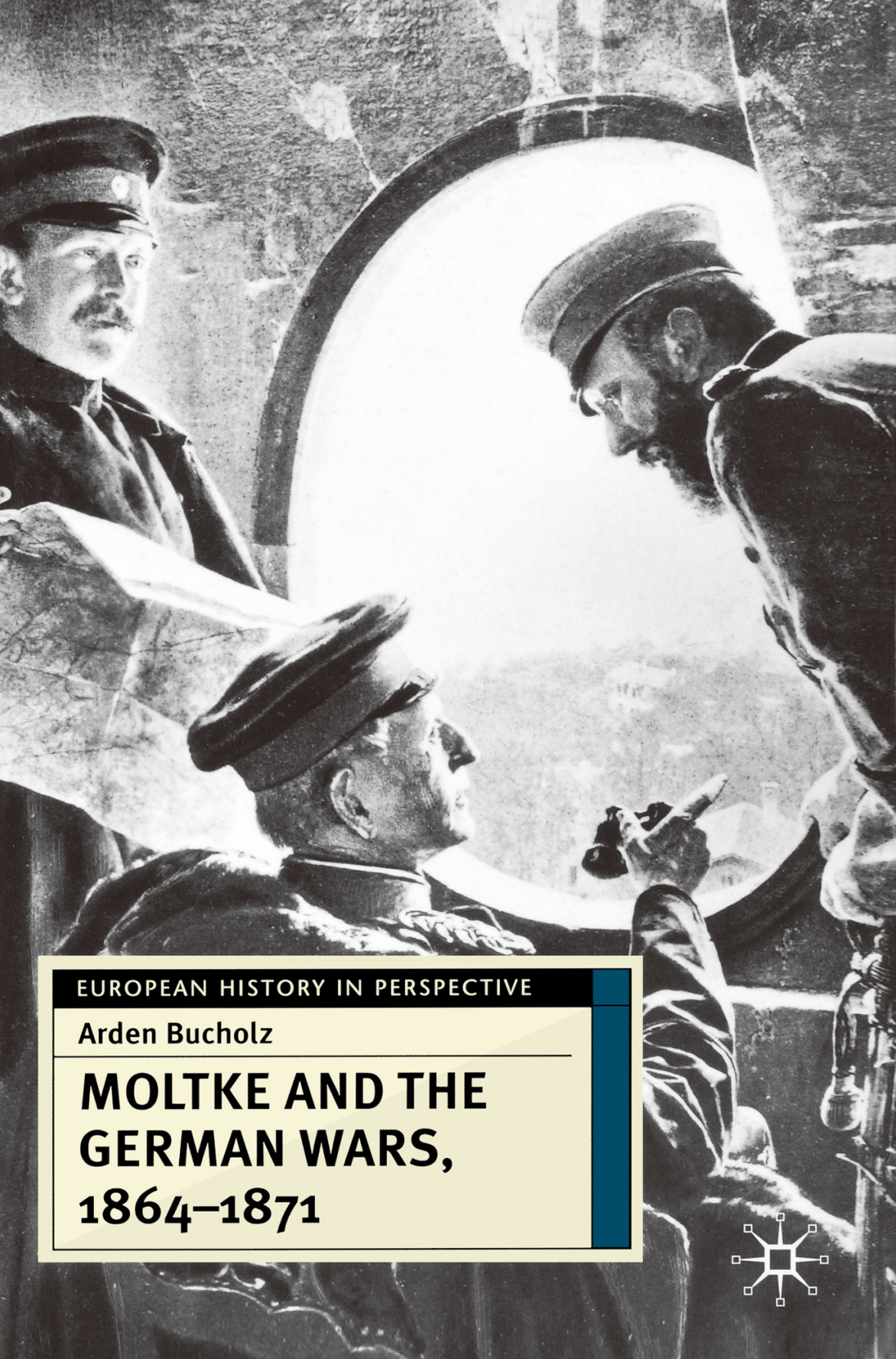

EUROPEAN HISTORY IN PERSPECTIVE

Arden Bucholz

MOLTKE AND THE GERMAN WARS, 1864–1871

Moltke and the German Wars, 1864–1871

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Arden Bucholz

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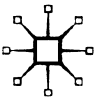

