headrick's examination, Parker traced the Western world's rise to imperialist domination back to the age of gunpowder. New siege weapons led to improved fortifications which themselves required larger garrisons and contributed to the increase in the size of armies, as originally noted by Roberts.¹⁶ The increased impact of war on society is rooted in increasingly destructive weapons, thus placing technology at the centre of the story, much like Headrick's emphasis on technology as one of the keys to consolidating and maintaining imperialistic power over the non-western world.

Thus, as Parker developed his ideas, gunpowder and fortification technology grew in importance and emphasis within the concept of MRs. This aspect of Parker's analysis was criticized by Bert Hall and Kelly DeVries in *Technology and Culture* (1990) for treating technology as a "black box" and consequently for advocating technological determinism.¹⁷ David Parrott's "Strategy and Tactics in the Thirty Years War: The Military Revolution," as well as Simon Adams' "Tactics or Politics? "The Military Revolution and the Hapsburg Hegemony, 1525–1648" (1995),¹⁸ brought into question the predominance of tactical or technological causes of army growth. Instead, they pointed towards changing political balances and strategic approaches. Parrott argued that before making arguments based on tactical reforms, historians must look at how battles were actually fought. Thus, logistics and political influences must be assessed in determining army growth. Similarly, John Lynn's "The *trace italienne* and the Growth of Armies: The French Case" (1995), was skeptical of the technologically-based thesis, arguing instead that

16. Roland, "Technology and War," 123.

17. Bert S. Hall and Kelly R. DeVries, "Essay Review – the "Military Revolution" Revisited," review of *The Military Revolution: Military Innovation and the Rise of the West, 1500–1800* by Geoffrey Parker, *Technology and Culture*, 31, 3 (July 1990): 500–507. They quibble with some technical aspects of his arguments and methodology. Also argue he fails in giving the full depth of analysis to certain themes. They point out that microbes and disease play an important role as guns in the history of Western imperial expansion and that cases like Japan are ignored in his assertion that non-Europeans failed in adopting Western military technology effectively.

18. Both available in Clifford J. Rogers, ed., *The Military Revolution Debate* (Boulder, Colorado: Westview Press, Inc., 1995).

the key behind the military revolution was the growth of populations and wealth in Europe which were decisive in the development of massive armed forces of the 16th and 17th century.¹⁹ Despite its criticisms, Parker's book was praised for its contribution to the "breadth and importance" of the subject of Europe's rise to global power. It expanded the concept of military revolution beyond the confines of early modern Europe and showed that the consequences of military innovation "belonged to the world as well as European history."²⁰

In 1993, Clifford Rogers published "The Military Revolutions of the Hundred Years' War" in which he argued that two revolutions occurred during the Hundred Years' War: first in the form of an infantry revolution, and then as an artillery revolution.²¹ Both, according to Rogers, represent revolutions with consequences as significant as those that took place in the period of Parker's revolutions (1500–1800). Because these two revolutions were followed in later centuries with revolutions in fortification and administration (as Robert's argued), Rogers' analysis points to the possibility that there are multiple revolutions in history, as opposed to the single one articulated by Roberts. Some have argued as many as ten revolutions, others as few as two.²²

19. Also available in *ibid.*

20. *Ibid.*, 5.

21. Rogers, "The Military Revolutions of the Hundred Years' War," 244. The infantry revolution was represented in the relationship between military power and political power; as the importance of common infantry on the battlefield grew, this was reflected in the political influence of the commons which was derived from the governments' need to secure financial support of the people to sustain war efforts as well as need to secure military service. Rogers, "The Military Revolutions of the Hundred Years' War," 252–253. The importance of the artillery revolution lay in the fact that artillery was expensive. Central governments of larger states could not afford to maintain large siege trains and thus there was an imbalance between offense and defence in siege warfare in favor of offense. Only large states and central governments could supply the resources to maintain sizable standing armies. Rogers, "The Military Revolutions of the Hundred Years' War," 272–273.

22. For example Andrew Krepinevich identifies 10; Max Boot, 4; Alvin Toffler, 3; Williamson Murray, 4. See also, Bernard Simon, "The Revolution in Military Affairs: Approach

Paradigms and Definitions: Evolution or Revolution?

