WAR MADE NEW

TECHNOLOGY, WARFARE, AND THE COURSE OF HISTORY, 1500 TO TODAY

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BOOKS

The Rise of the Industrial Age

Britain was in a self-congratulatory mood in 1851, and the opening of the Great Exhibition in London—the first world's fair—showed that it had much to congratulate itself on. The exhibition was housed in a giant building in Hyde Park constructed entirely of glass and iron. The Crystal Palace, it was dubbed, and Queen Victoria was not alone in thinking it "one of the wonders of the world." Such a structure would not seem at all remarkable today, but this was a time when most construction was still done with brick or wood. No one was sure that this airy design—the largest enclosed space in the world—would survive the elements. Not only did it survive, it flourished. More than six million paying visitors came to marvel at the building and all the wonders contained within its nineteen acres of interior space.

There were one hundred thousand objects in all, ranging from the mundane (prizewinning vegetables, ornate umbrella stands, fancy toast racks) to the exotic (African loincloths, rhubarb champagne, a false nose made of silver) and the absurd (a carriage drawn by kites, a vase made of mutton fat, a silent alarm bed that tipped a sleeper onto the floor). The stars of the show were the mechanical displays—steam hammers, marine engines, textile looms, printing presses, a thirty-one-ton broad-gauge locomotive—many of them actually chugging and hissing away to the delight of awestruck spectators. Like many of her subjects, the queen found it all "so vast, so glorious, so touching" that she declared the Exhibition's opening "the *greatest* day in our history."

What they were really celebrating, these visitors to the Crystal Palace, was the transformation of their rainy isles during the past hundred years. In 1750 most Britons still lived in villages and worked the land with their hands, as their ancestors had always done. Machines were used in some industries, but they were small-scale and usually powered by muscle, wind, or water. To get anywhere on land required riding a horse or getting into a

horse-drawn carriage and jostling over bad roads at a top speed of about six miles per hour. Water travel was a little faster and cheaper but even more uncertain, being subject to the vagaries of the weather. Long-distance communication was possible only by mail, and it could take two months for a letter to get from New York to London.

By 1851, all of these constraints had been cast off as completely as powdered wigs and silk breeches. Population had increased in general and urban population in particular. Manchester, "the metropolis of the commercial system," shot up from 25,000 souls in 1772 to 455,000 by 1850. London reached 2.3 million that year, making it the world's largest city. In 1851 for the first time the census found that the majority of the British population lived in cities and towns. While more Britons remained employed in agriculture and domestic service than in any other occupations, a growing number toiled over steam-powered machinery in dimly lit factories. Once upon a time, a visitor knew he was approaching a city by the appearance of church spires; now it was the sight of belching smokestacks. "Nothing can be conceived more grand or more terrific," wrote one observer in 1830, "than the yellow waves of fire that incessantly issue from the tops of these furnaces."

Few had such admiring words for the communities that grew up around the smokestacks. With urbanization had come greater attention to such perennial evils as child labor, prostitution, pollution, crime, and poverty, which were so eloquently exposed by writers like Dickens and Disraeli. Even in England, that placid "nation of shopkeepers," there had been outbreaks of class conflict such as the "Peterloo Massacre" of 1819. But by 1851 the rising middle class—a new term and a new concept—could assure themselves that the worst excesses had been addressed and that a new golden age was dawning. Statistics bore out their faith: Average wages in Britain, which had risen by 15 to 25 percent between 1815 and 1850, soared 80 percent in the next fifty years.

Not many Britons were aware of wage figures. All of them could see how transportation was changing, and it seemed nothing short of miraculous. Travelers could now zoom along at thirty-five miles per hour aboard a train—"swifter than a bird flies," marveled the actress Fanny Kemble, who, after taking her first train ride in 1830, found that "this sensation of flying was quite delightful and strange beyond description." Luckily, one learned professor's warning that "Rail travel at high speed is not possible because the passengers, unable to breathe, would die of asphyxia," was not borne out by experience. A railway boom in the 1840s crisscrossed the British Isles with five thousand miles of tracks, and it was now common to hear a locomotive's distinctive toot-toot puncturing the tranquility of the countryside.

Sea travel likewise had been altered beyond all recognition since Robert Fulton's first steamboat had been exhibited on New York's East River in 1807. Since 1838 vessels powered exclusively by steam had been crossing the Atlantic, dramatically reducing both the time and cost of long-distance travel and making possible the greatest mass migration in history as tens of millions of people left Europe for the Americas and Australia.

Communications had become even faster than a speeding train thanks to Samuel Morse's invention of the electric telegraph in 1837. In 1851 the first working telegraph line was laid under the English Channel. Within two decades, submarine cables would link Europe with America, Asia, Africa, and Australia. In 1750, using the mail, it had taken six months to communicate between Britain and India; by 1870, the telegraph had cut the time down to five hours. By 1886, with the completion of a cable line from Europe to West Africa, the entire world was wired together. (One of the unforeseen consequences of this development was to give a big boost to magazines and newspapers, which in turn subjected military actions to far greater public scrutiny than in the past. The Crimean War [1853–56] saw the advent of the first professional war correspondents.)

All of these events were part of what came to be known as the Industrial Revolution, and, in the view of many sober historians, they changed the world more than anything that had happened since the advent of farming (the Agricultural Revolution) some twelve thousand years before. Like the Gunpowder Revolution, the Industrial Revolution was a complex, long-term process that was the work of many minds in many countries over many years. It first developed in Britain, which had the advantages of peace (no major battles on English soil after 1651), stable government, freedom from arbitrary arrest or confiscation, secure property rights, well-established patents, courts that would enforce contracts, an entrepreneurial culture, and plenty of cheap capital.

The precursor to industrialization was a substantial improvement in agriculture. Better planting, harvesting, and ranching techniques increased the yield of English farmland early in the eighteenth century and made it possible to feed more people. Large landowners took advantage of these developments by enclosing fields that had once been farmed communally. The spread of private ownership and market techniques yielded further advances in productivity while pushing many small farmers off the land. Thus England had a growing and increasingly mobile labor force just as machines were being invented to harness their labor in unconventional ways.

The most important of these inventions was the steam engine. Thomas Newcomen produced the first practical model in 1705, but it was so inefficient that its usefulness was limited to coal fields where the fuel supply was

essentially inexhaustible. A Scottish inventor named James Watt improved on Newcomen's design in the 1760s, making it much more fuel-efficient. Watt's steam engine ushered in a new age in which power would come primarily from fossil fuels, first coal and then oil, and machines would replace much of the labor of man and beast.

The steam engine had its biggest immediate impact on the textile industry. Previously most cloth-making machines had been run by hand in cottages or by falling water in riverside mills. Now these contraptions became steam-powered and it made sense to congregate them in factories which sprouted in industrial towns like Manchester and Birmingham. In 1813 Britain had 2,400 power looms; in 1820, 14,000; in 1833, 100,000.

