3

RMA Dynamics

Social scientists can appear cavalier, easily satisfied at least, in their approach to the empirical evidence for theory that they claim to locate in strategic history. Protagonists in the RMA debate of the 1990s, for example, proceeded undismayed by the fragility of pertinent empirical research. What is striking about the RMA literature is the prevalence of didactic certainties, even though the possible historical evidence is either inherently ambiguous or simply missing.[1] Busy defence professionals lacked time and the patience to wait for the slow emergence of a more reliable base of historical knowledge of RMA phenomena.[2] So speedily did the great RMA debate achieve its velocity change (or 'delta-v') to ascend into the orbit of live activity in the years 1991–94 that few people took the trouble to engage, perhaps indulge, in fundamental enquiry. Now that the debate has so lost momentum that natural orbital decay has brought the idea, much reduced in splendour, back to earth, we can take the time to appreciate just how flimsy are the intellectual and empirical underpinnings of speculation about RMA.

This is not necessarily to criticise the RMA concept, or to deny its utility. If I did not believe that RMA theory can aid strategic understanding this book would not be worth writing. Rather it is the point that truly grand conceptions for the interpretation of processes of change in strategic history, and vastly ambitious schemes for the reordering of defence policy and strategy, have been labelled and debated under the umbrella of an RMA theory that does not come close to meriting the authority often imputed to it. It is true that the RMA hypothesis provided more than adequate fuel for a great, albeit largely American, debate (another World Series with most of the world absent). However, much of the scale of that greatness is explained more by the sheer size of the US defence debating community, and by the scale of the financial and strategic stakes, than by the readiness of the RMA concept and its adjuncts for policy prime-time.

In defence of the somewhat hard words just written, I submit that a decade of extensive and intensive debate among scholars and policy-oriented strategic commentators has failed to answer satisfactorily four basic questions about RMA phenomena. Of course, good work has been done, and some poor ideas have been revealed to be such. For example, an important measure of consensus has been achieved on the question of the relative significance of technology in military and strategic innovation. Similarly,

today there is widespread assent to the idea that RMAs come necessarily neither as uniform, nor as discretely sequential, episodes in strategic history. Nonetheless, to date there is a notable absence of scholarly bedrock upon which theorists and policy-makers can build with high confidence.[3] Four basic questions remain almost embarrassingly open to speculative answer.

1. What is the (historical) evidence for RMA theory?

2. Why do RMAs happen?

3. How do RMAs 'work'?

4. What difference do RMAs make to the course of strategic history?

There is a sense in which posing these questions invites a charge of disingenuousness. After all, questions 2, 3, and 4 would be literally nonsensical were the answer to question one strongly negative. My reply in anticipation of the charge is that I do not regard RMAs, and cognate concepts, as strategic historical phenomena to be hunted down and brought into captivity. RMA is better viewed as a potentially valuable perspective upon strategic history that has reality as an organising idea in the minds of commentators and historians. The empirical story that provides the existential referents for RMA theory is interesting, but cannot be inherently conclusive. Propositions important to the reach and grip of the theory can be tested for plausibility of fit with historical data. Ultimately, however, there will be a residual zone of judgement and preference. Questions 1, 2, and 3 are considered in this chapter. Treatment of question 4, on the strategic historical consequences of RMAs, I defer to later chapters.

Williamson Murray is informative, yet probably misleading, when he writes:

historians have done relatively little work on RMAs. Michael Roberts introduced the idea of a single military revolution in his inaugural lecture at Queens University Belfast in 1955. Thereafter until 1991, interest in the military revolution was focused on the 16th and 17th centuries; early modern historians argued among themselves about whether there was such a revolution and, if so, when it occurred and what form it took. That debate continues. Since the mid-18th century, however, military historians have concentrated on other issues such as innovation, effectiveness, adaptation, organizational behavior, or—the bread and butter of the profession—battle histories. *Modern historians quite simply have not been very interested in military revolutions… The crucial point is that the historical record is not yet in; and*

until there is detailed research on the subject [RMAs] most commentaries may be distortive.[4]

Murray is right in pointing to the paucity of focused historical study of RMA. Inadvertently he may mislead, however, when he suggests—certainly he implies—that a better grasp of the historical record should combat 'distortive' commentaries. There is everything to be said in favour of careful historical scholarship. The problem with RMA theory, though, is that it cannot be forged for truth according to some Rankean notion of a final solution by weight of detailed and *correct* scholarship.[5] Ever more rigorous and finely nuanced study of 1916–18 will not reveal beyond challenge whether or not those years of the Great War produced a true military revolution, one or several RMAs, or simply an unsurprising wartime acceleration in innovation. To employ and analyse the concept of RMA is, in a sense, akin to theology. No matter how plausible the reasoning, and no matter how suggestively illustrative the apparent facts, in the last resort there is no evading the necessity to choose between making, or not making, a leap of faith. Regardless of how competently and industriously Murray's historians quarry away, there is no final boulder to be moved beneath which will be the definitive proof that 1916–18 did or did not witness an MR, RMA, or any other acronym of choice. In principle, at least, with the aid of forensic science historians can answer the question, 'was Napoleon murdered?'[6] No less in principle, historians cannot truly answer the question, 'was Napoleon's conduct of war an RMA?' The former question intrinsically is a matter of fact; the latter is, and can only be, a matter of interpretation.

It follows that scholars are well advised to finesse this first fundamental and empirical question. The finesse is necessary because empirical enquiry must fail to answer a question that ultimately is not capable of empirical resolution. Alas, the impossible is impossible. Strange to record, perhaps, the intrinsically empirically mysterious identity of historical RMAs is not a matter of great significance. It merely alerts us to unprofitable lines of investigation which should be avoided. Conceptual reformulation is the proper response to the existential challenge in question 1.

If we rework the empirical question for feasibility and utility, the result should approximate the following: 'Which episodes of military innovation most plausibly have had the greatest significance for the course of strategic history?' With the language thus deflated, and the ambition for theoretical outreach suitably punctured, most potentially lethal problems for theory conveniently vanish. Chapters 6–8 treat three major episodes in military innovation which, by near universal scholarly assent, merit admission to the RMA hall of fame. Whether or not the three cases truly are RMAs is a matter to which the Scottish verdict-plus applies: RMA status is both not proven and *not provable*.

The events or episodes commonly now called RMAs (as well as MRs or MTRs) undoubtedly, indeed by definition, are cases of strategic behaviour in which radical change occurred or which promoted such

change. Our interest lies in what those cases can tell us about the complex working of strategy and war, not in exact labelling. A bid for such labelling would be a futile endeavour, no matter how carefully conducted. The choice of cases for analysis is discussed at the beginning of Chapter 6.

PROVENANCE

If, for the sake of argument, Napoleonic warfare, warfare in (late) 1917–18, and nuclear threat and (mercifully hypothetical) nuclear warfare are postulated to be RMAs, MRs, or MTRs according to intellectual taste, where did they come from? Why did they occur? These episodes of innovation in the conduct of war are each described and analysed in some detail below. Because of the many inconsistencies in conceptual labelling even by scholars, a firm ruling on usage is required. Since nearly everyone agrees that my historical cases assuredly are RMAs—if RMA theory is deemed useful, that is—while most would accord them the status of super-RMAs (or MRs), I elect to refer to them all simply as RMAs. This decision does not elide recognition that some RMAs are more significant than others, which is to say, major as opposed to minor.[7] Furthermore, this drastic conceptual conflation will not be allowed to obscure the probability that the categories of ‘major RMAs’ (or MRs), as contrasted with ‘minor RMAs’ and MTRs, will have distinctively deeper origins, more complex dynamics, and profounder consequences.

Much as *security*, in contrast to *strategic*, studies has frontiers that are unhelpfully porous and uncertain for focus in analysis and theory,[8] so the idea of MR, in contrast to RMA, is apt to confuse context with subject. For example, without seeking to downplay the importance of political contextual factors, among others, my subject is the conduct of war by Napoleon and his enemies, or by the belligerent great powers in 1914–18. MR theory, as with Toffleresque social-wave speculation, gambles dangerously with dice too heavily loaded towards predetermined outcomes more likely to trivialise than elucidate their topics.