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For my favourite 'Three L'

Frontispiece Helmuth von Moltke (1800–91) the professional soldier. His bald head is covered by his own hair in the back, a wisp of the wig he always wore showing over and behind the right ear. His costume is not the embellished, bedecked dress of the court general, but the clothes of a professional soldier, with campaign hat instead of court regalia and the upper part of the simple long coat worn by Prussian generals since Frederick the Great. He is wearing the Iron Cross, awarded for action in war under fire. He is depicted in a steadfast, realistic, straightforward gaze: no heroics, no romantics. The most competent professional war leader of the mid nineteenth century European world: confident but not enthusiastic, both fatalistic and trusting (Courtesy Ullstein Bilderdienst, Berlin).

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To these and many others I am grateful. For the errors which remain I alone take responsibility.

Arden Bucholz
Waterport, New York,
August 2000

Introduction
Prussia: War, Theory and Moltke

Reversing Established Orders[1]

Is it necessary to forever blame the sins of the sons on the fathers? Historians too often consider the past on the basis of what came later rather than on what came before.[2] That is one of the problems with Prussian–German history before 4 August 1914.[3] The great Fischer controversy of the 1960s hinged around it, as did the Sonderweg dispute of the 1980s and the Goldhagen disagreement of the 1990s.[4] Each of these paints nineteenth-century Germany in various ways with the brush of Nazi Germany and the Holocaust.

World War I was *the* radical break in German history, not the link between Second Reich (1871–1918) and Third Reich (1933–45). The Great War (1914–18) and Weimar Republic (1918–33), not the Second Reich, established the preconditions for the advance of National Socialism.[5] Suppose historians could describe the Prussian Army before 1914, unencumbered by the baggage which has accompanied two world wars? What would it look like? Can we imagine it so?[6]

It might look very different. The most influential Afro-American intellectual of the twentieth century – who became a radical critic of the United States in the first half of the last century – spent two years in Berlin in the 1890s. W. E. B. Du Bois developed deep attachment and profound respect for Imperial Germany. It was not, he said, a land of militarism and authoritarianism. He lauded Bismarck as an example of the power of purpose and the force of ideas: 'it shows what a man can do if he will'.[7]

Du Bois's images were not to last. After 1914 the modern mind became overwhelmed by slaughter in the last 'holy wars': the 'German cousin' died, to be replaced by the 'German Satan' of World Wars I and II.[8]

Of course it is impossible to describe Germany exactly as Du Bois experienced it. Many of the sources are destroyed. And the two greatest wars in world history left so much devastation we have still not recovered

from it. And it is ahistorical. The present, it is said, always derives its small and large origins from the past. Anything else would be to reverse the logic of time.

But let us try.

1864–2000: Cycles of War

A decade ago the world resembled Europe 100 years before. There was rapid technological change, an arms race of increasingly complex, costly and destructive weapons, two large, competing alliance systems, and very great specialization of labour in the bureaucracies which dealt with these matters. The basic framework of war in 1988 – its size, space and time configurations – had first confronted war planners in about 1888: armies much larger than a million men, campaign areas greater than 40 000 square miles and time pressures such that planners feared a 72-hour delay might lose the war.[9] In 1988 combined NATO–Warsaw Pact European forces were several million, campaign areas spread across ten planetary time zones and time pressures were exerted from weapons effective against targets 4000–6000 miles, but less than an hour, away. Nuclear weapons had changed international relations, dramatically raising the stakes. A basic error in 1988 appeared to have much greater consequences than in 1888.

Some of this has now changed. With the breakup of the former Soviet Union, the detargeting of missiles, the entry into NATO of Poland, Hungary and the Czech Republic, the Cold War which followed World War II for several generations is over. Explicit, overt, steady international tension caused by friction between two great alliance systems has abated. We are in a period of major power détente. Martin van Creveld has called it an era of low-intensity conflict.