No sooner had textiles been transformed than other industries followed suit. British iron production increased from 17,000 tons in 1740 to 700,000 tons in 1830 and 4 million tons in 1860. By fashioning a smaller and more powerful steam engine capable of hauling a load along a "railway," Richard Trevithick opened up new uses for this suddenly abundant metal. Utilizing his invention, George and Robert Stephenson designed the first really successful locomotive, the *Rocket*, which won a competition sponsored by the newly constructed Liverpool and Manchester Railway in 1829. From this humble beginning, the global rail network would grow to 220,000 miles in 1880, which not only made possible the rapid movement of goods and passengers but also provided a plentiful source of demand for iron producers, coal miners, and engine makers. The increasing use of steamboats, which began to be made of iron starting in the 1820s, also proved a boon for manufacturers and consumers alike.

Railroads and steamships demonstrated how the various innovations of the Industrial Age interacted with one another. Each new product seemed to create demand for other products, some not yet invented. Historian David Landes has argued that the distinctive feature of the age was the "routinization of discovery, the invention of invention." The number of patents issued in England soared from 7 in 1750 to 250 in 1825. Scientists in many different lands competed against one another and sometimes worked together to expand the frontiers of knowledge. Their work did not always lead to practical benefits, and in fact science lagged behind engineering throughout most of the nineteenth century. The principles of steam power, for instance, were not understood until decades after steam engines had become widespread. It was not until after 1850 that scientific research began to drive technological progress. But even in the eighteenth century, professional organizations like the British Royal Society and the French Académie des Sciences had created a fertile intellectual climate that encouraged the work of myriad inventors.

Their more practical inventions could be brought to market because of the availability of cheap capital, spread by institutions such as the London

Stock Exchange, which opened its doors in 1773, and a growing number of private banks that usurped some of the functions previously reserved for the Bank of England.

The result was continuous, self-sustaining economic growth that enabled industrialized nations to support ever-growing numbers of people in ever-greater comfort. This material progress rendered old methods of thought as obsolete as old methods of production. New ideas like socialism, nationalism, and Marxism would now jostle for attention. Influential as they became, the most important ideology of the early Industrial Age was laissez-faire capitalism. Its prophets, Adam Smith and David Ricardo, preached that limitless growth was possible as long as government did not interfere with the "invisible hand" of the market. By 1846 Britain had become such a firm convert to this creed that Parliament repealed the protectionist Corn Laws. Legislation that had prohibited the export of advanced technology and the emigration of skilled craftsmen was also lifted. The era of free trade had begun.

THE IMBALANCE OF POWER

Britain could be so generous because it had taken such a big lead over the rest of the world. In 1851 it owned half of the oceangoing ships and railway tracks in the world and produced more than half of the world's cotton cloth, coal, and iron. Such dominance by such a tiny island could not and did not last forever. A half century later Britain would be overtaken in manufacturing output by the United States, with Germany close behind. Other European states such as France, Russia, Italy, Spain, and Austria would lag behind, but they were still heading in the same general direction as America, Britain, and Germany. Not so the rest of the world. The Industrial Revolution opened up a yawning economic chasm between the West and the Rest that still has not been bridged. In 1750 Europe accounted for just 23 percent of world manufacturing output; what came to be known as the Third World had a hefty 73 percent. By 1900 the European share had risen to 62 percent (the United States added another 23.6 percent), while the Third World's portion had shrunk to a paltry 11 percent. There is good reason to think that leading Asian states like India and China actually got poorer during the nineteenth century, at least on a per-capita basis, even as Europe was witnessing the greatest explosion of wealth in its history.

The resulting imbalance in power would make it much easier for European empires to extend their dominions abroad. But it took a while for industrialization to affect warfare. Wellesley's army in 1803 fought much as the Duke of Marlborough's had 100 years before, and not all that differently

from Gustavus's 70 years before that; its transport (bullock-drawn carts) was identical to that employed 2,100 years earlier by Alexander the Great. "The hardware of war," writes one historian, "was essentially the same in 1815 as in 1631."

The biggest change associated with the French Revolutionary and Napoleonic Wars (1792–1815) was universal conscription, the *levée en masse*, which made armies bigger, better motivated, and less reliant on mercenaries, though its impact was hardly as revolutionary as some historians claim. The principle of draftee armies had already been established by Gustavus Adolphus in the seventeenth century and expanded by Russia's Peter the Great in the early eighteenth century. (Prussia's Frederick the Great had managed to conscript a higher percentage of his population than the French revolutionaries ever would.)

In the late eighteenth and early nineteenth centuries, logistics and command-and-control systems could not keep pace with the growing size of armies. Supplies still had to be hauled by horses; muskets, cannons, ammunition, and uniforms still had to be handmade by skilled artisans; orders still had to be relayed by bugles, shouts, and messages carried on horseback; and commanders still had to depend on their spy glasses to figure out what was happening on a smoke-shrouded battlefield. All this severely limited the number of troops that could be deployed effectively. Napoleon commanded six hundred thousand men when he invaded Russia in 1812—50 percent more than had served Louis XIV a century earlier, although only half were Frenchmen—but he could not support that many in the field, and most of his Grande Armée did not make it home.

Other reforms associated with post-1789 France—selecting officers based on talent, not birth; organizing armies into combined-arms divisions and corps; arraying attackers into columns, not lines—were also, for the most part, incremental expansions of what the áncien regimes had already been doing. Napoleon brought the old style of war to its ruthless zenith; he did not invent a new style. At most, by stoking the fires of nationalism, the Napoleonic era blazed a path for a true revolution in warfare when mass production could be combined with mass mobilization.

After 1815 most armies shrank again. The period of relative tranquility that followed the end of the Napoleonic Wars did not provide strong incentives for military innovation. The Royal Navy patrolled the world's oceans virtually without challenge, while the Holy Alliance of Russia, Prussia, and Austria tried to preserve a reactionary status quo on the continent. Britain was the most industrialized nation in the world, but guided by its traditional antipathy toward standing armies and its equally passionate attachment to parsimonious government, it made little attempt to apply advanced technology to its armed forces.

It was not until the Crimean War that warfare really began to be transformed, with cataclysmic consequences. A century that had begun with swords and muzzle-loading, smoothbore muskets and cannons, would end with repeating rifles, quick-firing artillery, and machine guns. Sailing ships firing solid cannonballs would give way to turbine-powered dreadnoughts spewing high-explosive shells. The eventual result was a slaughter of such frightful proportions that it seemed to mock the very idea of progress that had been the centerpiece of the Great Exhibition of 1851.

CHAPTER 4

RIFLES AND RAILROADS:

Königgrätz, July 3, 1866

Where, oh where, was the Crown Prince?