The debate over the number of revolutions and exactly which technologies, strategies, and phenomena constitute a revolution highlights a crucial aspect of the military revolution debate: so much depends on the definition. Historians and analysts are free to define what constitutes the term “revolution” and are free to interpret technologies and strategies throughout history however they choose, adding certain ones to their list of revolutions, and leaving others off. The number of revolutions and the nature of those revolutions across time forms the most interesting and analytical aspect of the military revolution debate. Just how one conceptualizes the idea of “revolution,” and distinguishes it from “evolutionary” change, forms a core component of the literature.

In “Revolutions in Warfare: Theoretical Paradigms and Historical Evidence: The Napoleonic and First World War Revolutions in Military Affairs,” Andrew Liaropoulos notes that analysts are often in agreement that a MR/RMA involves radical change in the history of warfare, but lack consensus on how and when these changes take place and what causes them.²³ A number of paradigms for understanding MRs have been identified, helping to organize the debate into clear competing interpretations: “Social Wave,” “Radical Transformation,” the “Revolution in the Revolution” (MR, RMA, MTR theory), “Continuity and Evolution”/“Continuous Innovation,” and “Punctuated Equilibrium” (action-reaction).²⁴ What follows is a brief overview of each model.

with caution,” *Army Doctrine and Training Bulletin* 3, 4 (Winter 2000): 60, for an overview of various authors and what they consider to be revolutions.

23. Andrew N. Liaropoulos, “Revolutions in Warfare: Theoretical Paradigms and Historical Evidence: The Napoleonic and First World War Revolutions in Military Affairs,” *Journal of Military History* 70, 2 (April 2006): 366.

24. For a good overview of these paradigms, see *ibid.* and Gray, *Strategy for Chaos: Revolutions in Military Affairs and the Evidence of History* (London: Frank Cass Publishers, 2002).

The ‘Social Wave’ paradigm explores the broad social, political and economic changes that affect military transformations and the way society organizes and conducts war.²⁵ Events such as the French Revolution, the Industrial Revolution, and the Information Revolution are examined with attention to how shifts between the revolutions correspond with shifts in the nature of war. The social wave concept is usually attributed to the work of Alvin and Heidi Toffler whose idea of social waves are expressed most clearly in *War and Anti-war* (1993).²⁶ They examine three waves of civilization—Agrarian, Industrial, and Information—and how they correspond to war. Their argument is that the socio-economic waves are boosted by productivity and the resources of wealth creation and power (identified as agriculture, industry, and knowledge), and these waves affect warfare: “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.”²⁷ Thus, military revolutions are seen as the outgrowth of changes in economic production; the way humans make war reflects the way they make wealth. The argument is that for the current social wave, information will become the key source of wealth and power. This will lead to new types of war for information, which is becoming the new strategic asset. Moreover, control of information will not only be the source of war, but the *means* of war (through C4I).

Some have been critical of the social wave theory, arguing that it does not stand up to the evidence. Jeremy Shapiro writes that evidence of a shift towards this third social wave is not present—where past social revolutions have been marked by dramatic productivity improvements (food production for Agricultural Revolution and industrial goods with the Industrial Revolution), the productivity increase due to information is not

25. Liaropoulos, “Revolutions in Warfare,” 367.

26. Alvin and Heidi Toffler, *War and Anti-war: Survival at the Dawn of the 21st Century* (Boston: Little, Brown and Company, 1993).

27. Liaropoulos, “Revolutions in Warfare,” 368.

Strata sufficiently evident.²⁸ This is a conclusion supported by Biddle, who argues that “there is little evidence of any significant productivity acceleration attributable to IT [information technology].”²⁹ However, the idea that military change is the product of deep social, political, and economic changes indeed fits the historical evidence.³⁰ For example, the French Revolution and its major effects on the way of war as a result of the *levée en masse* are widely accepted. The real skepticism with the social wave theory seems not to rest in the concept of social roots of revolutions and its impact on war, but in its argument that a *current* third wave based on information is upon us.