If industrial- or information-age societies necessarily conduct war according to their distinctive natures, what room remains for choice and contingency? So broad can be the brush-strokes applied to describe and explain major RMAs (or MRs), that historical understanding of who prospered strategically, and why, is not much assisted. The methodological issue here is very much the one flagged tellingly by Jeremy Shapiro with the distinction he draws between the historian’s and the strategist’s viewpoints.[9] An, if not the, historian’s approach to the Napoleonic RMA can examine the rise and consequences of the whole alleged phenomenon at issue. A strategist, in contrast, is more likely to

empathise with the historical figures and institutions which had to behave in real-time in the face of uncertainty in response to evolving circumstances. The realm of the strategist is the realm of possible RMA, not of MR.

Plainly, there are problems of evidence which bedevil efforts to fit episodes in historical strategic behaviour neatly into conceptual categories (MR, RMA, and so forth). As a consequence, it is sensible to focus on the reality of that behaviour with respect to the persisting dimensions of strategy and war. For example, articulation of a large body of soldiers into several *corps d'armée* is just that, no matter how one labels it on the scale of innovation.

As precursor pointers to later detailed analysis, the paragraphs immediately below pose and provide terse interim answers to four vital questions bearing directly upon RMA provenance.

1. Do RMAs occur plausibly as a direct result of perception of strategic challenge? *Après* Arnold J. Toynbee, are we talking of 'challenge and response',[10] if not quite of mechanistic action and reaction?

2. Is adoption of RMA discretionary? Perhaps adaptation to RMA is mandatory, while would-be faithful adoption is not.

3. Characteristically, how sharp a break with past practice is an RMA? Is there typically an astonishingly magical 'strategic moment' when a manifestly new style of war is unveiled?

4. Are RMAs made by prophets as much as by executors? Do RMAs emerge from the fertile brains and pens of strategic visionaries in long periods of peace (punctuated only by minor scuffles), or are they more often the desperately improvised practice of military executives in time of war?

These questions by no means exhaust the range of the possible on RMA provenance, but they do point research and analysis in particularly useful directions.

First, are RMAs the consequence of perception of strategic challenge? This question suggests such challenge as a possible necessary, though probably not wholly sufficient, cause of RMA. We have to

beware of the existential trap. Even if plausible challenge-response nexuses are locatable for RMAs, how should we handle cases when RMA does not occur? Challenge-response theory is unlikely to advance understanding very far or convincingly. Such theory could not explain RMA-as-response without, of necessity, locating a potent strategic challenge. Similarly, within its own logic it could not handle cases of apparent non-response, at least ineffective response, in face of strategic challenge.

Of the cases examined in Chapters 6–8 one—the Napoleonic—was not plausibly driven by strategic challenge.[11] Although one can locate an extensive provenance for the preferred Napoleonic way in warfare that is both quite distant—stemming from the 1760s, if not before—and very recent—the revolutionary period of 1792–95—*la patrie* was not significantly *in danger* during Napoleon's heyday as 'master of the battlefield' (say, from 1800 to 1807).[12] The Napoleonic RMA was the immediate product of one person's insatiable ambition,[13] of a French military system that throve on war and more war, and on apparent opportunity. The hugely heralded information- (or knowledge-)led RMA beckons seductively a lone US superpower which until very recently perceived and articulated no clear strategic challenge.[14] Of course there are dangers abroad. Purportedly 'rogue' polities, post-modern terrorists, and aspiring-returnee superstates, all litter the landscape of possible twentyfirst centuries.[15] But the fact remains that today the leader among the menaces just cited, global terrorism, does not provide much horsepower to push or pull either a major, or even a minor, RMA into physical reality. Indeed, today it is unclear how 'the American I-led RMA' which appears to beckon relates to the emerging threat environment. The future of warfare may derive more from the military-strategic context than from the military-technical.

The two among my RMA cases that seem to fit a pattern of challenge and strategic response are the First World War and the nuclear revolution. In 1915–16 the leading belligerents participating in the great unpleasantness recognised that they had to solve the problem of how, in contemporary conditions, to achieve tactical break-in for operational breakthrough and (strategic) breakout-for-victory. Strategic plans and the operational grand designs to effect them were strictly moot in the face of repeated and apparently systemically preordained tactical failure. The modern style of combined-arms warfare was invented in 1916–17 in theory, and executed by painful experiment in 1917–18 in direct response to the challenge of tactical, and hence operational and strategic, ineffectiveness. By way of some contrast, the nuclear revolution was pursued initially as a response not to demonstrated tactical failure, but rather as an offset to the expected strategic consequences of a possible German atomic bomb.[16] The military application of German research in atomic physics could challenge the verdict achieved by all other kinds and quantities of arms.

Second, are polities at liberty to opt in or out of participation in an RMA? The RMAs selected for examination in this book are so clearly in the major (perhaps MR), as contrasted with a minor, category, that their identity may prejudice commentary on general RMA theory. However, one should not confuse adoption with adaptation. The historical record shows that military effectiveness for strategic success does not strictly require adoption of the RMA *du jour*. Among other considerations, distinctive polities with characteristic social and military systems and military cultures generally are unable simply to adopt an RMA as a standard package (as if they could buy it from a catalogue).[17] For a tactical analogy, the wearing of green berets does not, in and of itself, create special forces' warriors.[18] Whether the country leading an RMA on balance is wise or foolish in its would-be revolutionary behaviour, any choice of change in style of warfare so radical as to merit the RMA label cannot be ignored by opponents. The question of interest is not whether foes choose to adopt the RMA leader's mode of war, but how they elect to adapt to it. The choices in adaptation include attempts at emulation and efforts at asymmetric negation.[19] Blithely to ignore an RMA is to risk suffering the fate of the Prussian Army in 1806 and the French Army under General Nivelle in 1917. Sir Arthur Wellesley did not ignore the Napoleonic way in war, but he was not obliged by circumstances either to adopt it or to adapt systematically to it. An excellence in the ability to execute traditional tactical forms sufficed for the Iron Duke.[20] His example, however, is the exception not the rule.

Each of my historical cases of (major) RMA either delivers or at least promises such military effectiveness that the principal foes of the RMA leader of the day are not free to ignore the new style of warfare. Every opponent will find its own feasible mix of adoption and adaptation. As a general rule, however, an attitude of superior disregard is not a reasonable choice. Napoleon's continental adversaries were obliged to adopt and to adapt, lest they be overrun *again*. Similarly, the great attritional battles of Verdun and the Somme in 1916 demonstrated that there were better and worse, which is to say correct and incorrect, ways of waging modern war.[21] A belligerent that failed to identify and execute the superior methods of war was likely to lose. Of course, one might lose anyway, given that the enemy also was learning how to wage modern war. Despite the ecological and moral issues arguably distinctive to nuclear weaponry, the rising but still second-class superpower of the 1940s and 1950s, the USSR, judged emulative adoption a necessary, but not sufficient, feature of its response to nuclear peril.[22] As for information-led warfare in the twenty-first century, debate already is well joined over the range of possibilities for asymmetric responses to that style of warfare.[23] The United States' foes may well pay tribute to the putative military potency of the information-led RMA by seeking offsets in the creation of cyber-havoc, or the terror of weapons of mass destruction, inter alia.

Third, do RMAs occur after the fashion of a Russian spring which bursts suddenly into life, or rather of an English spring which emerges all but imperceptibly out of winter in a smooth and lengthy development? The thesis of discontinuity is both persuasive yet fraught with the possibility that it may induce misunderstanding. On the one hand, there is no doubt that the Napoleonic way of war, the 'modern style of warfare' of 1917–18, and nuclear warfare, are each more (nuclear) or less (Napoleonic, First World War) radically different from the styles in war most popular only a few months or years previously. On the other hand, that apparent repeated nonlinearity in principle duly admitted, each of these major RMAs necessarily had extensive antecedents. The point is made superbly in an eloquent judgement written by Spenser Wilkinson in 1914.