That was the question on everyone's minds at the Prussian command post atop the heights at Roskosberg, two miles behind the front. King Wilhelm I and his large retinue of staff officers, diplomats, and hangers-on anxiously directed their telescopes to the left, looking for some sign that Crown Prince Friedrich Wilhelm's Second Army was approaching the battle raging in front of the fortress at Königgrätz, about fifty miles east of Prague in the Habsburg province of Bohemia. But little could be seen through the thick rain and even thicker fog, which combined with the white smoke billowing from hundreds of thousands of guns to almost completely obscure the entire area. As the fog of war settled lower and lower, the anxiety of the Prussian commanders crept higher and higher.

Wilhelm had allowed himself to be drawn into this *Brüderkrieg* (brothers' war) against Austria by his ambitious minister-president, Count Otto von Bismarck, to ensure that Berlin, not Vienna, would dominate the future course of Germany. Few would have bet on Prussia emerging victorious. The Habsburg Empire had 78 percent more people, 38 percent more soldiers, and a defense budget that was 54 percent larger. Its generals were also more experienced, having fought France just seven years before. Prussia had barely fought at all since the Napoleonic Wars, when it had suffered a catastrophic defeat that was only partly redeemed by Napoleon's final defeat at

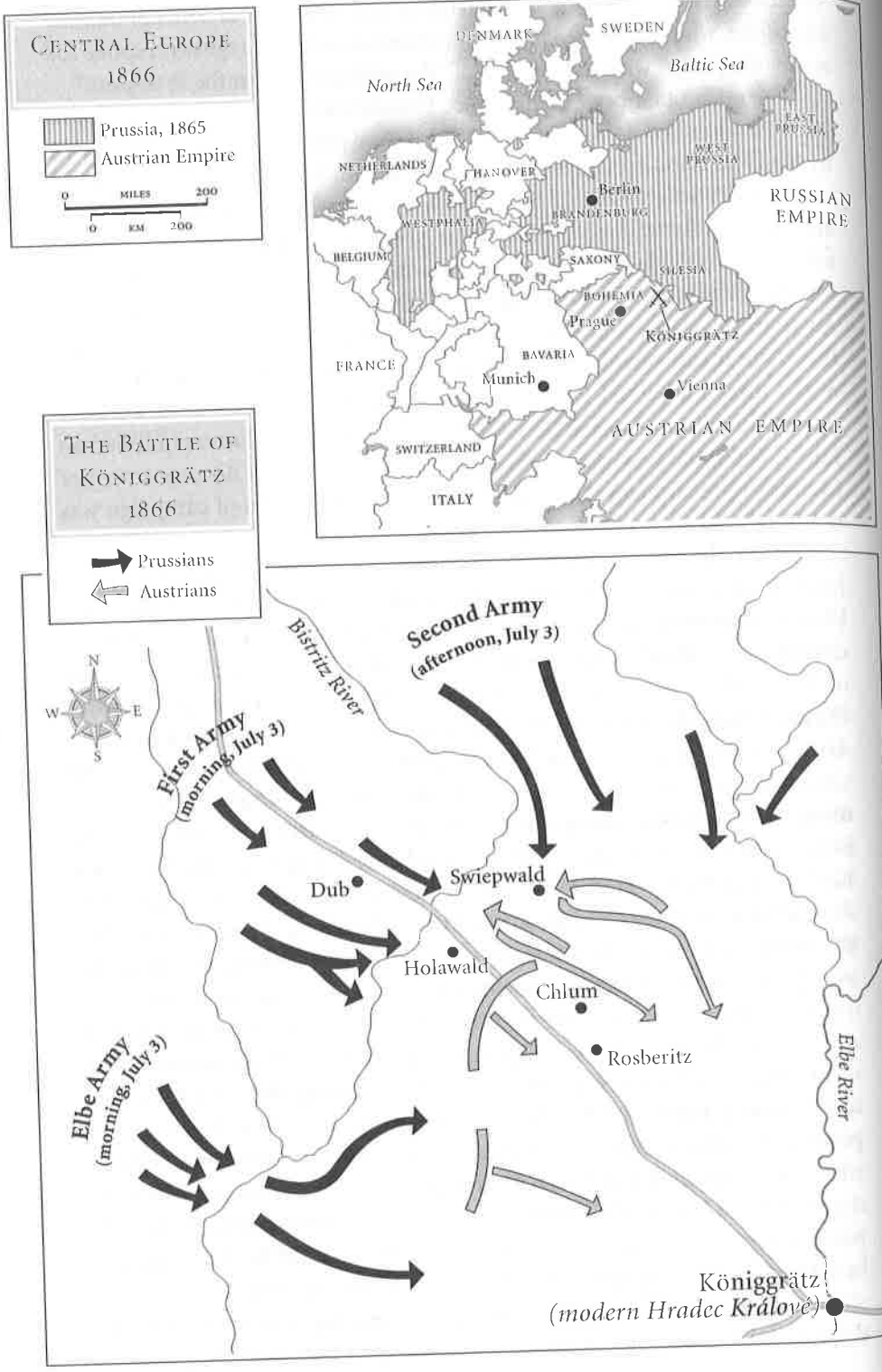
Waterloo. Friedrich Engels, the journalist and co-author of *The Communist Manifesto*, who had served a year in a Prussian artillery regiment, spoke for received opinion when he wrote that "the odds are against the Prussians."

The odds tilted even further once Prussia's war plans became apparent. The Prussians had dared to violate the cardinal principle of war as laid down by the great Napoleon himself: Never divide your forces in the face of the enemy. The Prussian General Staff had broken up its troops into three field armies (First Army, Second Army, Elbe Army) which had crossed the mountains into Bohemia at three widely separated points. General Helmuth von Moltke, chief of the General Staff, hoped that one of his armies would fix the Austrians in place while the other two would circle around and annihilate them. But it was equally likely that the Austrian main force, larger than any of the three individual Prussian armies, would defeat each in turn before they could reinforce each other. Engels, in a newspaper column published on July 3, 1866, the very day of the battle, was withering in his assessment of Moltke's novel strategy: "an officer proposing such a plan of campaign was not fit to hold even a lieutenant's commission."

Indeed, the grand envelopment envisioned in Berlin was proving hard to implement. Lacking solid intelligence about the enemy, the Prussians had blundered along blindly until some scouts had run into the main Austrian encampment on Monday, July 2. The Austrians were spread out over nine miles of farmland, villages, and low, rolling hills in front of Königgrätz. Prince Friedrich Karl, the king's nephew, who was in command of both the First Army and the Elbe Army, resolved on an immediate attack, even though the Crown Prince's Second Army was still thirteen miles away, a whole day's march. Friedrich Karl thought he could take on the entire Austrian army by himself and earn all the glory. Moltke knew better. Upon learning of Friedrich Karl's plan in the early morning hours of July 3, the chief of staff immediately dispatched a messenger to the Crown Prince's headquarters with orders that the Second Army was to march at once. Unfortunately the order did not arrive until 4 A.M., and the troops did not start moving until three hours later.