The ‘Radical Transformation’ paradigm emphasizes military technology, doctrines, and organizations, and the way that these impact warfare. The proponents of this paradigm³¹ view military revolutions as a series of radical transitions where far-sighted innovators are able to see the potential of new technologies and create new doctrines as a result. It is innovation of great scope and speed that characterize revolutions. The most common historical example cited is the development of *Blitzkrieg* by Germany prior to World War II. Tanks, airplanes, and radios were available to all of the great powers during the interwar period, but it was the innovation by the Germans, born out of their loss in World War I, that spurred their imaginations for new doctrines and new ways of organizing their armed forces. Some disagree on this point, arguing that *Blitzkrieg* was not a radical transformation, but the product of an evolutionary development of the strategy of annihilation and encirclement that can be traced back to Moltke

28. Jeremy Shapiro, “Information and War: Is it a revolution?” in *The Changing Role of Information Warfare*, Zalmai M. Khalizad and John P. White, eds. (Santa Monica, CA: RAND, 1999).

29. S. D. Biddle, “The Past as Prologue: Assessing Theories of Future Warfare,” *Security Studies* 8, 1 (Autumn 1998): 34.

30. See Liaropoulos, “Revolutions in Warfare.”

31. For this approach, see Krepinevich, “Cavalry to Computer”; Daniel Goure, “Is there a Military-Technical Revolution in America's Future?” *Washington Quarterly* 16 (Autumn 1993): 175–92; James R. Fitzsimonds and Jan Van Tol, “Revolutions in Military Affairs,” *Joint Force Quarterly* (Spring 1994): 24–31; and Eliot A. Cohen, “A Revolution in Warfare,” *Foreign Affairs* 75 (March–April 1996): 37–54.

the Elder.³² Thus, it can be argued that trial and error and the learning process that is necessary for military innovations suggests an evolutionary perspective of change.

The ‘Revolution in Revolution’ theory argues that there are larger revolutions, usually referred to as ‘Military Revolutions’ (MRs) which are made up of smaller RMAs or MTRs. Williamson Murray is the key proponent of this perspective.³³ The argument can be outlined as follows: Occasionally history records a systematically radical change, or shock, which is considered a true military revolution. This MR is accompanied by “pre-shock” as well as “post-shock” RMAs/MTRs. These shocks can result from many possible factors, including technology (in which case it would constitute an MTR), or strategic, doctrinal and tactical innovations (which would constitute an RMA).³⁴

For example, the Industrial Revolution is identified by Murray as one of four main MRs.³⁵ This large shock was characterized by smaller, technologically based MTRs, which included the railroad, rifling, precision tooling and interchangeable parts. Additionally, one could argue that a mid-20th century military revolution was composed of *Blitzkrieg* and strategic bombing, which would be considered RMAs because they were based on strategic innovations applied to already existing technologies. The strength of Murray’s analysis lies in its ability to distinguish between MRs, RMAs, and MTRs, accepting each as valid and avoiding the restrictions of other interpretations. Additionally, Murray allows for a variety of influencing forces: MRs can be the product of broader *social* and *economic* forces, while RMAs the result of *strategists’* innovations, and MTRs can be driven by *technological*

32. Moltke the Elder was chief of the Prussian Army, and is regarded as one of the greatest strategists of the 19th century.

33. See Williamson Murray, “Thinking About Revolution in Military Affairs,” *Joint Force Quarterly* (Summer 1997) and Knox and Murray, eds., *The Dynamics of Military Revolution, 1300–2050*.

34. Gray, *Strategy for Chaos*, 40.

35. He identified four: creation of the nation state based on organized military power in the 17th century, the French Revolution, the Industrial Revolution, and World War I.

advances. The concept of differentiating between MRs and RMAs/MTRs holds more than academic interest. As Thierry Gongora points out:

Establishing whether we are confronted by [an MR] or [an RMA] carries significant policy implications. If we are facing a military revolution, the policy debate should transcend issues of technology and operations to embrace such fundamental aspects of defence policy as the nature of future conflicts; the size, recruitment mode, and make-up of armed forces; the financing of defence; and the shape of the defence industrial base. . . if we are only confronting an RMA, then the challenge becomes more manageable, and can be met within the current framework of defence, so long as the military maintain the ability to innovate.³⁶

Similarly, Knox and Murray argue that MRs are beyond the control of future-oriented or strategic thinkers/defence planners, a contrast to the radical transformation paradigm that argues in favour of the notion of foresight and control. They do argue, however, that although MRs are less controllable because they are products of deep and varied forces, the RMAs that compose MRs appear susceptible to human direction and institutions that can recognize them.³⁷

The ‘Punctuated Equilibrium Evolution’ paradigm was articulated by Clifford Rogers in his 1993 article “The Military Revolutions of the Hundred Years’ War.”³⁸ He argues that that the concept of “revolution” in history is flexible. This is seen in that the term is used for events as varied as the French, Copernican, and Industrial Revolutions; and their flexible periodizations, as

36. Thierry Gongora, “The Shape of Things to Come: Sizing up the Revolution in Military Affairs,” in *Security, Strategy and the Global Economics of Defence Production* (Montreal: McGill-Queen’s University Press, 1999): 38.