> The year 1796 [when Napoleon assumed his first major command, the Army of Italy] is thus the beginning of an era, the necessary starting-point for the historical study of modern war. But in the processes of life and growth there is no beginning; what we call a beginning marks equally the end of one development and the start of another. If the exploits of the Army of Italy are the explanation of the subsequent history of Europe, their own explanation must be sought in the years that came before.
>
> Napoleon and his soldiers were the outcome of the efforts, the controversies and the experiments of a whole generation of predecessors.[24]

Focusing on the novel elements of alleged RMAs has the potential to blind scholars and military practitioners to the vital significance of the perpetual military virtues. For an especially persuasive example, Williamson Murray develops the argument that the human factor, a constant, is always the most important determinant of military success. That factor, Murray reasons, plays in war most fundamentally through its obedience, or not, to a tactical battle-space discipline that flows from military culture.[25] His argument is not startling, but it is not much in evidence in the literature of RMA advocacy.

Fourth and finally, are RMAs more imagined by visionaries than done by executive agents? To postulate so stark an opposition between advance theory and practice is to overdraw for the sake of analytical clarity. As a working hypothesis, I suggest that in the practical world of strategy theory tends to follow, and in its turn modify, practice.

Of my three cases of major RMAs, only Napoleon's arguably was preceded by intellectually significant speculation and prophecy. Intellectual significance is not necessarily political significance. The 'nation in arms', the sine qua non for Napoleonic warfare, clearly was envisioned well before 1793.

[26] But that prophecy was irrelevant to the actual emergence of such a nation, while France as that nation could plausibly threaten to impose a European hegemony only when commanded by Napoleon Bonaparte. He was educated, in part, by the military—strategic prophets of the ancien regime, but even more by what his own industry and intuition advised him was possible in the circumstances in which he found himself.[27] Napoleon made the Napoleonic RMA, but the French Revolution made Napoleon. Good ideas at the wrong time or in the wrong brain remain simply good ideas. The postulated information-led RMA is a similar story. As the French Revolution gave a young Corsican professional artilleryman his opportunity, so the end of the Cold War provided a permissive context for a non-, anti, and even allegedly post-, nuclear RMA keyed to information technologies.[28] Bourcet and Guibert, Toffler and Ogarkovi: both the RMAs just cited had prophets who heralded a new dawn in military effectiveness.

Important though ideas assuredly are, and always have been, executive action is apt to be more important still. If the Napoleonic RMA was more carried out by Napoleon as opportunity knocked, albeit a Napoleon well educated by masters of theory, than it was implemented according to some blueprint for success,[29] then a parallel judgement applies to the nuclear RMA. It is probably fair to claim that the nuclear RMA was more made by General Curtis LeMay and US President Dwight D.Eisenhower[30] than it was envisioned, no matter how perceptively and prudently, by—say—a Bernard Brodie or an Albert Wohlstetter.[31] It may be important to note that all three of our major RMAs were implemented *in wartime*. Notwithstanding his substantial prescience, neither Ivan Bloch nor anyone else prior to 1915 had a comprehensive vision of a modern style of combined-arms warfare.[32] Similarly, nuclear strategy was implemented, at least in peacetime routines in readiness for war, before it was treated wholly pervasively by the realm of theory (if ever it was).[33]

Practice expresses actual or perceived necessity. That practice may be inspired or modified by strategic ideas, but typically it will perform or attempt what opportunity and available talent suggests to be feasible.

RMA LIFE-CYCLE

Without prejudice to the outcome of contention over the merit in RMA theory or the identities of historical RMAs (if any), it is useful to suggest a standardised process in ‘the making of RMAs’. Of course, each candidate historical RMA must be richly distinctive in its detail. Nonetheless, RMAs of all

kinds, of any magnitude, and in any period, are likely to share a common structure with fairly common structural-functional dynamics. As with the dimensions of strategy and war, which remain constant through all of strategic history,[34] so RMAs similarly can be understood according to a single template. Far from being an exercise in reductionism, this framework for enquiry accommodates as much richly distinctive period detail as research and analysis suggests is evidence. So, why and how do RMAs work? I suggest that the RMA process fruitfully can be understood as a nine-step process. The steps may overlap, while assuredly they have different periodicities, both among themselves in one RMA and from RMA to RMA.

My nine-step theory of the RMA life-cycle may appear to challenge the desideratum of Occam's razor, but it is necessary for this number of steps to be identified if the process of innovation is to be rescued from undue opacity. The paragraphs below explain that RMAs emerge from periods of *preparation* (step 1), that functionally, at least, they express *recognition of challenge* (step 2), if only the challenge of opportunity to explore and exploit. The theory specifies the importance of RMA *parentage* (step 3) in the context of an *enabling spark* (step 4) being struck which produces a *strategic moment* (step 5) of clear first actualisation of a new style in warfare. *Institutional agency* (step 6) is necessary to effect the *instrument* (step 7) of new military capabilities which carry the RMA forward. The new style of war is in a phase of *execution and evolving maturity* (step 8), beyond which lies a period of *feedback and adjustment* (step 9) as real enemies and no less real friction of all other kinds provide practical education 'in (and from) the field'.

1. *Preparation* (generally unplanned). RMAs occur following more or less lengthy periods of reform, or at least of change. If an RMA is by commonsense definition a nonlinearity, still it erupts and can be recognised as a radical discontinuity only in contrast to linear antecedent behaviour. An RMA may well not have been a gleam in many, if any, eyes long in advance, but extensive preparatory work must be a necessary—albeit not sufficient—condition for the nonlinear event. Serendipity may rule. Many makers of revolution, RMAs and others, did not intend to make revolution, certainly not the revolution that occurred. The claims that step 1 for RMA is considerable preparation does not imply RMA-purposeful preparation. Each of the cases of RMA examined in Chapters 6–8 required (unplanned) preparatory behaviour that can easily be traced back 30–50 years.

2. *Recognition of challenge.* RMAs occur, in an important sense are made to occur (see below), for reasons judged important by their 'parents'. Brian R. Sullivan is not quite plausible when he asserts that 'an RMA is the military manifestation of a prior and radical political-strategic reorientation', but he is insightful.[35] RMAs, like wars, can be effected for a wide variety of reasons, and those reasons can be more or less strategic as well as more or less persuasive to relevant domestic audiences. The challenge to

which some people will claim that a preferred RMA is the answer may well reside only in the realm of 'being all that we can be'. In other words, an RMA may be pursued by way of exploiting a perceived opportunity, rather than countering a particular strategic menace. The core point of step 2 is simply that there has to be a reason to implement an RMA. Some lawful authority needs to decide that there is a challenge, a threat, or an opportunity, in need of RMA solution. The executive agents of RMA may not define their role and mission in quite those terms, but functionally they have to register some challenge and identify RMA as the, or at least as an, answer.

3. *Parentage.* An RMA requires revolutionaries. This third step in the RMA process can overlap with the second and indeed with the fourth, fifth, and sixth steps. Individuals on their own authority, or with the authority of significant institutions (official or other) have to make, in the sense of conceive and nurture, the revolution. My point here in step 3 is no more than the claim that RMA requires conception and nurture by particular human agents, even if they do not intend to effect revolution. The agents of the RMA in newly republican France in 1792–94 were trying only to save *a patrie en danger*. It so happened that the consequences of French strategic behaviour in the first half of the 1790s lit the powder in the touch-hole for an RMA. However, the relevant politicians and soldiers of 1792–96 were desperate patriots as well as ruthless self-seeking opportunists, not RMA theorists or even self-conscious RMA executives.

Exactly how parents bring their RMA proposals to practical effect at the sharp end of strategy is a matter for the steps which succeed this one. Much as some great military and naval commanders are allowed the running room to demonstrate greatness by de facto teaming with a Potent Protective Political Patron (we might represent this idea as the P4 factor), so RMA parents, even if not themselves politically powerful, at least need the P4 factor to work for them. It might be recalled that the birth of the nuclear RMA as a real military programme, as contrasted with what transpired to be broad preparatory effort in atomic physics, lay in the relationship between Dr Vannevar Bush and President Franklin Delano Roosevelt.[36] For another case, the information-led RMA of the 1990s had Andrew W.Marshall as intellectual parent and patron, but its executive authors—the revolutionaries of the deed as well as of the word—comprised the team of Secretary of Defense William J.Perry and ViceChairman of the Joint Chiefs of Staff William A.Owens.[37] Revolutionaries for RMA need the political clout, or the patronage of those with political clout, in order to deliver the revolution.