The Second Army was still far away when the battle began around 7:00 A.M. on Tuesday in what a correspondent described as "a downpour worthy of a monsoon." Elbe and First Armies advanced through the "gray and cheerless" morning across Bistritz Creek, the northern boundary of the Habsburg position. Positioned on the other side was Austria's Northern Army, 206,000 strong, occupying what Moltke described as "an extremely strong position on the heights . . . behind the Bistritz." The Elbe and First Armies together deployed only 124,000 cold, tired, hungry men; they would be badly outnumbered until the Second Army's 97,000 reinforcements arrived.

Sure enough, the initial Prussian offensive quickly ground to a halt. The chief Prussian advantage lay in their needle gun, a breech-loading rifle that


CENTRAL EUROPE
1866
Prussia, 1865
Austrian Empire
0 MILES 200
0 KM 200
DENMARK
SWEDEN
North Sea
Baltic Sea
EAST PRUSSIA
WEST PRUSSIA
NETHERLANDS
HANOVER
Berlin
BRANDENBURG
RUSSIAN EMPIRE
WESTPHALIA
BELGIUM
SAXONY
SILESIA
BOHEMIA
Prague
KÖNIGGRÄTZ
FRANCE
BAVARIA
Munich
Vienna
AUSTRIAN EMPIRE
SWITZERLAND
ITALY
THE BATTLE OF
KÖNIGGRÄTZ
1866
Prussians
Austrians
N
W
E
S
Bistritz River
Second Army
(afternoon, July 3)
First Army
(morning, July 3)
Dub
Swiepwald
Holawald
Chlum
Rosberitz
Elbe Army
(morning, July 3)
Elbe River
Königgrätz
(modern Hradec Králové)

was far superior to the muzzle-loading muskets still employed by the Austrians. But in the early going the Prussians had trouble getting close enough to make their rifle fire count. The Austrians were blowing away the attackers from long range with 250 field guns entrenched on a series of hills. These were not antiquated smoothbore cannons of the kind that had been the norm for 350 years, but modern rifled pieces firing explosive shells. The Austrians had had a couple of days to prepare the battlefield. Ranges and trajectories had been carefully calculated in advance, so that the Prussians felt as if they were advancing straight into a shooting gallery. "The Austrian artillery shot exceedingly well," Moltke had to concede later. "Scarcely did a column of infantry or cavalry make itself visible in one of the gorges of the valley before a shell came along and exploded in most unenjoyable proximity, and they withstood the fire of our own batteries with the utmost steadiness."

Less phlegmatic observers spoke of the "terrible . . . cannonade" which was sending "whizzing shells among the Prussian artillery, dismounting guns, killing men and horses, and splintering carriages in all directions." As shrapnel exploded around them, ordinary Prussian soldiers "felt we were in God's hands."

The worst slaughter was occurring on the left side of the Prussian lines, in a small forest known as the Swiepwald. The 7th Prussian Division under General Eduard Friedrich Karl von Fransecky had occupied this position by 9:30 A.M., and ever since then the Austrians had been mounting increasingly desperate offensives to dislodge them. One Austrian unit after another marched into the Swiepwald, drums beating and horns blaring, supported by the fire of dozens of field guns. The Prussians more than held their own; their riflemen, concealed behind thick firs and stout oaks, took a terrible toll on the attackers. But the sheer weight of numbers was slowly pushing the 7th Division back to the edge of the forest. By noon Fransecky had lost almost two thousand officers and men. Both the general and his aide-de-camp had their horses shot out from under them. As the Prussian army's official history noted, "the situation became every minute more critical." How much longer could nineteen Prussian battalions hold off fifty Austrian battalions?

The 7th Division was as important to the Prussian line at Königgrätz as the 20th Maine Regiment had been to the Union troops at Gettysburg three years before. If the men of Maine under Colonel Joshua Chamberlain had been routed, Little Round Top would have fallen and the Union defense might have collapsed. Likewise, if the men of Magdeburg under Fransecky were routed, the Austrians would be able to turn the left flank of the Prussian position. The battle might be lost.

At 11 A.M., the embattled Fransecky sent a messenger to the king's headquarters to beg for reinforcements. Moltke refused to send any. He wanted to keep every reserve to block a possible Austrian counteroffensive in the center.

Fransecky would just have to fend for himself until Crown Prince Friedrich Wilhelm arrived with his army. Moltke's comment—"I know General Fransecky and I know he will stand firm"—must have been cold comfort to a general who was telling his own men, "We've got to stand here or die!"

Other Prussians were showing less resolution. As the Austrian artillery continued to hammer away, the Prussian center began to buckle. Whole battalions streamed off the battlefield, desperate to escape the relentless rain of artillery shells. King Wilhelm himself tried to turn back the tide, shouting, "Let's see you fight like brave Prussians!" To little avail. Brave though they undoubtedly were, many Prussian soldiers had been deeply demoralized by hours of shelling.

Around noon, the king exclaimed in desperation, "Moltke, Moltke, we are losing this battle!" Bismarck, who was hovering nearby, wearing the uniform of a reserve major in the Landwehr (militia), complete with a *Pickelhaube* (spiked helmet), was equally concerned. The only battles he was used to fighting occurred in drawing rooms, the only weapons he regularly employed were barbed words and stiletto wit. He was not prepared for the ferocity of real warfare and he feared for the safety of his son, Herbert, who was wearing the blue uniform of the Prussian army. By early afternoon preparations were being made for a Prussian retreat.

Only one man kept his head while all about him were losing theirs and blaming it on him. Bald, emaciated, deeply wrinkled, and nursing a cold, Helmuth von Moltke, a sixty-six-year-old general who had never before commanded an army in battle, remained confident that his carefully prepared plans would yet bear fruit. Supposedly, when the situation looked grimmest, he reassured the king, "Your Majesty will win today not only the battle but the campaign."

That was more than wishful thinking. Behind that bold prediction lay years of meticulous, detailed preparation to ensure that Prussia would take advantage of the Industrial Revolution that was transforming warfare in the mid-nineteenth century. The world did not yet know how well the Prussian General Staff had done its work. Moltke did. He had taken a conscript army, organized it with his staff officers, trained it with his drill instructors, mobilized it with railroads and telegraphs, equipped it with breech-loading rifles, and now he had every reason to believe that it would prevail over the less advanced forces of the Austrian Empire.

THE GENERAL STAFF AND ITS CHIEF

As with so many military renaissances, Prussia's rise had its origins in a defeat. At the battles of Jena and Auerstädt in 1806, Napoleon shattered the

Prussian army and destroyed any mystique remaining from the days of Frederick the Great. The French army then entered Berlin and turned Prussia into a tributary state. The memory of this humiliation was only partly erased seven years later when Prussia joined with Russia, Austria, and Sweden to defeat Napoleon at the epic Battle of the Nations near Leipzig in 1813.