37. Knox and Murray, eds., *Dynamics of Military Revolution*.

38. Rogers, “The Military Revolutions of the Hundred Years’ War,” 241–78.

“revolutions” vary from years in some cases, to centuries in others. Rogers identifies four revolutions over five centuries between 1300 and 1800: Infantry Revolution, Artillery Revolution, Artillery Fortress Revolution and Military Revolution (outlined by Michael Roberts). He acknowledges that if one so chooses, they could continue the list with the French Revolution, Industrial War, and Nuclear Revolution. Thus it can be argued that we are not dealing with one revolutionary change but a series of revolutions that have all combined throughout history to allow for Western military superiority.³⁹ Thus, it appears that the issue is more one of evolution than revolution in the development of this superiority.

However, he rejects a model based on a near infinite number of tiny changes. Instead, he advocates the ‘punctuated equilibrium’ model that combines both incremental and revolutionary change. Evolution is preceded by short bursts of change, interspersed with long periods of near stasis, rather than constant and slow alterations.⁴⁰ Military change is more the result of a long causal chain of action and reaction than sudden revolutions. Rogers summarizes his theory by saying: “I . . . argue that Western military dominance derived from a *series* of sequential revolutions, each an attempt to reverse a disequilibrium introduced by the previous one, rather from a single “Military Revolution.”⁴¹ Rogers’ thesis is a neat characterization of change, but has been criticized by some, such as Murray, for imposing “an undue orderliness upon strategic history.”⁴² Gray continues on this line of thought, noting that the necessarily competitive context for strategic behavior “cannot be assumed to follow a strategically logical and tidy path of action and reaction. . . even the most apparently self evident of action-reaction chains are not what they appear to be.”⁴³

39. Ibid., 276.

40. Ibid., 277.

41. Gray, *Strategy for Chaos*, 47.

42. Murray, “Thinking About Revolution in Military Affairs,” 70.

43. Gray, *Strategy for Chaos*, 48.

The ‘Continuity and Evolution’ Paradigm takes the perspective that “innovation and transformation [is] a continuous process intended to deal with the chaotic nature of war.”⁴⁴ Authors like Jeremy Black and Colin Gray take a balanced approach towards the concepts of MRs and RMAs, recognizing the potential importance of military innovation and radical change, but remaining skeptical towards the idea of regularly paced innovation. Proponents of this approach agree that transformations do occur in history, and accept the idea that pace can vary, but they view innovation as a *continual* process of coping with the challenges of warfare.⁴⁵

It can be argued that all current technologies and doctrines are merely evolutionary results of thousands of years of war fighting innovation that is never static or in stasis. The eras between each technological breakthrough are important periods of innovative development. Each development can be traced back through a constant evolution of innovation.

For example, one can view all current technologies and doctrines as merely evolutionary results of thousands of years of war fighting innovation which is never static or in stasis. Jonathan Bailey’s work on World War I and the emergence of artillery firepower as the dominant factor in warfare⁴⁶ lends to the perspective that current weapons technology of computerized long range missile strike is merely an upgraded version of computer-calculated trajectories developed after World War II. Moreover, this is the same concept in a different form as cannons rooted in the gunpowder revolution, or siege weapons such as trebuchets. Every innovation builds on the previous, and the eras between each technological breakthrough are important periods of innovative development.

Colin Gray makes the case that although innovation plays a role, the ability of a state to cope with increasingly complex battlefields is the true determinant of success. His book *Strategy for Chaos* (2002) argues that strategy

44. Liaropoulos, “Revolutions in Warfare,” 370.

45. *Ibid.*, 371.