4. *Enabling spark.* Writing about architecture, Le Corbusier advises that 'The advent of a new period only occurs after long and quiet preparatory work.'[38] We should add, however, that preparation, planned and unplanned, may come to nought. Moreover, even preparation and explicit recognition of challenge may not suffice to ignite an RMA. History is replete with apparently good enough armies that would

have performed well had only commanders of suitable stature been available to lead them, or vice versa. Sometimes the hour produces the person. But then again, sometimes it does not.[39] The hour of need may not require a charismatic leader, but only powerful patrons (the P4 factor, cited above) who can enable would-be military revolutionaries to behave in an effectively revolutionary manner.[40] If an RMA has to be constructed by self-consciously revolutionary effort, rather than merely executed as change so linear in its cumulative evolution that the concept of revolution could scarcely apply, then some vital, enabling spark is needed. The nature and precise identity of that spark will be as variable as RMAs differ. With respect to the major RMAs considered in this book, the most plausible enabling spark, or leadingedge factors, were: Napoleon Bonaparte himself, for the Napoleonic RMA; the perfection of indirect artillery fire for the RMA of 1917–18; and the invention of the atomic bomb for the nuclear RMA.

5. *Strategic moment.* It may seem odd, if not downright peculiar, to identify as a vital

5. *Strategic moment.* It may seem odd, if not downright peculiar, to identify as a vital step the postulate of a ‘strategic moment’ of first actualisation of an RMA vision, ahead of the itemisation of the institutional agency and military-instrument building that implement the revolution. My logic is strategic and political, rather than strictly historical. I wish to emphasise the fact, certainly the possibility, that RMAs, no matter how slow the preparatory period, can and usually do appear as a flash in the sky of strategic consciousness. There is, if you will, and to risk hyperbole, a ‘strategic moment’, a moment when new possibilities are signalled to those willing to receive such a message.

There are several reasons why we should be comfortable with the postulate of a strategic moment. Because our analytical framework encompasses the idea of a process of innovation over time, the potential for damage that might be wrought by the idea of all but magic moments is sharply reduced. Similarly, the potential of the concept of strategic moments to invest the *revolution* in RMA with undue gravitas, must be greatly reduced by the extensive doubts already expressed about the overall validity of the idea of great strategic historical discontinuities. I contend that RMAs typically contain a ‘strategic moment’ which reveals, as in a flash, enticing and exciting new strategic possibilities. These moments may be the first full-up synergistic expression in unified action of trends which come together and achieve critical mass. In such cases, the moments could belong squarely within my step 8, ‘execution and evolving maturity’. In addition, however, there are strong candidate strategic moments that are, and function as, the herald of more extensive possibilities, really as strategically revealing precursor events. Such moments are not themselves the main event, but they hint persuasively at what might be feasible.

Thomas J.Welch, a close associate of Andrew W.Marshall in the Office of Net Assessment (ONA), has explained what he calls a culminating event, and I term a strategic moment.

A final feature of a definition of an RMA is a ‘culminating event’, a battle that employs the new systems, operational concepts, and organizations and that clearly demonstrates a dramatic change in the conduct of warfare. Examples might be France in 1940, or the Battle of Midway. In this sense, we [in ONA] do not see the 1990–91 Gulf War as the culmination of an RMA but rather as analogous to the Battle of Cambrai in World War I, where the innovative combination of airplanes, tanks, and radios hinted at what was to come later.[41]

As with the RMA concept itself, the notion of a strategic moment, or ‘culminating event’, is not empirically demonstrable. Scholars can choose whether to select as such moments events that truly are akin to brief and intriguing flashes of light, or events that show RMA behaviour at its most mature. I propose both to bear this distinction in mind and to allow each particular historical case to suggest its own pattern. For example, two leading candidates for the strategic moment(s) of the Napoleonic RMA are General Bonaparte’s first Italian campaign in 1796 and the Emperor Napoleon’s destruction of most of the continental armies of the Third Coalition in 1805 (the Ulm and Austerlitz campaigns). The 1796 (and its second phase in 1797) campaign was small in scale relative to the campaigns of the Empire, but most aspects of the Napoleonic way in warfare, including some of its warts, were amply demonstrated.[42] The year 1805 showed the Emperor and his new Grande Armée at their peak.

In the case of the RMA of the First World War, it is plausible to agree with Welch (and Marshall) that Cambrai (20 November-3 December 1917) was the strategic moment, though General Oskar von Hutier’ s assault against Riga (1 September 1917) merits consideration also. It is scarcely less plausible, however, to cite the opening of the attack by the Australian Corps against Hamel (4 July 1918), the Second Battle of the Marne (18 July 1918), or the first day of the Amiens offensive (8 August 1918, ‘the black day of the German Army’ in Erich Ludendorff’s melodramatic words), or even the breaking of the Hindenburg Line by General Rawlinson’s Fourth Army (beginning on 29 September 1918).[43] The Amiens and ‘Hindenburg Line’ operations were for the Allied variant of the RMA of 1917–18 what the Ulm manoeuvre and then Austerlitz had been for the Napoleonic revolution.

The case of Germany in 1918 is particularly instructive for the approach to RMA theory adopted in this book. It is a plausible hypothesis that there was a tolerable equivalence of expertise in the contemporary art of war in 1918 among the German, British, and French Armies at all levels. When an RMA is tested in the field, it is tested upon, and in some senses against, the enduring structure and

dynamics of strategy and war. Strategic theorists must never forget that when they pontificate about, say, the German version of the RMA of 1917–18, they are talking about the behaviour of real people in an actual, and deeply muddy, historical context. RMA theory, to be useful, has to be ready to accommodate the reality of half-starved soldiers, too few in number, abused by indifferent operational and strategic guidance, and beset by material and morale problems of a galloping severity. One might object, not unfairly, that I have just outlined an extreme example. My response would be to say both that war is by definition an extreme activity and that every theory, in common with every practice, of RMA, must be able to cope with exogenous elements. Any theory of RMA which requires execution in battle only by entirely healthy troops, operating on level and unobstructed terrain of modest dimensions in clement weather, needs to be labelled with a strategic hazard warning.

The strategic moment for the nuclear RMA has to be the attack on Hiroshima on 6 August 1945.

6. *Institutional agency.* RMAs need agencies and agents for implementation. Those agencies must include appropriate military organisations with suitable military cultures, (probably) innovative operational concepts, and hard training in the practice of those concepts in the field.[44] In addition, new technologies may, but only may, play a vital role. No RMA can be implemented in the absence of military organisations competent or better at fighting in the new manner. Just as strategy has to be carried out through tactics, so RMA has to be executed by the agency of potent military forces. To be thus potent, those forces require suitable organisation (be it in a phalanx, in legions, by corps, in groups of all-arms panzer divisions, or in strategic rocket armies). Also they require the operational concepts which serve as the firm but flexible foundation for a doctrine of war which the troops practise in conditions as close to those of war itself as is practicable. New weapon technologies may play a critical role in the particular RMA brew in question. In that event, there must be a period for assimilation both of tactical competence in the effective handling and maintenance of the advanced weapons, and for understanding how the new or improved weapons should function in the conduct of war. 7. *Instrument.* Through the agency of organisation, concepts, doctrines, and training

7. *Instrument.* Through the agency of organisation, concepts, doctrines, and training (and possibly new technologies also), the military instrument of an RMA is forged. Clausewitz and Jomini, not to mention all strategic experience, alert us to the enabling significance of sheer mass, numbers, or brute arithmetic.[45] No matter how elegant the organisational forms, how cunning the operational concepts, how savagely realistic the training, or how absolutely potent the military technology (from longbow to h-bomb and beyond, to misquote Bernard and Fawn Brodie),[46] numbers count. They do not usually count the most, but there is a sense in which they are always critical. Whatever the RMA at issue, it must be expressed in action in a sufficiency of man-machine (weapon and support) systems. Not only do RMAs

have to be conceived and forged; their military instruments also have to be procured. The world's first integrated air defence system, invented by Britain in the late 1930s, had to be bought in the form of the mass of vital interdependent components necessary for tactical and operational effectiveness in war.[47] In its procurement aspect, the minor RMA—and minor miracle—of the military instrument of British air defence in 1940, was *numbers* of radar towers, trained operators, communication relays, RAF control rooms and their staffs and communication equipment, fighter aircraft with reliable radios, pilots, ground crews, and so on and so on back through training and industrial infrastructures to the policy that set it all in motion. Regardless of its nominal potency, the military instrument of any RMA has to have the size appropriate for execution of those novel operational concepts in the particular contexts of unique historical missions. In 1941–42, Germany's Ötheer suffered from a weakness in quantity for its assigned task of the conquest of the USSR. In 1812, a similar condition eventually had doomed the great French adventure in Russia.[48]