However, other factors present in 1888 and 1988 are still with us. And they have been enhanced.

The rate of technology change has been raised to the next level, the level of information and smart weapons. Whereas it took one or two generations to increase firepower in the decades prior to World War I, during the past ten years the application of computers has raised the possibility of enhancing war power more rapidly.[10]

The Gulf War of 1991 displayed some of this power. Communications networks that linked satellites, aircraft, planners, commanders, tanks, bombers and ships, enabling one side to produce a completely new

air-tasking order – a list of hundreds of targets for thousands of sorties – every 72 hours. A decade later, all of this has again been taken to the next level. The US Department of Defense today spends as much on satellites – tools of intelligence and communication that are crucial in getting an army through an OODA cycle quickly – as Britain spends on its whole military establishment. OODA refers to the method taught to jet fighter pilots to train them in aerial combat, 'observe, orient, decide, act'.[11]

There is still an arms race: NATO recently spent $464 billion. Russia spent more than $100 billion, China half that amount. There are still intense and ever-increasing time pressures. Control the electromagnetic dimension of the battlefield, it is now said, and you are most of the way to controlling all of it.[12] The information battle space – hundreds of miles on a side and ten trillion wavelengths deep – reminds us of the spatial dimensions war planners began to look at a century ago. Size, space and time were paramount in the strategic world of Alfred Count Schlieffen, chief of the Prussian General Staff, 1891–1905. The first modern military historian, Hans Delbrück, 1848–1929, was acutely aware of these changes and they pervaded all of his path-breaking work.[13]

Armies, Games and Complex Systems

In thinking about these matters an analogy may be useful. In the past 200 years war has passed through three stages which can be roughly equated to three widely played board games. Napoleonic warfare may be likened to the game of whist. In whist four players compete against each other. The cards are dealt out one at a time and the last card turned up becomes trump. Players follow suit and tricks are taken by the highest card. Because there is no bidding, the game just begins. Knowledge of the opponent and preparation of the players is always incomplete. Each hand is a surprise, revealing information the players did not have before. To play successfully the players adopt a series of expedients. Pure chance, and the ability to improvise after the game begins, prevails. Such was war up to about 1860. Field Marshal Moltke was even quoted as having said his strategic philosophy was nothing more than a 'system of expedients'. Nothing could be further from the truth. In reality he played whist *because* it was so different from his professional responsibilities as the first modern war planner.

By the 1860s, war was well into a fundamental transition. Industrial mass war – with its million-man armies transported by railroad and

communicated to by telegraph, employing small-bore repeating rifles and steel breech-load guns – could not be played like whist. Bridge became the new game paradigm. Intricate bidding revealed long-range strategies based on carefully built up competitive strengths. These known quantities dictated long-range planning. Skilled players had the whole game in mind as the first card was played. Although expedients still played a great part, it was becoming a game which, once under way, followed the preprogrammed scheme of the opposing war plans.[14] This was the model which came into full definition and usage during the 31-year dark ages from 1914 to 1945.

In 2000 we are in a third, very different world. Postmodern war is like GO. It is a game of patterns. GO has uniform pieces whose characteristics depend entirely on their position. GO pieces do not move, they depend upon their place in the overall mosaic. Once the pattern is set, it is that which brings victory or defeat.

Except that armies are complex systems, not linear equations. War, where two armies fight, is more comparable to storms where two great weather systems clash: small variations and imperfections become magnified. War is the ultimate counteractive experience: it is a competition between two armies in which both participants will suffer some degree of death. On this stage, minor occurrences can have important outcomes.[15]

Most of the size, space, time and technology patterns of twentieth-century war have their roots in the nineteenth century. The German Wars were some of the first wars in world history to be preplanned. That is, they were thought about, written and talked about and specifically laid out on paper in complex timetables, mobilization orders, charts and plans for men, weapons, equipment and supplies. These plans were practised in war games, staff rides and manoeuvres which began at regimental level in the spring and ended at army level in early September. These forms of preplanning lasted for years.[16]