46. See Jonathan Bailey, “The First world War and the Birth of Modern Style of Warfare,” in *The Dynamics of Military Revolution*, ed. Knox and Murray, 132–153.

and war are not linear, but ever changing and chaotic. Gray is skeptical of the idea of RMA explanations of innovation, viewing RMAs more as an intellectual construct than an accurate description of historical trends. For Gray, evidence points more towards continuities based on a fluid and plastic course of history than sudden changes or revolutions. This is a conclusion reinforced by S. D. Biddle's article "The Past as Prologue: Assessing Theories of Future Warfare" (1998).⁴⁷ His analysis of MR paradigms also concludes that a non-revolutionary/continuity perspective is best supported by the evidence. He posits that future war will be an *incremental* extension of a long pattern of growth in skill development. For him innovation is not necessary to success, nor does it often lead to success. Instead success is the result of the "ability to cope with an increasingly complex battlefield."⁴⁸

It appears then that the idea of momentous and revolutionary change is invalid. But, to argue that coping with complexities of war is a never-ending process does not negate the possibility of important innovations. Gray and Biddle seem to take a similar stance to Rogers' punctuated equilibrium. Both argue that change and innovation is a reaction; one sees change as a reaction to preceding innovations, the other as a reaction to the chaos of war. At the core, they might be less incompatible than they appear because they are essentially describing the same thing and attempting to contextualize the same phenomena: the process of innovation. Indeed, where the paradigms disagree is not in the idea of particular momentous change, but in the technical aspects of change: Is innovation regularly or irregularly paced? How much chance and risk is involved in assuming a revolution? How much can change be controlled? What are the most important driving forces?

But the idea that certain strategies, technologies and ideas can have profound and lasting effects on the way of war is indeed agreed upon. In fact certain aspects of the debate are not mutually exclusive, but are compatible, and combine in complex ways. After an analysis of the Napoleonic Revolution

47. Biddle, "The Past as Prologue: Assessing Theories of Future Warfare."

48. *Ibid.*, 5.

and World War I, Liaropoulos concludes that both case studies give credibility to the social wave paradigm, *as well as* evolutionary paradigm. One could argue that the social wave theory accurately explains the French Revolution and that the revolution in revolution explains the Industrial Military Revolution. Moreover, there is a case to be made that the modern information based RMA will show elements of both, as well as the radical transformation paradigm. So certain paradigms work with certain historical events, and sometimes work in conjunction to explain the same event.⁴⁹ But this raises an issue: just how one characterizes revolutions, and indeed what even constitutes a revolution, displays a problem of subjectivity.

However, evolutionary and revolutionary perspectives are harder to reconcile, and it appears that the concept of incremental and revolutionary change cannot be validated by the same MR.⁵⁰ But just because particular case studies seemingly exclude the radical transformation paradigm does not mean we should be quick to discard the concept. An evolutionary/incremental perspective need not necessarily be incompatible with the concept of radical and revolutionary change. Revolutionary change might in fact be the *result* of incrementalism.

Williamson Murray of the 'Revolution in Revolution' paradigm agrees that revolutionary change might in fact be the *result* of incrementalism. In *The Dynamics of Military Revolution* (2001) he makes the case that *Blitzkrieg* is less a result of revolutionary ideas than evolutionary development. He argues that interwar German efforts and innovation were aimed at "incremental improvement."⁵¹ He maintains that *Blitzkrieg* was still revolutionary, but only became so when victory was achieved. Similarly, Andrew Krepinevich argues in "From Cavalry to Computer: The Pattern of Military Revolutions" (1994),

49. For example see Jeffrey R. Cooper, "Another View of the Revolution in Military Affairs" (U.S. Army War College Strategic Studies Institute, July 1994) and David Jablonski, "The Owl of Minerva Flies at Twilight: Doctrinal Change and Continuity and the Revolution in Military Affairs" (U.S. Army War College Strategic Studies Institute, May 1994).

50. Liaropoulos, "Revolutions in Warfare," 382.

51. See Williamson Murray, "May 1940: Contingency and Fragility of the German RMA," in *The Dynamics of Military Revolution, 1300–2050*.

that there is no common transition period between “military regimes,” but what is revolutionary is not the speed of transitions between regimes, but the “the recognition, over some relatively brief period, that the character of conflict has changed dramatically, requiring equally dramatic, if not radical, changes in military doctrine and organizations.”⁵² The idea of incremental innovation does not necessarily remove the revolutionary importance of ideas born out of it. Revolutions are defined by *realizations* of change, not *pace* of change.