8. *Execution and evolving maturity.* The life-cycle of an RMA captured in these nine steps includes periods of execution and evolving maturity, and then of modification in the light of opponents' behaviour. An RMA's shock effect for the destabilisation of the foe— in Sun Tzu's terms, the creation of disharmony[49] —must diminish rapidly with exposure.[50] Elephants and tanks—though hypothetically perhaps not nuclear weapons— are less effective after several close encounters with them are survived. Scholars and commentators can give the impression that they believe that trial by RMA is identical to trial by war. Alas, perhaps, some godlike reified Strategic History does not distribute medals to the security communities that carry through the cleverest, the most eloquently explained (or entertainingly 'briefed'), the most plausible, or the most startlingly unorthodox of RMAs. Instead, strategic history shows RMAs—conceptual and empirical caveats suppressed for the moment—to be instruments of policy, in common with the military capabilities which they fashion and refashion. The only test that really counts for an RMA in the pragmatic world of strategy is the examination by consequences. Armed with the classic question, 'so what?', we want to know what happened to those who led, and to those who responded to, a process of RMA. We must hasten to add that the ultimate strategic failures of such RMA leaders as Napoleonic France, and (arguably)

Wilhelmine and Nazi Germany, is not necessarily proof of the basic inefficacy of their designs for military revolution. Such failure may point, however, to some limitations in the reach or grip of the RMA at issue. Moreover, such failure is certain to indicate that the French, or German, actual conduct of war—shaped by a particular RMA (or RMAs)—was fatally ineffective in the last resort, which is trial by

combat (this is the resort that history records in the 'win/loss' column). Step 8, 'execution and emerging maturity', refers simply to the military, then strategic, effectiveness secured by RMA implementation. As with each of these steps, 'execution' merges into the succeeding step, the adjustment phase.

9. *Feedback and adjustment.* This step does not imply any mechanistic process of action and reaction. There is no presumption here that as a foe responds to the evidence of an enemy's RMA in action, the RMA leader adjusts so as to negate the response. Step 9 is logically compelling and practicably empirical as a subject for research. The unremarkable claim in this step is that enemies not overwhelmed by violent first exposure to an RMA will have time, motive, and sometimes the ability, to learn how to frustrate the enemy's novel way in warfare. If 'no plan of operations extends with certainty beyond the first encounter with the enemy's main strength',[51] so no RMA survives intact the counteracting behaviour of an alert, intelligent, and competent foe. As a matter of research, we can examine how Napoleon's enemies sought to defeat his new way of war, his eponymous RMA. Similarly we can, and we will, investigate the ways in which opponents answered the artillery-led and nuclear RMAs of 1917–18 and 1945-plus. It may be unnecessary to add that this step 9 always has the potential to fuel a complete renewal of the RMA cycle. Readers are excused if they find this process non-trivially dialectical.

The nine steps just specified as constituting the RMA life-cycle are no more than an analytical tool. The argument is not that RMAs have nine steps from conception to death. Instead, the claim is that the RMA process usefully can be considered as having these steps. The number of steps may be conflated or expanded as preferred, but the content of any conceptual toolkit for understanding RMAs should contain these steps, however they are organised and whatever they are called.[52]

CLARIFYING CONFUSION

Much as Stewart Granger could ride away in the closing shot of *The Prisoner of Zenda,* or Alan Ladd could head for the horizon to conclude *Shane*, so this lengthy foray into the badlands of RMA theory can conclude with that useful closing line from many a Hollywood movie, 'our work here is done'. My argument has made about as much as it can, and probably more than it should, of the possibilities in RMA theory. The point now is reached where the trajectory of enquiry has to turn to matters of a kind more reliable than rival baskets of RMA speculation. Nonetheless, it is essential to identify, and try to improve on, the conceptual tools on offer to help clarify the intellectual confusion.

The chapters here concluded on RMA anatomy and dynamics fulfil the functions of familiarising readers with the significant conceptual features of the subject, flagging necessary caveats, separating useful from less useful questions, and specifying a way forward so that theory and historical data might work synergistically.

I have expressed serious reservations about RMA theory. Above all else, we should be concerned lest a concept which by any plausible definition files claims for sharp strategic discontinuity (RMA), should prejudice historical research and then bias policy analysis also. To convene conferences to discuss Atlantis is to dignify Atlantean hypotheses. Similarly, a debate about RMA has no small potential to encourage confusion between interesting concept and empirical reality.

Chapters 2 and 3 find the RMA concept—and adjunct concepts (e.g. MR, MTR)— both intriguing and useful, though, of necessity, not ‘true’. There are grounds for concern lest some audiences for RMA ideas may believe in a positivistic doctrine of RMA keyed to a fallacious notion of RMAs in history. The relationship between theory in social science and historical evidence begs for more careful treatment than it often receives in public debate.

Although the RMA hypothesis is on balance useful, I seek to alert readers to the fact that a decade of intensive and extensive work on the subject has left answers even to the most basic of questions hugely incomplete. When we ask, ‘what is the evidence for RMAs?’, ‘why do RMAs happen?’, ‘how do RMAs work?’, and ‘what are the consequences of RMAs?’, the answers from a large literature remain confusing and unsatisfactory. This chapter has tried to clarify the confusion, recognise those issues that are literally unanswerable, yet make constructive suggestions to advance understanding. The discussion of the hypothesis and life-cycle of RMA, with a grand total of nine steps from ‘preparation’ (step 1) all the way to ‘feedback and adjustment’ (step 9), provides a template sufficiently flexible as to be applicable to the analysis of any postulated historical RMAs. Chapters 6–8 employ this nine-step approach to the RMA life-cycle in order to facilitate focused comparisons of historical data (which might prove to be evidence).

Before RMA theory meets hypothesised RMA cases, however, the persisting nature and working of strategy needs explanation. A sound theory of strategy and war must derive from an understanding of strategic experience that transcends belligerents, time, place, and technology. Only such a theory can be trusted to guide us through the thickets of rival RMA ideas, and might enable us make some general sense of the rich particularisms of detailed historical scholarship. Inspiration for this endeavour is provided by none other than the unduly unfashionable Baron Antoine Henri de Jomini.

The new inventions of the last twenty years seem to threaten a great revolution in army organization, armament, and tactics. Strategy alone will remain unaltered, with its principles the same as under the Scipios and Caesars, Frederick and Napoleon, since they are independent of the nature of the arms and the organisation of the troops.[53]

NOTES

1 . General Dennis J.Reimer, then Chief of Staff of the US Army, both informs us unequivocally that 'We are presently experiencing a revolution in military affairs', and states as fact that 'In the past two hundred years, six revolutions in military affairs have radically affected the conduct and character of war': 'Forward', in Robert L.Pfaltzgraff, Jr and Richard H.Shulz, Jr (eds), *War in the Information Age: New Challenges for US Security Policy* (Washington, DC: Brassey's, 1997), p. ix. The confidence in the claims is quite startling.