Armies as Organizations

Armies are large public monopolies, created and maintained primarily to compete against each other on future battlefields. At the uttermost bounds of this competition, one or both of the organizations will suffer some degree of death. These two factors – future orientation and death – set armies apart from all other human organizations.[17]

Armies exist primarily to deal with future contingencies, not the day-to-day problems of the everyday world. They remain focused beyond their borders at distant targets and foreign enemies. When they look in the mirror, they compare themselves – defence budgets, weaponry, readiness – not to other domestic agencies but to foreign armies. They are counteractive organizations, ready to react as a ratchet wheel to movements and actions beyond their borders. Like a ratchet, once raised, it is sometimes hard for armies to climb back down.

The thing that armies exist to do – fight wars – does not happen very often. But since the nineteenth-century Prussian invention of modern war processes, major powers always expect, anticipate and think about it. This deep future orientation – always looking ahead and watching what other armies are doing – has meant that armies have sometimes become the first modern organizations in traditional societies. Examples such as Egypt, Turkey and Japan come to mind. And, of course, Prussia.

Counteractivity was a law of human affairs before it became a law of physics. The ancient Chinese philosopher Lao Tzu described it as follows:

> There is a tendency for every existing object or arrangement to continue to be what it is. Interfere with its existence and it resists, as a stone resists crushing. If it is a living creature, it resists actively, as a wasp being crushed will sting. But the kind of resistance offered by a living creature is unique: it grows stronger as the interference grows stronger, up to the point where the creature's capacity for resistance is destroyed. Humans and human societies are thus highly responsive to challenge. When anyone, ruler or subject, tries to act on humans individually or collectively, the ultimate result is often the opposite of what he is aiming for.[18]

War as an ironic phenomenon is aptly characterized by Shakespeare. In *Romeo and Juliet* it is produced when both principals accidentally create exactly the opposite of what they intended. It is massive understatement to say that the outcome of World War I was ironic, confounding those who began the fighting. However, we can say with certainty that the outcome of World War I was totally opposite to what the planners had in mind when it began.

'Unintended consequences' is a favourite name for this situation. Under conditions of stress, which is the essence of war, unintended consequences become routine. Clausewitz called them the 'frictions of war'.

Contemporary surgeons call them 'latent errors': errors waiting to happen because of the structure and process of situations. Onerous workloads, inadequate communications and chaotic environments: the hospital emergency room and the combat battlefield are both full of such situations. Modern error experts believe that it is process, not individuals, that require examination and correction.[19] Latent errors are built into the complex processes of modern war fighting.

Military people speak of 'peacetime duty' and 'combat' as two different worlds. This is an important, nay an essential, distinction which civilians often do not understand. The difference is that in 'combat' someone else, the enemy, wants to kill you. Peacetime duty, no matter how realistic, cannot simulate this. Armies train and train and train to prepare for it. Training never includes death, except accidentally. Yet death, the fear of it and the response to it, is not only at the heart of war, it *is* the heart of war.

The fact that armies serve as instruments of death is the primary factor which differentiates them from all other human social organizations. It is also the glue which attaches one soldier to another in combat and the primary bond between army and society. The sanctity of grace – the death bond – also gives special status to other organizations such as the church, police, fire agencies and hospitals. But only armies encompass this to the terminal degree. No other modern organization has suffered nearly 60 000 casualties in 12 hours as did the British Seventeenth Army on the first day of the battle of the Somme in 1916. No other organization has absorbed such numbers of deaths as occurred to Germany during World War I. Had the German war dead been buried at home as they died, it would have entailed almost 1300 funerals per day for each of the 1560 days of World War I.[20]

For most human beings, such intimate relationship with death is entirely extraordinary. Yet at certain times and places it is customary, normal and usual for armies in combat. That is why combat is so different from peacetime duty. Armies must look ahead and prepare for the worst-case scenarios which do not happen very often. For that is sometimes normal war.