Thus, the outcome seems more important than the process. Although *Blitzkrieg* can be viewed as an evolutionary development for Germany, it can be considered revolutionary by the French holding the Maginot Line. Nuclear weapons can be the result of sequential development of increasing destructiveness of explosives, but was undoubtedly seen as radical upon its use in Japan and the realization that a new era of warfare had begun. It is not an either-or situation between radical or incremental process in explaining change. Both can be accurate descriptions, and it often depends on how you tell the story. We are faced then with the possibility that revolution is relative. A revolution is not born out of the *process* of innovation, but the *realization* by opponents that the way of war has been changed in some way.

Lessons from the Literature

So here some features begin to take shape. First, it would appear that the concept of MR/RMA does fit the historical evidence. It is hard to argue that gunpowder, *levée en masse*, the Industrial Revolution, strategic bombing, atomic weapons, or a host of other developments did not fundamentally change the nature of war. Whichever revolutions you include or exclude, the MR/RMA seems to be a valuable analytical tool in describing military and strategic history, especially Murray’s analysis that accounts for both. One, however,

52. Andrew Krepinevich, “From Cavalry to Computer: The Pattern of Military Revolutions,” *The National Interest* (Fall 1994), <http://find.galegroup.com/>.

must proceed cautiously and with skepticism. Analysts must sort through the complexity of the debate by navigating the theories and paradigms as much as possible, and focus on the evidence that the history provides. Other than acceptance that innovations occur, and some are more important than others, there seems to be little else upon which to agree.⁵³

The second salient feature is the problem of semantics. Whether one sees *Blitzkrieg* as a testament to the power of technology or strategy is largely a matter of perspective. Whether it represents the end of an incremental chain of ideas, or a moment of genius occurring within a narrow time span is debatable. Whether a revolution occurs when one side first conceives the potential of a new doctrine or technology, or when victory is achieved, is a matter of interpretation. Whether there are two, four, or ten observable revolutions in history is a matter of opinion based on how you define military revolution, or include sub-categories like RMAs and MTRs. The problem with the concept is that it is largely a matter of how you define the terms used, and what is left out or included is up to the one making the definition. This is especially true with a term like “revolution” whose historical usage is so varied.

Colin Gray is right when he asserts that the concept of an RMA or MR is merely an intellectual construct.⁵⁴ The idea itself does not hold much tangible weight, but has value in that it spurs research into innovations and helps shed light on the course of military and strategic history. Whether certain historical events or phenomena are defined as evolutionary or

53. Clearly the nature of military revolutions leaves much to interpretation. What, then, are the general conclusions about MR and RMAs of the *early modern* period that find broad consensus across the literature? According to Alex Roland, there are certain features of the original MR debate that are generally agreed upon: sometime in the early modern period there was a dramatic change in Western warfare; Although this change helps explain the rise of the West, the nature of the change is in doubt and debated; It is most likely that several, as opposed to one revolution were taking place, but the earliest began before 1560; All the revolutions seem tied to gunpowder; Army size increased, but not uniformly; True growth in size came with Louis XIV and the French Revolution; Siege weapons tipped the balance towards the defence, but only temporarily. Roland, “Technology and War,” 125.

54. Gray, *Strategy for Chaos*, 31.

revolutionary is merely a debate of words. Clifford Rogers concludes his analysis of the 'Punctuated Equilibrium' paradigm by stating: "It might be argued that, so long as we all know what we are talking about when we say "Military Revolution," my objections are mere quibbling, only a question of semantics."⁵⁵ Martin Dunn expresses similar apprehension when he states that beyond the broad understanding that an RMA is a fundamental revision of how war is conducted, the "RMA becomes amorphous as different authors choose to define it in different, and sometimes contradictory, ways."⁵⁶ Because of this problem one must either reject everything, or accept everything as valid. But once you begin to accept the full range of periodizations and driving forces, and accept all paradigms as valid, the historical scope in which to draw strong conclusions becomes overwhelming.