To a whole generation of Prussians, Jena had shown the rotten underpinnings of the old Prussian state. The years after 1806 saw a burst of reforms including the freeing of serfs, the emancipation of Jews, the strengthening of government bureaucracy, and the weakening of trade guilds. The changes were especially significant in the military realm. The overhaul of the army was led by two officers, General Gerhard von Scharnhorst and Count August von Gneisenau, who sought to replace Frederick the Great's force of aristocrats and mercenaries with a French-style nation in arms. They stopped recruiting foreigners and instituted a universal draft that did not allow the rich to buy an exemption. They also created a citizen militia called the Landwehr and a substantial force of reserves. After 1815, the army would conscript forty thousand men annually to serve for three years. Upon leaving active duty they would serve a further two years in the reserves and fourteen years in the Landwehr. In this way Prussia limited its military expenditures in peacetime while creating a vast pool of trained manpower that could be called to the colors in wartime. By 1850 Berlin had around a half million trained soldiers at its beck and call.

And increasingly these soldiers were not the ignorant peasants of old. Starting in 1809, under the direction of Baron Wilhelm von Humboldt, Prussia created one of the best systems of public education in the world, offering elementary schooling for all, secondary schools for some, and university education for the elite. Out of the classrooms came citizen-soldiers who were able to master the complexities of industrial warfare. Special schools were set up to train a corps of noncommissioned officers, the sergeants and corporals who would become the backbone of the Prussian army.

As important as Scharnhorst's and Gneisenau's reforms were for the rank and file, they were equally significant for the officer corps. Their goal, in which they were only partly successful, was to break the stranglehold of the Junker aristocracy ("heartless, wooden, half-educated men," one reformer called them) on the leadership ranks in the army. They wanted to make merit, not birth, the most important criterion for officer selection, so they put many old warhorses out to pasture and forced every officer seeking promotion to pass an exam. Military academies and staff colleges were set up to train officers, the first one being the Kriegsakademie (War Academy), whose most illustrious early director was Carl von Clausewitz, author of the classic exposition of military philosophy, *On War*. Under the guidance of Clausewitz and his colleagues, soldiering became a profession, not a pastime for the nobility.

At the center of these reforms was the creation between 1803 and 1809 of a unique institution called the *Grosser Generalstab* (Great General Staff), charged with war planning. Its ranks, which initially numbered fewer than fifty and never rose to more than one hundred, were composed of the best and brightest officers. Their relationship to the rest of the army was ambiguous. The chief of the General Staff did not exercise formal command, but he and his officers did exert a strong influence. Each army, corps, and division commander was assigned a General Staff officer to be his adjutant; Scharnhorst wanted them to "support incompetent generals, providing the talents that might otherwise be wanting among leaders and commanders." This system spread the tentacles of the General Staff throughout the army.

All previous generals had made plans, of course, but usually they were made in haste only when war was imminent or had already broken out. The Prussian General Staff inaugurated a new era, one in which, as historian John Keegan writes, "plans [were] conceived at leisure, pigeon-holed and pulled out when eventuality became actuality." To facilitate this task, the General Staff was organized into geographical sections that planned for hostilities against such likely enemies as France, Austria, and Russia. War plans were updated every year. Staff officers also oversaw vital functions such as mapping, intelligence, and logistics.

Although the General Staff was future-oriented, a good deal of its time was spent in the study of the past. Its dedication to learning the lessons of battles past has endeared it to historians ever since. Twice a year, officers undertook "staff rides" in which they studied old battles on the very ground where they had been fought. Their findings were published in a series of books and a monthly journal whose focus was not just on what had happened but why it had happened and whether the various participants had made the correct decisions.

This was only one of many practices started by the General Staff that has become routine in virtually all professional armies. Another was war gaming. Staff officers played out elaborate scenarios at a map or sand table. Metal symbols were used to denote the opposing armies—red for the enemy, blue for friendly forces, a color code that has persisted to the present day in the armed forces of the United States and other nations. A roll of the dice indicated the element of chance and an umpire scored the results. In the summer and fall, the General Staff took their war games outdoors, supervising large-scale maneuvers by the army. War gaming became a fashionable pursuit among Prussian officers, with various regiments pitted against each other.

The General Staff system created a group of military intellectuals without peer, an elite group instantly recognizable by their distinctive red-striped trousers. Other states had general staffs, but none was as brilliant or

influential as Prussia's. Helmuth Carl Bernhard von Moltke was an outstanding, but not unrepresentative, product of this system.

Curiously enough, some of the greatest conquerors of modern times were not natives of the countries they led. Napoleon hailed from Corsica, Hitler from Austria, Stalin from Georgia, and Moltke from Denmark. His parents were Germans—his mother the daughter of a Lübeck merchant, his father a former Prussian officer turned unsuccessful farmer—who settled in the duchy of Holstein, which was under Danish rule. Helmuth, who was born in 1800, was educated at a military academy in Copenhagen, which he found "strict, even harsh," and then commissioned a lieutenant in the Danish army. Seeing scant opportunities in this tiny force, he applied to join the Prussian army, and after passing an officer's exam, he was accepted as a second lieutenant in 1822.

A decade later, after having graduated from the War Academy and served an apprenticeship as an army surveyor, Moltke joined the General Staff. He would serve in its ranks for the rest of his life. He never led so much as a company before becoming commander of the entire Prussian army, and he never served with troops in the field after his time as a lieutenant. His only experience of war prior to the 1860s occurred in 1836–39 when he served as an adviser to the Ottoman sultan who was fighting an Egyptian army in Mesopotamia. He was an intellectual whose abilities to apply his theories in practice would be revealed only when he was well into his sixties.

Moltke hardly fit the image of a Prussian militarist. He loved music, poetry, art, archaeology, and theater. He knew seven languages (German, Danish, English, French, Italian, Spanish, and Turkish). He was a prolific artist who filled sketchbooks with landscapes and portraits, as well as a popular author. His German translation of Edward Gibbon's *History of the Decline and Fall of the Roman Empire* was never published, and a novella he penned in the 1820s was not well received, but his account of his travels in Turkey, released after his return to Berlin in 1840 and illustrated with his own drawings, turned him into a literary celebrity, a role that he embraced by donning a Turkish fez and giving public lectures. Basking in the glow of fame, the forty-two-year-old officer married a sixteen-year-old English girl who was his sister's stepdaughter. Despite the disparity in their ages and their lack of children, they would live together happily until Marie's death in 1868. Out of devotion to her memory, he refused to remarry during the remaining twenty-three years of his life.