2 . The RMA debate of the 1990s was significantly dissimilar to the great debate of the 1950s about strategy for the nuclear age. In the 1950s, all major debaters agreed that their subject lacked much of a historical hinterland. That neglect of historical perspective, discounting of distinctive cultures, and general under-appreciation of the continuities in strategic history, was unwise and unfortunate. Nonetheless, the knowing denial of history's relevance liberated the social scientific defence rationalists at RAND to proceed competently with their nuclear abstractions. In contrast, the RMA debate of the 1990s, the next great debate with a strategic domain comparable to the stakes in the nuclear case, was tied inalienably to historical argument. Whereas a Thomas Schelling and an Albert Wohlstetter had been inventing strategic reasoning and consequent recommendations for defence planning, out of a mixture of whole logical cloth and emerging military-technical data, RMA theorists assert that the military possibilities emerging now are but the latest in a series of historical RMAs. Regardless of whose views of RMA are judged most plausible, the principal scholarly authority for the entire debate is inescapably historical, as are its policy outcomes. If a growing body of respected historical scholarship were to cast significant doubt on the RMA premise, the foundation necessarily would crumble away beneath much of the theory concerning a contemporary information-led revolution. The nuclear revolution is considered in some detail in Chapter 8. For theorists of nuclear strategy, see Bernard Brodie, *War and Politics* (New York: Macmillan, 1973), chs. 9–10; Colin S. Gray, *Strategic Studies and Public Policy: The American Experience* (Lexington: University Press of Kentucky, 1982); Fred Kaplan, *The Wizards of Armageddon* (New York: Simon & Schuster, 1983); Lawrence Freedman, 'The First Two Generations of Nuclear Strategists', in Peter Paret (ed.), *Makers*

of Modern Strategy: From Machiavelli to the Nuclear Age (Princeton, NJ: Princeton University Press, 1986), pp. 735–78; and John Baylis and John Garnett (eds), *Makers of Nuclear Strategy* (New York: St. Martin's Press, 1991). Andrew F.Krepinevich, 'Cavalry to Computer: The Pattern of Military Revolutions', *The National Interest*, 37 (Fall 1994), pp. 30–42, was particularly important both because the author wrote with the authority of a scholar close to Andrew W.Marshall and his Office of Net Assessment (wherein Krepinevich worked for a while), and because he stated a powerful claim for the historical existentiality of RMA. It should be noted, however, that Krepinevich was careful to write only that '*there appear to have been* as many as ten military revolutions since the fourteenth century' (p. 31, emphasis added). As we have seen with General Reimer's claim as quoted, not all subsequent commentators would choose to qualify their historical claims (or, perhaps, even recognise the need for such qualification).

3 . Which is why MacGregor Knox and William Murray (eds), *The Dynamics of Military Revolution, 1300–2050* (Cambridge: Cambridge University Press, 2001), is so important.

4 . Williamson Murray, 'Thinking About Revolutions in Military Affairs', *Joint Force Quarterly*, 16 (Summer 1997), pp. 70–1 (emphasis added).

5 . Leopold von Ranke, *The Theory and Practice of History* (Indianapolis, IN: Bobbs-Merrill, 1973).

6 . See Tim Hicks, 'St. Helena: Controversy to the End', in Philip J.Haythornthwaite and *others*, *Napoleon: The Final Verdict* (London: Arms and Armour Press, 1998), pp. 191–220. Hicks concludes with the apposite thought that '[t]he only sure way of resolving the poisoning controversy would be to exhume the body and perform another autopsy' (p. 209). Candidate RMAs cannot be handed over to science for definitive resolution.

7 . Steven Metz and James Kievit, *Strategy and the Revolution in Military Affairs: From Theory to Policy* (Carlisle Barracks, PA: Strategic Studies Institute, US Army War College, 27 June 1995), p. 10.

8 . Richard K.Betts, 'Should Strategic Studies Survive?' *World Politics*, 50, 1 (October 1997), esp. p. 27.

9 . Jeremy Shapiro, 'Information and War: Is It a Revolution?', in Zalmay M.Khalilzad and John P. White (eds), *Strategic Appraisal: The Changing Role of Information in Warfare* (Santa Monica, CA: RAND, 1999), pp. 136–8.

10 . Arnold J.Toynbee, *A Study of History*, 12 vols (Oxford: Oxford University Press, 1934–61). Richard J.Evans, *In Defence of History* (London: Granta Books, 1997), pp. 54–6, is appropriately damning.

11 . Arguments pertaining to my historical cases of postulated RMAs are employed at this juncture strictly to illustrate the salience of the questions about RMA provenance. As a consequence, and with only a few exceptions, I make no particular effort here to justify the summary judgements offered. Sources in support of my historical judgements are provided with the case studies in Chapters 6–8.

12 . With thanks for inspiration to John Davidson, *Haig: Master of the Field* (London: Nevill, 1953), and Nigel Hamilton, *Master of the Battlefield: Monty's War Years, 1942–1944* (New York: McGraw-Hill Book Company, 1983).

13 . Paul W.Schroeder, 'Napoleon's Foreign Policy: A Criminal Enterprise', *Journal of Military History*, 54, 2 (April 1990), pp. 147–61, must dent the armour even of the most forgiving among Napoleon's admirers.

14 . The 'strategist's view' (following Shapiro, 'Information and War', p. 137) of the candidate information-led RMA is so indistinct that there was sense in Jeffrey R.Cooper's possibly rhetorical question, 'Should we pursue the RMA for its own sake? Because it could be done?': *Another View of the Revolution in Military Affairs* (Carlisle Barracks, PA: Strategic Studies Institute, US Army War College, 15 July 1994), p. 5. He does proceed to inherently less pejorative questions: 'Because it promises substantial advantages in addressing our evolving security challenges? Or, finally, because we may have no choice since potential competitors may decide to pursue the RMA regardless of its course' (pp. 5–6). Cooper usefully adds the thought that a state should think carefully about the consequences of leading an RMA if it already holds a dominant position in the marketplace of war-making prowess. Correctly enough, he cites the own-goal aspect to Britain's Royal Navy introducing a new class of all-big-gun battleships with the launching of HMS *Dreadnought* on 10 February 1906. Jon Tetsuro Sumida, *In Defence of Naval Supremacy: Finance, Technology and British Naval Policy, 1889–1914* (London: Routledge, 1989), is fundamental.

15 . Trends and fashions in threat-set identification and evaluation can be monitored reliably in the annual (since 1995) 'strategic assessment' publication of the United States' National Defense University.

16 . See R.V.Jones, *Most Secret War* (London: Coronet Books, 1979), pp. 269–70, 392–6; and Gerhard L.Weinberg, *A World at Arms: A Global History of World War II* (Cambridge: Cambridge University Press, 1994), pp. 568–74.

17 . Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, NY: Cornell University Press, 1991); Deborah D.Avant, *Political Institutions and Military Change: Lessons from Peripheral Wars* (Ithaca, NY: Cornell University Press, 1994); and Peter Trubowitz, Emily O.Goldman, and Edward Rhodes (eds), *The Politics of Strategic Adjustment: Ideas, Institutions, and Interests* (New York: Columbia University Press, 1999), all shed important light on the problems that military institutional culture can place in the way of possible adoption of new ideas and practices.

18 . The green beret may be unconventional headwear, but the mind that it covers could be inappropriately conventional. For more detail, see Colin S.Gray, *Explorations in Strategy* (Westport, CT: Praeger Publishers, 1998), ch. 7; and idem, 'Handfuls of Heroes on Desperate Ventures: When Do Special Operations Succeed?' *Parameters*, 29, 1 (Spring 1999), pp. 12–13.

19 . See Lawrence Freedman, *The Revolution in Strategic Affairs*, Adelphi Paper 318 (London: IISS, April 1998), ch. 3.

20 . The literature is vast and, when of British origin, is inclined to err towards patriotic hagiography. That sin is avoided in Paddy Griffith's clear-eyed appraisal, 'Wellington— ommander', but is not wholly absent from the otherwise excellent essay by Correlli Barnett, 'Playing Into Wellington's Hands—Bonaparte's Mistakes', both in Griffith (ed.), *Wellington—Commander: The Iron Duke's Generalship* (Chichester: Antony Bird Publications, 1986), pp. 13–53, 127–38 respectively.

21 . See Timothy T.Lupfer, *The Dynamics of Doctrine: The Changes in German Tactical Doctrine During the First World War*, Leavenworth Papers 4 (Ft. Leavenworth, KS: Combat Studies Institute, US Army Command and General Staff College, July 1981); Tim Travers, *How the War Was Won: Command and Technology in the British Army on the Western Front, 1917–1918* (London: Routledge, 1992); Paddy Griffith, *Battle Tactics of the Western Front: The British Army's Art of Attack, 1916–18* (New Haven, CT: Yale University Press, 1994); and especially Holger H.Herwig, *The First World War: Germany and Austria- Hungary, 1914–1918* (London: Arnold, 1997), chs 5–10.