In the end we are left with conceptual disorder—a "multiple analytical pile-up."⁵⁷ Because a more universal agreement on the nature of the concept remains elusive, it might be concluded that the phenomenon has little use because the concept itself is a fabrication of academic minds. Yet it is possible to pick through this disorder to identify some lessons in the literature that hold significant importance for strategic analysts and policy experts.

The perspective that technology is an underlying factor but not a necessary cause of revolutions runs throughout the literature. The general consensus is that the key to success is the way in which doctrine or strategy is applied to technology, whether it is old or new. Jeffrey Cooper, writing in the mid-1990s, shows awareness of the serious policy implications of misjudging the RMA, particularly in hanging too much on the role of technology. Therefore Cooper argued against fruitless searches for a "silver bullet" technology on which to build an RMA and instead argued that the crucial issues were strategy, doctrines, and operation innovation.⁵⁸ Metz and Kievit

55. Rogers, "The Military Revolutions of the Hundred Years' War," 278.

56. Martin Dunn, "RMA=Revolution in Military Acronyms." *Research and Analysis: Newsletter of the Directorate of Army Research and Analysis* 5 (March 1996).

57. Gray, *Strategy for Chaos*, xiv.

58. Cooper, "Another View of the Revolution in Military Affairs."

similarly conclude: “If policymakers decide to pursue the revolution in military affairs, strategy, rather than technological capability should guide force development.”⁵⁹

Andrew Krepinevich concludes his article “From Cavalry to Computer: The Pattern of Military Revolutions” (1994) with a number of lessons about the character of military revolution: First is that emerging technologies only make revolutions possible. New strategic doctrines and organizational structures are paramount. Second, competitive advantages of military revolutions are increasingly short lived. Competitors can copy and exploit new technologies and strategies. And third, although most militaries will be quick to recognize a competitor's advantage, there are no certainties. Not even war will guarantee that all military organizations will recognize and exploit a military revolution or understand a revolution in all its dimensions.⁶⁰

Krepinevich also argues that it is likely that other competitors may seek to exploit the RMA. Continued technological and operational leadership in the West (specifically in the U.S.) will not be assured. Even countries not capable of participating in the full spectrum of RMA capabilities will become formidable niche competitors as specialization will give advantages in certain areas. Similarly, it cannot be assumed that competitors will follow the same transformation paths because different security environments, strategic perspectives, and economic situations will lead in different directions. There is

59. Steven Metz and James Kievit, “Strategy and the Revolution in Military Affairs: From Theory to Policy” (U.S. Army War College Strategic Studies Institute, June 1995). For more on the role of technology and strategy, see: Colin S. Gray, “Weapons for Strategic Effect: How Important is Technology?” Occasional Paper 21 (Air War College Centre for Strategy and Technology, January 2001); George Raudzens, “War-Winning Weapons: The Measurement of Technological Determinism in Military History,” *Journal of Military History* 54, 4 (October 1990): 403–434; S. Neil McFarlane, International Security and the RMA,” in *Security, Strategy and the Global Economics of Defence Production*; Dunn, “RMA=Revolution in Military Acronyms”; Andrew Krepinevich, “From Cavalry to Computer: The Pattern of Military Revolutions”; Geoffrey L. Herrera, “Inventing the Railroad and Rifle Revolution: Information, Military innovation and the Rise of Germany,” *Journal of Strategic Studies* 27, 2 (June 2004): 243-271; Sean M. Maloney and Scot Robertson, “The Revolution in Military Affairs: Possible Implications for Canada,” *International Journal* 54, 3 (Summer 1999): 443–462.

60. Krepinevich, “From Cavalry to Computer.”

great danger in assuming one's own revolution will develop in an anticipated direction, and equal danger in assuming the same path for others. The RMA, even when identified, is fickle, elusive, and there is no guarantee to success if harnessed in a certain way.

Conclusions from a Policy Perspective

The idea of an RMA/MR is a powerful one. It suggests radical changes in the character and nature of war and requires concomitant changes in the character of military operations.⁶¹ Advocates argue that the ways of war are fundamentally altered by developments in technology, doctrine and organization. RMAs thus necessitate adaptation. Adapting to changes brought upon by an RMA, or even adapting in an attempt to create an RMA, ensures a military's position in a world marked by uncertainty and chaos. Therefore, the concept is important for policy and strategic analysts. A complete assessment of the RMA with respect to policy assessment and implications is beyond the scope of this paper. However, there are a few points that can be made.