The German Wars

Several of the grand masters of German military affairs have written spellbindingly on these wars: Gordon Craig on the Austro-Prussian War

and Michael Howard on the Franco-Prussian War.[21] There is no need to retell their stories, except to use the methods, sources and insights which have turned up since their work. Organizational, knowledge and learning theory are the methods. Theodor Fontane (1819–98) is the source. Helmuth von Moltke (1800–91) is the individual in need of new insight. Let us briefly describe each of these and suggest how they blend together to form the central mosaic.

Knowledge and learning theory

A powerful perspective from which to understand modern armies comes from those who focus on the organizational impact of knowledge. The definition that applies to armies is the systematic use of organized knowledge applied to the practical skills of war making.[22] This results in the division and subdivision of labour so that tasks become coterminous with established areas of scientific and engineering knowledge. Modern organizations break down their tasks, and organize themselves, partially or wholly, on the basis of knowledge.

The systematic use of organized knowledge applied to the practical skills of war has many implications. The more complete the application, the longer the task cycles become, and the more procedures become inflexible and harder to change. Personnel become more specialized since organized knowledge can only be applied by those who possess it. The organization itself becomes more complex in order to focus the knowledge of separate specialists on single pieces of work. As individuals become more specialized, and as the task is further divided, more information is needed. Finally, power passes to those who have the knowledge necessary for important decisions. Knowledge is that component, the possession of which gives one section of a bureaucracy a 'knowledge advantage' over other sections and departments. In 1864 Moltke had this on 2 May, midway through the war. In 1866 he got it on 2 June, 32 days before the battle which decided the war. By April 1870 – months before the war began – Moltke and the General Staff had it all.[23]

Important illustrations of this are transportation and communication. Nineteenth-century railroad and telegraph companies were the first modern business organizations. It was they which provided the first fast, regular and dependable services essential for high-volume production and nationwide distribution. They were the first to require managers to coordinate, control and evaluate the activities of far-flung separate operating units. To carry high volume safely and efficiently, up-to-date

information was constantly needed.[24] To coordinate size, space and time on such a vast scale a new kind of organization was created, the knowledge organization. The Prussian General Staff was such an agency: the first organization in the world to put both rail transportation and electric communication together to fight a complete war.[25]

A second example of the impact of knowledge on modern organizations is information theory. Structures of organizations and parts thereof vary according to the uncertainties they confront, according to what sources of information they depend on and how that information is best got to the decision-making units. It is argued that organizations develop functionally towards those locations where information about the future is located.[26] That is one reason why the General Staff over time became so important in Prussian war mechanisms as a whole.

In high-technology organizations, skill is measured by the capacity to routinize activities that come to a given work role.[27] Uncertainty within the organization – units, soldiers or commanders who do not follow orders and procedures – undermine productivity. Military continuing education, pioneered by Prussia, aimed to educate soldiers from corporal to general so that, in similar situations, they responded in roughly similar fashion.

In sum, the structure of organizations is partially determined by their growth towards sources of news about the uncertain future. These uncertainties are distinctive in different parts of the organization, depending on tasks and environments. To deal with uncertainty continuing education taught routines. In the bowels of what appeared to be a very ancient, traditional organization, the Prussian Army, its control mechanism, the General Staff, became powerful because it often had the earliest vision of the future and application routines with which to master this future.

A final insight into the Prussian Army is provided by learning theory. Organizations that purposely build structures and processes to enhance and maximize organizational learning are called 'learning organizations'. The nineteenth-century Prussian Army was such an organization. The learning goal of armies, the productivity goal if you will, is to improve its ability to win quickly and decisively at low cost. This goal was repeatedly stressed by Moltke, who considered George Washington's victory at Yorktown a stunning achievement: a war-winning battle achieved with low casualties.[28]

To enhance learning, the Prussian Army introduced competition and conflict into its educational process by inventing the war game.

Competition and conflict are an essential condition for learning. Conflict caused, for example, by error, contrary evidence or opposing views, acts as a motor driving the learning process.[29] War games institutionalized this motivational sine qua non in early nineteenth-century Prussia. From the 1820s to the 1860s Moltke participated in dozens of war games every year, from intimate sand table and map games to outdoor manoeuvres in which divisions and corps played against each other across many square miles of terrain.