For all his catholicity of interests, Moltke was no closet liberal. He was a nationalist and a monarchist to the core who was appalled by the liberal revolutions that swept Europe in 1848. He placed his faith in the king and the forces of the old regime. Eventually the king returned his trust. In the 1840s

and 1850s, while serving as a personal aide to several princes, Moltke made a favorable impression on the Hohenzollern court and got to know the future king Wilhelm, himself a professional officer who was known as the Soldier Prince. In 1857 Wilhelm's brother, the king, was incapacitated by illness, and Wilhelm was made regent. One of his first acts was to appoint Moltke chief of the General Staff after the death of the previous chief.

The fifty-seven-year-old major general immediately moved into the General Staff 's official mansion in Berlin. The first two floors served as offices; upstairs the general lived with his wife. In later years, after the German Wars of Unification, Moltke ascended to the status of a demigod and numerous memoirs appeared of his personal life. The picture that emerged was of a hardworking, modest man who dutifully took part in the whirl of court socializing but disliked dinner parties and had a horror of shaking hands. Instead of going out, he preferred a quiet dinner at home, followed by some music (Mozart was his favorite), a cigar, and a game of whist with a few close friends. His only vanity was to wear an ill-fitting wig to cover his completely bald head.

The chief of staff 's outstanding characteristic was his taciturnity. He became known as "The Great Mute" (*der grosse Schweiger*), or "the man who could be silent in seven languages." According to one of his relatives, "This silence was a mixture of reflection and shyness, as he himself has sometimes confessed. He did not feel that he possessed the talent of expressing himself easily on the idea of the moment, much less of making, as one says, 'Fine speeches,' and so his silence was often interpreted as pride."

Moltke preferred to express himself not in public flights of oratory but in top-secret war plans.

OVERCOMING GEOGRAPHY

The strategic challenges that Moltke inherited as chief of staff would have daunted a lesser man. The 1815 Congress of Vienna had added to Prussia's domains but also made them harder to defend. Prussia acquired much of the Rhineland and Westphalia in the west. Eventually, this would be a great boon, for the Rhineland would become one of the wealthiest and most industrialized regions in the world. But from a military viewpoint the added territories were quite a headache. They were not directly connected to the rest of Prussia; in between were the independent German states of Hanover and Hesse-Kassel. It was as if Prussia were made of two giant icebergs floating in treacherous, shark-infested waters, for all around were potential foes—France, Russia, Austria, Denmark, and the other German states.

Prussia was not considered one of the leading powers of Europe; it was not even the dominant power in Germany. That position was occupied by the Austrian Empire, leader of the German Confederation, which had replaced the defunct Holy Roman Empire. The thirty-nine-member Confederation did not have much power, but in its Diet in Frankfurt, Prussia was in a distinct minority. Prussia tried to counteract its isolation by creating a Zollverein, or customs union, which excluded Austria, but this could hardly disguise Vienna's preeminence in central Europe.

Along with the difficulties of geography, Moltke confronted the challenges of changing technology. It was a tribute to his peculiar genius that he figured out a way to harness three key innovations—the railroad, telegraph, and rifle—so as to compensate for Prussia's inherent vulnerability and turn it, improbably enough, into the strongest state in Europe, if not the world.

Railroads came to Germany a decade later than they did in Britain: The first steam-driven railway, covering less than four miles, was not opened until 1835, when Britain already had 340 miles of track. Railroad promoters had trouble raising enough capital and getting rights of way, so they turned to governments for help. Initially the Prussian army was not too impressed by the possibilities of railways whose carrying capacity, in the early days, was severely limited. One of the exceptions was Moltke, who as a major in 1841 joined the board of the Berlin Hamburg Railway and sank most of his savings into its stock. Moltke was fascinated by the possibilities of steam power once he discovered that railroads could transport troops ten times faster than Napoleonic armies had marched and that a single train could carry as much as one thousand horse-drawn carts. He produced a steady stream of memoranda and reports on the military uses of this new form of transportation.

As the size of the German railway system expanded to 3,638 miles by 1850, the rest of the Prussian army awakened to its possibilities. The Prussians made use of railroads in 1848 to rush troops from city to city to squelch the liberal uprisings. Further confirmation of railways' usefulness came from other conflicts that were carefully studied by the General Staff, such as the Italian War of 1859 (pitting Austria against France and her Italian allies) and the American Civil War of 1861–65.

With railways proving their worth, the state got more involved. Laws and conventions were signed to ensure the uniformity of rail lines in Prussia and other German states. A Prussian Railway Fund was set up to subsidize the construction and operation of some lines that were militarily valuable but not commercially profitable. By 1860 about half of Prussia's railway lines were state-owned or -administered. And all Prussian freight cars were required to have fittings that would allow them to be used in wartime to transport soldiers and horses. A special Railway Section was set up within the General

Staff to synchronize rail movements in wartime, and Field Railway Detachments were created within the army to repair damaged tracks and build new ones. The General Staff even pressed successfully for the adoption of standard time for the entire country to facilitate planning and execution.

By taking full advantage of railways, Moltke hoped that his soldiers could mobilize and deploy before their enemies did. They could then dash from one end of the kingdom to the other to deal with different threats. Railroads were particularly important because Prussia depended heavily on reserves and had a smaller standing army than neighboring states like France and Austria. Speed was of the essence if Prussia was to beat its enemies to the punch. All reservists were told exactly where they had to go when the mobilization order was given, and all regiments were provided with railheads at which they would assemble. Mobilization was facilitated by the fact that each regiment was based in the district from which it recruited. The General Staff knew that it would have to plan everything precisely, down to the minute, otherwise bottlenecks would develop and troops and supplies would not be able to move fast enough.

If hundreds of thousands of soldiers had to be mobilized within a matter of weeks, there was no time to send orders by horse courier. Luckily, the development of the electric telegraph allowed nearly instantaneous communications between headquarters and various divisions. In theory, that link could be maintained even in the field if soldiers strung copper wire as they advanced; in practice, armies usually outran their tether to headquarters. Nevertheless, improvements in communications allowed effective command and control to extend over a much wider area than in the past, and hence made possible another leap in army size. Napoleon had been able to control an army only as far as he could see with the aid of a telescope; Moltke hoped to control troops spread over hundreds, even thousands, of miles.

The chief of staff realized that while he could send general orders over long distances he could not manage a battle in detail from afar. He insisted that his subordinates digest the general principles of the war plan and then exercise their own initiative in carrying them out. "No plan of operations can look with any certainty beyond the first meeting with the major forces of the enemy," Moltke famously wrote. "All consecutive acts of war are, therefore, not executions of a premeditated plan, but spontaneous actions, directed by military tact."

To avoid the temptation to micromanage, Moltke instructed that "an order shall contain everything a commander cannot do by himself, but nothing else." These spare *Auftragstaktik*, or "mission-type orders," became a hallmark of the Prussian, and later the German, army. So ingrained did this system of delegation become that in 1864, when the Prussian commanding

general ordered an invasion of the Danish duchy of Schleswig, his order simply stated: "On February 1st, I want to sleep in Schleswig."