22 . See David Holloway, *Stalin and the Bomb: The Soviet Union and Atomic Energy, 1939– 1956* (New Haven, CT: Yale University Press, 1994).

23 . Not least among the ranks of military thinkers in China, the country most likely to find itself actively opposing American hegemony in the twenty-first-century. Michael Pillsbury (ed.), *Chinese Views of Future Warfare* (Washington, DC: National Defense University Press, 1997), rewards careful reading. Lloyd J.Matthews (ed.), *Challenging the United States Symmetrically and Asymmetrically: Can America Be Defeated?* (Carlisle Barracks, PA: US Army War College, Strategic Studies Institute, July 1998); and Ralph Peters, *Fighting for the Future: Will America Triumph?* (Mechanicsburg, PA: Stackpole Books, 1999), also warrant respectful attention. After 11 September 2001, of course, 'asymmetrical threats' came to mean terroristic threats. To date the outstanding dissection of asymmetry is Steven Metz and Douglas V.Johnson II, *Asymmetry and US Military Strategy: Definition, Background, and Strategic Concepts* (Carlisle Barracks, PA: Strategic Studies Institute, US Army War College, January 2001).

24 . Spenser Wilkinson, *The French Army before Napoleon* (Aldershot: Gregg Revivals, 1991 [1915]), p. 22.

25 . Williamson Murray, 'Military Culture Does Matter', *Strategic Review*, 27, 2 (Spring 1999), pp. 32–40.

26 . Writing about the Roman Republic in the era of the Punic Wars, Alvin Bernstein informs us that 'Between his seventeenth and forty-sixth birthdays the Roman citizen owed the state sixteen years of active military service': 'The Strategy of a Warrior-State: Rome and the Wars Against Carthage, 264–201 BC', in Williamson Murray, MacGregor Knox, and Bernstein (eds), *The Making of Strategy: Rulers, States, and War* (Cambridge: Cambridge University Press, 1994), p. 60. Also see F.E.Adcock, *The Roman Art of War Under the Republic* (Cambridge, MA: Harvard University Press, 1940), ch. 1. Inspiration for the *levée en masse* rather closer to home than Republican Rome could be found in the much praised work, *My Reveries upon the Art of War*, written by Marshal of France Maurice de Saxe in the late 1740s (published posthumously in 1757). 'Would it not be better to prescribe by law that every man, whatever his condition in life, should be obliged to serve his prince and his country for five years. This law could not be objected to because it is natural and just that all citizens should occupy themselves with the defense of the nation': Thomas R.Phillips (ed.), *Roots of Strategy: A Collection of Military Classics* (London: John Lane, 1943), pp. 102–3.

27 . Wilkinson, *French Army before Napoleon;* idem, *The Rise of General Bonaparte* (Aldershot: Gregg Revivals, 1991 [1930]); David Chandler, *The Campaigns of Napoleon* (London: Weidenfeld & Nicolson, 1967), pt 3; Peter Paret, 'Napoleon and the Revolution in War', in Paret, *Makers of Modern Strategy*, pp. 123–42.

28 . In 1994, Michael J.Mazarr was in no doubt that 'We are in the midst of a revolution in military affairs (RMA). It is a post-nuclear revolution, a return to an emphasis on non-nuclear warfare, both conventional and unconventional': *The Revolution in Military Affairs: A Framework for Defense Planning* (Carlisle Barracks, PA: Strategic Studies Institute, US Army War College, April 1994), p. 3.

29 . Peter Paret, *Understanding War: Essays on Clausewitz and the History of Military Power* (Princeton, NJ: Princeton University Press, 1992), ch. 5, 'Napoleon as Enemy', is particularly clear on this matter. '[T]he revolution in war that occurred at the end of the eighteenth-century was not consciously structured' (p. 75). Even if there had been a blueprint for success, in Paret's opinion that design could not have been invented by Napoleon or even by his immediate antecedents in command of the armies of revolutionary France. Paret advises that '[t]he French Revolution coincided with a revolution in war that had been under way through the last decades of the monarchy'. 'Napoleon and the Revolution in War', p. 124.

30 . 'From late 1948 to 1957, Lieutenant General (later General) Curtis E.LeMay was the driving force behind SAC's [the Strategic Air Command's] early development': Samuel R.Williamson, Jr and

Steven L.Rearden, *The Origins of US Nuclear Strategy, 1945–1953* (New York: St Martin's Press, 1993), p. 167. Also see Harry R.Borowski, *A Hollow Threat: Strategic Air Power and Containment before Korea* (Westport, CT: Greenwood Press, 1982), and William S.Borgiasz, *The Strategic Air Command: Evolution and Consolidation of Nuclear Forces, 1945–1955* (Westport, CT: Praeger Publishers, 1996). On the contribution of President Dwight D.Eisenhower see Colin S.Gray, 'The Defence Policy of the Eisenhower Administrations, 1953–1961', DPhil. thesis (Oxford: Rhodes House Library, 1970), and Saki Dockrill, *Eisenhower's New-Look National Security Policy, 1953–61* (London: Macmillan, 1996).

31 . For Bernard Brodie, see Ken Booth, 'Bernard Brodie', in Baylis and Garnett, *Makers of Nuclear Strategy*, pp. 19–56; and Barry H.Steiner, *Bernard Brodie and the Foundations of American Nuclear Strategy* (Lawrence: University Press of Kansas, 1991). For Albert Wohlstetter, see Richard Rosecrance, 'Albert Wohlstetter', in Baylis and Garnett, *Makers of Nuclear Strategy*, pp. 57–69, and James Digby and J.J.Martin, 'On Not Confusing Ourselves: Contributions of the Wohlstetters to US Strategy and Strategic Thought', in Andrew W.Marshall, Martin and Henry S.Rowen (eds), *On Not Confusing Ourselves: Essays on National Security Strategy in Honor of Albert and Roberta Wohlstetter* (Boulder, CO: Westview Press, 1991), pp. 3–16.

32 . I.S.Bloch, *Modern Weapons and Modern War* (London: Grant Richards, 1900). See Michael Howard, 'Men Against Fire: The Doctrine of the Offensive in 1914', in Paret, *Makers of Modern Strategy*, pp. 510–26.

33 . A.J.Wohlstetter and others, *Selection and Use of Strategic Air Bases*, R-266 (Santa Monica, CA: RAND, April 1954), undoubtedly was influential, but in its advocacy of a maximum feasible degree of US homeland basing for SAC it was pushing on an open door for an official client who wanted to be given that particular message. The same RAND team of systems analysts proved much less influential when it advocated housing SAC's long-range bombers in expensive concrete shelters (among other measures of base hardening). SAC ignored advice that it did not want to hear. General Curtis LeMay did not intend his forces passively to try to ride out a Soviet surprise attack. Kaplan, *Wizards of Armageddon*, ch. 6, 'The Vulnerability Study', is informative.

34 . At least, so I argue at length in my *Modern Strategy* (Oxford: Oxford University Press, 1999).

35 . Brian R.Sullivan, 'The Future Nature of Conflict: A Critique of "The American Revolution in Military Affairs" in the Era of Jointery', *Defense Analysis*, 14, 2 (August 1998), p. 92.

36 . Early in 1940, Dr Vannevar Bush was President of the Carnegie Institution of Washington; formerly he had been at MIT. On 12 June of that year, Bush secured Roosevelt's approval of his bureaucratically somewhat imperial proposal to create, and of course head up, a National Defense

Research Council which would guide, mobilise, and help to manage diverse scientific research for national security. ‘To most of those who had a part in the revolution [in the relations among American scientists, politicians, and soldiers] it became a truism that Vannevar Bush was its indispensable man’: McGeorge Bundy, *Danger and Survival:Choices About the Bomb in the First Fifty Years* (New York: Random House, 1988), p. 39. That indispensability proved nowhere more momentous than in his intermediary role between the worlds of science and politics in the case of atomic possibilities (p. 45). Also see Richard Rhodes, *The Making of the Atomic Bomb* (New York: Simon & Schuster, 1986), pp. 336–8.