Good quality organizational learning involves error detection and correction. Called 'single loop learning', it permits the organization to carry on its present policies and achieve its present objectives. 'Double loop learning' occurs when errors are detected and corrected in ways that modify the organizations' norms, policies and objectives. The General Staff, using history and war games, routinely engaged in double loop learning.[30]

The organizational culture of the Prussian Army was unique. Within that culture, Prussia invented the four main core competencies of twentieth-century war: organizational, representational, educational and analytical. Each of these contained a host of knowledge-based specialities: the General Staff, the chief of staff system, the '*Auftrag*' or 'mission-type' command philosophy [a command and control principle which allows subordinate commanders great freedom of action in executing their orders], continuing education, cartography, and above all, the war plan and its testing vehicle, the war game.

One purpose of this book is to describe and analyse the German Wars within organizational, knowledge and learning theory. To describe the impact of increasing demands for knowledge on the practical task of war fighting. As size, space and time considerations burgeoned, as technologies changed, the bonding of war with knowledge was one way through.

Theodor Fontane

Theodor Fontane was the most important German writer between Goethe and Thomas Mann.[31] Fontane had three lives. First he trained as a pharmacist, became a reserve soldier, worked in London, participated in the 1848 revolution in Berlin, was a government official and journalist for the conservative *Kreuz-Zeitung* and wrote the classic *Travels in the Mark Brandenburg*.

Then he became a war correspondent. From 1864 to 1875 he wrote six volumes of war histories, 4000 pages, more than the string of literary masterpieces which were to make him famous in the 1890s. Fontane wrote about war as a newspaperman, as a wandering journalist who visited both sides, travelling back and forth. He was once arrested by French partisans behind German lines of occupation and nearly shot as a spy, and only rescued from a French prison by the combined efforts of Bismarck and the American ambassador.[32] Fontane, the newspaper correspondent, wrote history from the bottom up, using and describing small details of time and place. His war histories are illustrated by hundreds of woodcuts.

Finally Fontane became world famous as a novelist. He published eight novels, several of which are considered among the classics of German literature. Only *Schach von Wuthenow*, the tragedy of 1883, combines his military, social and psychological experiences. Why was *Schach* a best-seller in the 1880s? Because it described the ethos of the German Wars of 1864–70, which the Prussians of that day, a generation later, felt they were losing.

Helmuth von Moltke, 1800–91

Finally there is Helmuth von Moltke. He is the unifying theme that ties the story together. More than any other individual he developed Prussian war planning processes to the end of its first stage, then validated this development by proving it could win wars. Three wars in six years.[33] He is one of the first of a new breed: the modern, self-made, technically educated, professional officer.

Suppose Moltke's achievement was essentially neutral, like all technology? Suppose Prussia was one of the creators of modern high-technology industrial processes and organizations? Do the actions of later generations, especially in World War II, permanently dishonour this? In reversing established orders we are not asking readers to condone, explain away or exculpate twentieth-century horrors. Only to more carefully weigh judgement on its backwash. To avoid painting all Prussian–German history with the brush of the first half of the twentieth century.

This book is written to advance the hypothesis that Moltke is a much more remarkable individual than anyone has noticed up to now. A rare combination of artist and soldier, it was Moltke in his sixth decade of life, when many of his generation were dead or had retired, who developed and validated deep future-oriented war-planning processes.

This striking invention, which dominated all twentieth-century war – the Gulf War of 1991 was its most interesting recent example – was not 'militaristic', but, like all technology, essentially neutral.[34] It carried with it no necessary political baggage and did not doom Prussia and Germany to the path and track it followed thereafter. After 1871, Moltke the 'Superman' of modern war processes, became what he had been before, the mild-mannered 'Clark Kent' who went about his life in a normal unaggrandizing way, tending to his modest estate, reading, playing whist, and leading the General Staff into increasingly intellectual venues.