Mobilization and deployment could get an army only so far. It still had to come face-to-face with the enemy forces and defeat them. Prussian soldiers were well equipped for this task because by the 1860s they possessed a better infantry weapon—the breech-loading rifle—than any other army in Europe.

The advantages of rifled barrels had been recognized early in the Gunpowder Age: The grooves imparted a spin to the projectile which made it possible to fire over longer ranges with greater accuracy. (The same principle explains why football quarterbacks, tennis players, and other athletes put spin on their balls.) But a rifle was hard to load, because a ball had to be laboriously forced down the barrel in order to grip the grooves. This limited its suitability for general military use. Most infantrymen were issued less accurate but faster-loading smoothbores. Rifles were generally reserved for hunters or specialized units of snipers. Yankee backwoodsmen made especially effective use of them against British redcoats during the American War of Independence.

Rifles began to spread in the nineteenth century following the invention of a cone-shaped bullet, hollow at the base and pointed at the nose, that was easy to drop down a muzzle and expanded when fired to grip the barrel's grooving. A French army captain named Claude-Étienne Minié perfected this design in 1843. His bullets were generally combined with a copper percussion cap that first appeared in the 1820s and was much more reliable than the old flintlock firing mechanism, especially in foul weather. The result was still a muzzle-loading musket but one that had been brought to new heights of deadly efficiency. Minié rifles could be fired with reasonable accuracy up to five hundred to eight hundred yards, or eight times the range of the old flintlocks, and their rate of misfires was twenty-five times lower. They proved their worth in the Crimean War, where the British and French troops, who had Miniés, mowed down the Russians, who did not.

Four years later, in the American Civil War, both sides started off largely with smoothbores but had completely changed over to percussion-cap Minié rifles by 1863. The result was 620,000 dead soldiers—more than would be killed in all of America's other wars combined. Unlike in the past, most wounds were caused by small arms, not artillery. (Most deaths, however, were the result of disease, not gunshot.) This slaughter occurred in large measure because commanders on both sides had trouble coming to grips with the destructive potential of these new weapons. The leading officers of both the Union and the Confederacy had learned their trade in the Mexican War (1846–48), the last major conflict fought mainly with smoothbores. Having seen frontal assaults work against the Mexican army, they tried the same tactics

stock, the Spencer, patented in 1861, represented a considerable advance over the needle gun.) But the inflexible conservatism of the Union army and in particular of its mulish ordnance chief, General James W. Ripley, prevented these revolutionary rifles from becoming standard issue for all soldiers, in spite of the importuning of President Abraham Lincoln, who had personally fired, and been impressed by, the Spencer and Sharps guns. Ripley was convinced that these easy-to-fire rifles would simply waste ammunition, and he wanted nothing to do with them. Seldom has there been a more egregious example of an army failing to take advantage of readily available technology that might have shortened a war.

The Prussian military, despite its reputation as a den of reactionary aristocrats, showed itself more willing to innovate even without the spur of a major conflict. The Prussians had seen the possibilities in Dreyse's work early on and had been subsidizing him since 1833, though it took several years for him to improve his design sufficiently to win a large order. After extensive field trials and his personal test firing, King Friedrich Wilhelm IV ordered sixty thousand needle guns in 1840. The production of guns had been simplified by Eli Whitney and other American inventors who in the early nineteenth century had come up with a system of interchangeable parts. But it took a long time for Dreyse to ramp up his operation to meet the Prussian army's growing demand. At first only 10,000 needle guns a year were produced, a figure that eventually rose to 22,000. At that rate it took more than twenty years to reequip all of Prussia's 300,000 active-duty and reserve soldiers. By 1866 all Prussian infantrymen finally had the needle gun.

Dreyse, an independent businessman, would have been happy to sell his products to France, Austria, and other nations too, but they weren't interested; they remained devoted to the Minié rifle and the bayonet charge. The French beat the Austrians in 1859 despite having an inferior musket. They had won through élan, by pushing home infantry assault after infantry assault. The Austrians decided that if it had worked against them, it would work for them. Their field regulations of 1862 downplayed the importance of rifle fire in favor of mass bayonet charges. While Prussian infantrymen went to rifle practice, their Austrian counterparts engaged in wind sprints. Like the Union Ordnance Department, the Austrian high command thought that breech-loading rifles would simply waste valuable ammunition by allowing soldiers to fire too often. In 1866 their infantry would be equipped with the Lorenz-model Minié.

The Austrians were not totally oblivious to the march of technology. Following their defeat to the French in 1859, they had reequipped their artillery with rifled muzzle-loading bronze cannons. The advantages of grooving were as great for cannons as for small arms. An old smoothbore cannon was useless beyond 1,500 yards; new rifled guns were effective at 4,000 to 5,000

against each other and turned farm fields into abattoirs. It took a few years of slaughter for both sides to start hiding their troops in trenches or dispersing them in order to mitigate the rifle's impact.

The Civil War brought muzzle-loaders about as far as they could go. Further progress would necessitate changing over to breech-loaders, which were faster and easier to load. A German craftsman named Johann Nikolaus von Dreyse led the way. Starting in the 1820s he began tinkering with new designs for what eventually became the *Zündnadelgewehr*, or needle gun, so called because the firing mechanism was a needle that drove through the paper casing of a cartridge to ignite its primer, thereby creating the mini-explosion needed to propel a lead ball out the barrel. This in itself was no improvement over the competition; it was in many respects less efficient than the percussion-cap musket. What made the needle gun special was the method of loading: the bullet went into the breech, not the muzzle. It was locked into place by pushing down a knob resembling the turn bolt of a door, which also automatically cocked the firing pin. Dreyse had made one of the first bolt-action rifles, a design still in common use to this day.

The disadvantages of the needle gun were many. The novel breech mechanism leaked gas, dissipating the force of the explosion. The needle gun's effective range was a bit less than the Minié rifle's (though still much greater than that of a smoothbore like the Brown Bess). The gun was also prone to malfunction. Jams caused by overheating were common, and soldiers were sometimes forced to use a rock to hammer the bolt open. The delicate needle was even more unreliable; it was so prone to break that riflemen had to carry spares.

But, flawed as it was, the needle gun represented a quantum advance over the Minié rifle. For one thing, it could be reloaded lying down or crouching, much to the relief of infantrymen who were exposed to enemy fire when they had to stand erect to load a traditional musket. Even more important, it could be reloaded much faster than any muzzle-loader—more than three times as fast as the Minié. This meant, as one historian notes, that "a ten-thousand-man unit armed with breechloaders was the equivalent of thirty thousand or forty thousand muzzleloaders or more."