37 . See James R.Blaker, *Understanding the Revolution in Military Affairs: A Guide to America’s 21st Century Defense*, Defense Working Paper 3 (Washington, DC: Progressive Policy Institute, January 1997), pp. 4–8. William J.Perry is a distinguished military scientist and administrator of military technological innovation. Whatever his more contestable credentials as a strategic thinker, there is no doubt that he was the right man at the right place at the right time to advance the supremely technological cause of an information-led American RMA. See William J.Perry: ‘Desert Storm and Deterrence’, *Foreign Affairs*, 70, 4 (Fall 1991), pp. 66–87; (with Ashton Carter and John D. Steinbruner), *A New Concept of Cooperative Security* (Washington, DC: Brookings Institution Press, 1992); ‘Military Action: When to Use It and How to Ensure Its Effectiveness’, in Janne E.Nolan (ed.), *Global Engagement: Cooperation and Security in the 21st Century* (Washington, DC: Brookings Institution Press, 1994), pp. 235–41; ‘Defense in an Age of Hope’, *Foreign Affairs*, 75, 6 (November /December 1996), pp. 64–79.

38 . Le Corbusier, *Towards a New Architecture*, trans. Fredrick Etchells (London: Architectural Press, 1946), p. 261.

39 . The synergism of person with opportunity to create radical, but apparently nonlinear, outcomes does not allow for the drawing of sharp lines of demarcation. The Bolshevik and Nazi revolutions were both very much manufactured, which is to say wilfully created, events and processes, but the ‘wills’ in question could only triumph in permissive contexts. For example, Ian Kershaw is highly persuasive when he claims flatly that ‘Without the changed conditions, the product of a lost war, revolution, and a pervasive sense of national humiliation, Hitler would have remained a nobody’: *Hitler, 1889–1936: Hubris* (London: Penguin, 1998), p. 132. One has to be careful lest a healthy recognition of the significance of context, or opportunity, leads to an unhealthy discounting of the value purposefully added by a particular individual, movement, or institution.

40 . For example, in 1916–18 General Sir Douglas Haig and General Erich Ludendorff both served as enthusiastic, ‘enabling’ patrons to a revolution in the conduct of war effected by their subordinates.

For Haig, see Michael Crawshaw, 'The Impact of Technology on the BEF and its Commander', in Brian Bond and Nigel Cave (eds), *Haig: A Reappraisal 70 Years On* (London: Leo Cooper, 1999), pp. 155–75; for Ludendorff, see Michael Geyer, 'German Strategy in the Age of Machine Warfare, 1914–1945', in Paret, *Makers of Modern Strategy*, pp. 527–97.

41 . Thomas J.Welch, 'Revolution in Military Affairs: One Perspective', in Frances Omori and Mary A. Sommerville (eds), *Strength Through Cooperation: Military Forces in the Asia- Pacific Region* (Washington, DC: National Defense University Press, 1999), p. 122.

42 . It is not necessarily entirely to Napoleon's credit to observe, as does Chandler, that 'most significantly of all, the form of the battle [Castiglione, 5 August 1796] proves beyond any doubt that Napoleon's master battle plan [including the idea of the *manoeuvre sur les derrières*] was already clear in his mind as early as 1796. In subsequent years he might polish and improve its technique—especially the crucial matter of timing the successive stages—but all the elements of the successful attacks carried out at Austerlitz, Friedland or Bautzen were already in existence and in operation at the battle of Castiglione': *Campaigns of Napoleon*, pp. 700–1. The thesis that Napoleon failed adequately to adjust his style in the conduct of war to sharply altered conditions, especially after 1809, is argued forcefully in Robert M.Epstein, *Napoleon's Last Victory and the Emergence of Modern War* (Lawrence: University Press of Kansas, 1994).

43 . Herwig, *First World War*, pp. 416–28, 'The Turning Point'.

44 . Eugenia C.Kiesling, *Arming Against Hitler: France and the Limits of Military Planning* (Lawrence: University Press of Kansas, 1996), is particularly persuasive on the relative importance of training. In common with logistics and medical matters, training is of so fundamental a significance to combat effectiveness that military professionals tend to believe that it needs no unusual emphasis. In their world everyone knows that quality and quantity of training is a sine qua non for high performance. In contrast, many amateur strategists are apt to overlook the importance of training—and discipline, logistics, and medical matters— because their professional expertise typically resides in ideas or technologies.

45 . Carl von Clausewitz, *On War*, trans. Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1976 [1832]), p. 204; Antoine Henri de Jomini, *The Art of War* (London: Greenhill Books, 1992 [1862]), pp. 70–1. John Ellis, *Brute Force: Allied Strategy and Tactics in the Second World War* (New York: Viking Penguin, 1990), emphasises the importance of material superiority for Allied victory.

46 . Bernard Brodie and Fawn Brodie, *From Crossbow to H-bomb*, rev. edn (Bloomington: Indiana University Press, 1973).

47 . N.H.Gibbs, *History of the Second World War, Grand Strategy, I: Rearmament Policy* (London: HMSO, 1976), ch. 15; R.J.Overy, *The Air War, 1939–1945* (New York: Stein & Day, 1985), pp. 54–63; John Terraine, *A Time for Courage: The Royal Air Force in the European War, 1939–1945* (New York: Macmillan, 1985), esp. pp. 173–80. Also see Francis K.Mason, *Battle over Britain: A History of the German Air Assaults on Great Britain, 1917– 18 and July-December 1940, and of the Development of Britain's Air Defences between the Wars* (London: McWhirter Twins, 1969); and Alan Beyerchen, 'From Radio to Radar: Interwar Military Adaptation to Technological Change in Germany, the United Kingdom, and the United States', in Williamson Murray and Allan R.Millett (eds), *Military Innovation in the Interwar Period* (Cambridge: Cambridge University Press, 1996), pp. 265–99.

48 . To invade Russia from peninsular Europe is to proceed into an ever-widening funnel-shaped domain. Even the largest of peninsular European armies—for the examples I cite, the German Östheer and the French Grande Armée—could register only modest force to space ratios, once an imaginary line connecting the Baltic and Black Seas was passed. The geographical dimension of strategy which must provide vital, and specific, context for RMA execution, is explored in Colin S.Gray, 'Inescapable Geography', in Gray and Geoffrey Sloan (eds), *Geopolitics, Geography, and Strategy* (London: Frank Cass, 1999), pp. 161–77. For the German and French cases cited, see respectively Horst Boog and others, *Germany and the Second World War, Vol. IV: The Attack on the Soviet Union* (Oxford: Clarendon Press, 1998); and Carl von Clausewitz, *The Campaign of 1812 in Russia* (London: Greenhill Books, 1992 [1st Eng. edn 1843]). The classic graphical presentation (by Charles Minard in 1861) of the diminishing size of Napoleon's army in Russia, plotted against time, distance, and temperature, may be located most readily in Michael I.Handel, *Masters of War: Classical Strategic Thought*, 3rd edn, (London: Frank Cass, 2001), opposite p. 194.

49 . Sun Tzu, *The Art of War*, trans. Ralph D.Sawyer (Boulder, CO: Westview Press, 1994 [*c.* 400 BC]), passim.

50 . Edward N.Luttwak argues that the more successful a tactical innovation, the more likely it is to be countered rapidly and effectively: *Strategy: The Logic of War and Peace* (Cambridge, MA: Harvard University Press, 1987), esp. ch. 2. To be successful is to attract attention and motivate an urgent hunt for countermeasures of all kinds.

51 . Helmuth Graf von Moltke, *Moltke on the Art of War: Selected Writings*, ed. Daniel Hughes, trans. Hughes and Harry Bell (Novato, CA: Presidio Press, 1993), p. 45. Moltke continues with the observation that 'Only the layman sees in the course of a campaign a consistent execution of a preconceived and highly detailed original concept pursued consistently to the end.'

52 . Alternative RMA life-cycle designs include Cooper, *Another View of the Revolution in Military Affairs*, which offers five steps (the right conditions, ‘recognition of a revolution in the making’, ‘acceptance or validation that a revolution is in progress’, ‘institutionalization’ by ‘careful specification of the new problem…that will be addressed’, and exploitation, pp. 23–4), and Metz and Kievit, *Strategy and the Revolution in Military Affairs*, which suggests six steps (‘initial stasis, followed by initiation, critical mass, consolidation, response, and return to stasis’), p. 12.

53 . Jomini, *Art of War*, p. 48.