First, the concept of military revolutions holds weight despite seemingly contradictory concepts. In fact, the idea of incrementalism versus revolution might not be so incompatible. MRs have been the product of different forces, and thus have developed in different ways; some the result of a slow process of social change over long periods of time, others the result of particular technological breakthroughs or flashes of strategic brilliance. Even incrementalists agree that transformations occur, but simply argue that they stand out from a "normal condition of generally steady innovation, not periods of near stasis."⁶² To argue an incremental sequence of events does not necessarily remove the importance of a particular event or breakthrough, if one occurs. Even if one gets hung up on the particulars of interpretation, the

61. Maloney and Robertson, 444.

62. Gray, *Strategy for Chaos*, 55.

concept that certain innovations in technology, strategy, doctrine, can have dramatic and at times revolutionary consequences is valid.

Second, the history is important. Understanding the historical traditions of the concept is necessary if analysts are going to successfully understand the potential nature and characteristics of any current or future MR/RMA. Although the analysis can be messy, it has been shown that there are several valuable and accepted conclusions that can be drawn from the vast and varied history and literature.

Third, the debates are valuable even if they do represent a problem of semantics. Indeed, the literature itself and its plethora of interpretations are useful in that they suggest that the different interpretations hold different significance for how revolutions are approached. An understanding of the literature is useful in that there is some reason to believe that each paradigm holds a degree of weight under different circumstances. Understanding how the various interpretations might be valid under certain conditions, or might interact at the same time, is an important consideration.

A fourth and related point is that the individual historical case studies do have limits in their usefulness. To assume a particular perspective is *the* valid one because it appears to dominate the historical evidence risks misunderstanding. The interpretive nature of the concept raises doubts about drawing universal conclusions from the past, and places emphasis on contextual issues for understanding possible present or future revolutions. If the concept of MR and the paradigms that describe them are dependent on a number of political, economic, social, and technological variables, then one needs to assess each possible revolution independently without imposing too much upon them from the outset. If some argue that a current RMA is upon us, analysts must be aware of the past, but must also carefully analyze the present. Is the current situation likely to be driven by a new technology, doctrine, or social forces? Is it likely that the process will be a rapid and revolutionary one, or the outcome of evolutionary ideas that are identifiable?

What factors might influence this development?⁶³ The most effective way to approach potential RMAs is to attempt to carefully assess them individually based on their current technological, political, economic, and social contexts. Policy-makers need to look beyond the military and technical, assess the external factors that shape the military and defence arena, and base their analysis on current and relevant issues. Just because a MR of the past was the product of certain forces, and fits a particular model, is not sufficient to assume it will always be that way.

Finally, uncertainty should not, and cannot stop the evolution of strategic thinking. Otherwise uncertainty of success would translate into strategic inertia. To be sure, some have raised doubts as to the ability of societies to predict MRs. Some have noted that *Blitzkrieg* was not a success until it was proven in combat and there was no way to know during the interwar period that the new strategy would be successful. Still, policy must press on. Risk taking is part of the nature of planning for the future. Luckily it can be argued that we are living in the most self aware era with respect to RMAs. Revolutions have consistently become shorter in duration and the result of this is that they become more salient and obvious. This increases the ability of policy-makers and strategists to interpret the current situation and make informed decisions based on likely trends. Preparing for the future based on potential MRs/RMAs not only requires an understanding of the historical tradition, but also relies heavily on assessments of current strategic positions, sound policy-analysis, and a considerable degree of risk. Risks due to misjudgment do exist, but they cannot stop policy.

63. If one looks at the current state of affairs, there is reason to believe that incrementalism will characterize the current so-called RMA. There are complex and deeply rooted bureaucratic and industrial interests involved in defence planning in the modern era dominated by the military-industrial complex. Thus it is likely that it would be very difficult to foster rapid investment in completely new forces and weapons systems which would require huge sums of money at come at the expense of current forces. A more likely scenario would be a process of upgrading existing systems to prepare the road for future developments. Thierry Gongora sees no incentive “to pursue the exploitation of the RMA along lines that would undermine the relevance of its current forces and their main weapons systems.” Gongora, 41.

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