'The Prussian army was as much a marvel of organization for the world of 1870 as Henry Ford's assembly line was for the world of 1920.'[35] In the destruction and grieving of industrial mass total war which dominated the twentieth century, we have lost the Prussian Army before 1914. It has become a mythological demon, one of the putative seedbeds of the only two global catastrophes in world history. Its legendary core, the General Staff, was outlawed in 1919. Its traditional heartland, Prussia, was downsized in 1945 and largely eliminated in 1989. Have we lost the ability to recapture it?

This work is not intended as a definitive statement. Quite the opposite. It is written to open up discussion, to suggest possibilities for further research and to lay out a framework to study modern armies using a slightly different approach than normally employed.

1

Napoleon's Legacy and the Prussian Invention

Napoleonic Transformations

Modern war begins with Napoleon's Italian campaign of 1796, reinforced by his wars against Austria, Prussia, England and Russia in the next decade. Three aspects of Napoleonic war tell us it begins modernity. First there is terminology: the names used to describe it. For example 'avant-garde' was originally a French Revolutionary term meaning something that invades unknown territory, exposes itself to the dangers of sudden, shocking encounters, conquers as yet unoccupied land.[1] With this phrase we are no longer in the safe world of eighteenth-century limited warfare, where armies under siege went home, soldiers did not fight in bad weather or at night, wars did not threaten the existence of states, and campaigns went on for years with only a few battles.

Napoleonic war brings a new time consciousness. Napoleon was the first commander to issue time-specific orders. Later with standardization of time and electricity, time becomes altered, reduced, conquered. Industrial mass war brings mobility and acceleration. Some have suggested that the idea of speed built into military strategy at this time helped define modern Western power.[2] The new time consciousness enters philosophy with Henri Bergson's fluid reality: attention came to be focused on the historical process rather than on the eternally valid, unchanging order of things. Interest was transferred from 'being' to 'becoming'.[3] Time became a positive and useful element, the stage for action of military élan vital.[4] There was a Yin/Yang quality to it: an unending, boundaryless continuum.

With Napoleon comes an increasing reliance on future expectations. Whereas previously small professional armies were often sent home

between wars and spent hardly any time at all getting ready for war, modern armies spend nearly all their time preparing, not fighting. They are constantly looking ahead. The more a particular time is experienced as new, modern, different, the more demands are made on the future; the more expectations increase. In periods of rapid change, such as the French Revolution, there is an acceleration of this process.[5]

Names, time consciousness and future expectations tell us we are in a different military world from the old regime. What created this new world?

Some changes had already begun before 1789 and were only accelerated by the wars which followed. But mainly war changed because of changes in ideas, politics and society which in turn transformed armies, tactics and strategy. And war changed as a result of material and technical factors, specifically weaponry, organization, road building and cartography.

The result of executing one king, exiling many of his nobles, and anointing a middle-class officer as emperor transformed not only society but the military. Careers were now open to talent. An even bigger change was to harness the new national state to the army. This opened recruitment to huge numbers of men who before this would not have considered joining an army. The new nation state, created by the participation of 'citizens', was threatened by the old royal states, populated by 'subjects'. Agricultural elite armies began to confront democratic mass armies.

Examples of these changes are easy to come by. By the spring of 1794 the French Republic had the largest army ever raised by a European power: 800 000 men. It was a national army, representing the people in arms, commanded by officers promoted on the basis of ability, not nobility. Its soldiers fought because they believed they had a political stake in military outcomes. Their enemies sought to extinguish the young French Revolution, an unheard of goal for eighteenth-century limited war, and French armies countered with the goal of exporting the revolution beyond French borders. In 1796 one of its commanders was Napoleon Bonaparte. He received command of an army which, in two campaigns, drove the Austrians out of northern Italy. His army was out of control: it lived by requisition, was self-supporting and created its own government. Later Napoleon took it to Egypt, where he destroyed the existing army and state and then moved back to Paris to become first consul.[6] An army that moves from the Mediterranean to the North Sea and fights between Paris and Moscow, remaking political boundaries

along the way, is very different from one that operates between the Rhine and the Danube to besiege cities.[7]

Meanwhile other things had been happening. Artillery changes, associated with Jean de Gribeauval and the brothers du Teil, improved the technical qualities of artillery, reduced its weight and allowed Napoleon to employ massed guns for tactical breakthroughs.[8] As the Chevalier du Teil said, multiply the artillery at the point of attack to decide the victory.[9] Artillery concentrations began to win battles.

Innovations in organization had led, before 1789, to the creation of divisions and corps. This separation had begun in the 1780s. Armies then contained two kinds of tactical units: cavalry and infantry. This new situation created units composed of separate, self-contained, interchangeable parts. They moved separately, but were capable of quickly reuniting to act together. The army regulations of 1791 institutionalized this change.[10] Self-contained units of 20 000–40 000 men became Napoleon's main element of manoeuvre. Blending volunteers and conscripts, veterans and recruits, old companies and new brigades, they were folded into a new construct, the corps. It had its own artillery and cavalry. With the disappearance of aristocratic officers, soldiers had less distance from and more attachment to their officers, who treated them not as subjects but as citizens.[11] Men from the same region ate, lived and fought together. Regulations were simplified, reducing dependence on exact drill and cutting down training time. French armies had a penchant for attack and more cohesion in defeat than the old armies which tended to scatter in confusion.

Maps began their modern transformation in the eighteenth century, providing for the first time a correct two-dimensional representation based on mathematical triangulation. Prior to that geographers estimated distance by the duration of travel. They lacked sophisticated instruments and used each others' maps as primary sources. As late as 1807 the Caucasus Mountains in southern Russia were estimated to have an elevation of 50 miles![12]

The French Academy changed this, using the new techniques of triangulation: that is, geodetically accurate maps based upon trigonometric numbers, careful topographic recording and modern printing techniques. In the middle of the eighteenth century France began a detailed topographic survey of their country at a scale of 1.25 miles to the inch.[13] These maps were so rare they were considered top military secrets.[14]

France wrote the first modern cartographic textbook and right from the start the needs of the army were considered.[15] It was estimated that

180 sheets would cover the whole of France, and that this could be done working with two engineers per sheet. By 1789 army map survey procedures were established. Each spring, commanders gave field teams instructions. Fieldwork – trigonometric measuring and plane table drawing – went forward during spring and summer, with winter for analysing, copying and preparing the actual maps. The French Revolution did not bring about any profound or enduring changes in cartography. France, which had the early lead, now lost its momentum.[16] But in 1809 Napoleon possessed one of the first examples of this new breed, a rare hand-drawn set of 1 : 100 000 maps of Europe west of Russia.

Stein's highways in the County of Mark were examples of road improvement in Germany. Beginning in the 1780s, Stein laid the foundations of a modern system of roads in part of the Ruhr coalfields. Prussia also completed the Finow, Plauen, Templin, Fehrbellin, Bromberg and Klodnitz canals. The German Customs Union of 1834 gave more impetus to improved roads and turnpikes and the first glimmerings of railroads. But the Germanies of this day were 39 sovereignties and many went their own way. As Goethe described the antique lifestyle of Duke Karl August of Saxe-Weimar: more was consumed in a day at the top than could be produced in a day at the bottom.[17]

What did all of these innovations mean for military activities?[18] There are diverse views. One is that tactical forms were essentially unchanged. Infantry volleys and bayonet attacks still decided things, with cavalry an auxiliary weapon and artillery most effective for defence, although the final Napoleonic campaigns gave the guns a greater offensive role. Brigades, divisions and corps were the characteristic form. Supply did not change much. In this view the defence remained stronger in combat between similar weapons systems.

However, the main features of Napoleonic warfare were its political goals, rapid tempo, future orientation and, above all, its battles: many more were fought using larger armies, traversing much greater spaces and with far more decisive results.[19]

Deep Future-oriented War Processes

Agricultural elite Prussia fought democratic mass France in 1806–7 and was swiftly and completely overwhelmed, losing not only its army and its identity, but nearly its state as well. A single philosopher of war, Carl von Clausewitz, described Napoleon's essentially unlimited goals. Napoleon