The potential of breech-loading small arms first became apparent during the American Civil War. A regiment of Union "sharpshooters" armed with the Sharps single-shot breech-loading rifle (roughly comparable to the needle gun) shredded larger Confederate formations armed with muzzle-loaders at battles ranging from Antietam to Gettsyburg. The U.S. 1st Mounted Rifles, popularly known as Wilder's Lightning Brigade, had similar success in the Western theater of operations with their Spencer repeating rifles. (A breech-loader capable of firing seven shots from a magazine hidden in its wooden

yards. Their ammunition changed also, from mainly solid cast-iron balls to explosive shells. The Prussians, too, were buying rifled cannons from a manufacturer named Alfred Krupp. But because the Prussians had spent so much money reequipping their infantry, they were unable to complete the process with their artillery by 1866. More than a third of Prussia's cannons were still antiquated bronze smoothbores, whereas Austria had gone over almost entirely to rifled pieces. Austria had 736 rifled cannons, Prussia only 492.

The Austrian edge in artillery was insufficient to cancel out the Prussian advantage in small arms, however, because the rifle had usurped the cannon's traditional place as the queen of the battlefield. In the American Civil War, rifles accounted for 86 percent of casualties, cannons only 9 percent. This was because the increased range of the rifle made artillerymen, who traditionally plied their trade from the front line, vulnerable to being picked off by infantrymen. The solution was to increase the range of artillery and move it into protected positions in the rear, allowing gunners to hit targets that they could not see by relying on forward spotters. But effective "indirect fire" did not become practical until the advent of field telephones and radios in the early twentieth century. In the meantime, as the Austrians were to learn to their sorrow, artillery's role on the battlefield had been much diminished.

BLOOD AND IRON: THE ROAD TO KÖNIGGRÄTZ

German unification had first become a real possibility in 1848. Liberals hoped to unite the various German states in a parliamentary democracy. But while granting a few of their demands, the king of Prussia, the emperor of Austria, and other German rulers had no intention of giving power to the people. After the liberal uprisings were crushed, the forces of conservatism schemed to snatch away the banner of nationalism. In 1862 Otto von Bismarck was appointed minister-president of Prussia, and the crafty politician maneuvered aggressively to unite all of Germany under the grip of King Wilhelm. He vowed, "The great questions of the day will not be decided by speeches and the resolutions of majorities—that was the great mistake from 1848 to 1849—but by iron and blood."

To ensure that Prussia would prevail in the coming struggle, King Wilhelm increased the military budget and the number of conscripts. The Prussian parliament, which had been created in 1849, refused to approve these measures, so the king simply ignored it. Military and foreign policy was to remain a royal prerogative as long as the Hohenzollerns ruled.

Prussia's revamped military met its first test in 1864 against a weak foe, Denmark. Popular sentiment in the German states had long been agitated by Danish rule over two duchies full of ethnic Germans, Schleswig and Holstein. Bismarck saw this as a convenient opportunity to enlarge Prussia's domains while converting Berlin from the enemy of German nationalism to its leading champion. Austria and the rest of the German Confederation went along, contributing a substantial force for the invasion of the duchies, which began on February 1, 1864.

The Danes had constructed some formidable defensive positions, but their weaponry was hopelessly outdated; they had neither breech-loading muskets nor rifled cannons. The Prussians, on the other hand, had not fought a real war in more than fifty years, and their rustiness showed. The Danes were not decisively defeated until the original Prussian commander, a relic of the Napoleonic Wars, was replaced by Prince Friedrich Karl, who brought Helmuth von Moltke with him as chief of staff. Moltke designed a daring amphibious operation that seized the fortified Danish island of Alsen and persuaded the king of Denmark to sue for peace.

Once Denmark was out of the way, the next target for Prussia was Austria, for, as Bismarck had once observed, "Germany is too small for us both." This was a much more formidable adversary than Denmark. Moltke, who predicted, "The struggle will be terrific," had been planning for this conflict since 1860, but he revised his plans in light of the lessons of the war with Denmark. He had seen the high casualties sustained both by German troops attacking Danish fortifications and by Danish troops attacking Prussians armed with the needle gun. With weapons becoming deadlier, Moltke realized that a massed frontal assault would be suicidal. But trying a flanking maneuver on the battlefield was also extremely hazardous because of the greater range of guns—artillery shells could now cover three miles, rifle bullets more than half a mile.

The answer, he decided, was an envelopment on a grand scale. His flanking maneuver would begin from the first day of mobilization when three Prussian armies would take trains to three different locations. From there, they would march toward the Austrians, hoping to arrive before the other side had completed its mobilization and catching the enemy in a vise. Instead of concentrating their forces before facing the enemy—the usual practice of Napoleon and countless other generals—the Prussians would unite only after the battle had already been joined. Moltke thought this risky scheme was justified because if all his armies started off from one location, moving and provisioning so many men would take too long. To seize and keep the initiative, Moltke proposed to take full advantage of railroads and telegraphs. He knew that Prussia had the edge here. It had five railroads running to the Habsburg frontier in Bohemia,

while the Austrians had only one railroad running from Vienna. Prussia could complete its mobilization and deployment in three weeks, twice as fast as the Austrians. That opened a window of opportunity when the Prussians would have "numerical superiority, and this," Moltke calculated, "is the period which we must use with all speed and energy to bring about great decisive battles."

The author of this daring plan did not anticipate all the difficulties of implementing it, not the least of which would be persuading King Wilhelm I to go along with it. Moltke had not reckoned with the king's hesitancy to attack his fellow German monarch, Emperor Franz Josef of Austria. In early 1866, Bismarck and Moltke urged Wilhelm to strike, warning him that "every day's delay may mean an incalculable loss." Strengthening the case for immediate action, Bismarck concluded an alliance with the new Kingdom of Italy in April to open a second front against Austria if war broke out within ninety days. But even after Austria ordered a full call-up on April 21, Prussia waited to follow suit until May 12. The Prussians thus lost an opportunity to strike before the enemy was ready, showing how political calculations can upset the best-laid military plans. But Austria was not able to take advantage of its three-week head start. Prussia used its superior mobilization capabilities to catch up fast.

Once their forces were assembled, the Prussians' immediate priority was to deal with the other German states, most of which were friendly to Austria. If 150,000 German troops joined with the Austrian Northern Army, 240,000 strong, the Prussians would face an insurmountable disadvantage. The Prussians solved this problem by issuing ultimatums on June 15, 1866, to the other German states to disarm immediately. When they did not respond, Prussian armies invaded the next day. Hanover, Hesse, and Saxony fell in short order. Only the Saxon army of thirty-two thousand men managed to escape the fast-moving Prussians and link up with the Austrians. But to do so they left their homeland undefended, giving the Prussians another invasion route into Bohemia. Bavaria, Austria's major German ally, was taken aback by this rapid Prussian offensive and decided to use its army for defensive purposes only, leaving the Austrian and Saxon armies on their own. There was still the danger of French intervention (France would not want Prussia to strengthen itself by defeating Austria), but Moltke, gambling that Emperor Louis Napoleon would not move fast enough, denuded western Prussia of troops, sending every man he could find to the east.

By June 21, 1866, the day that King Wilhelm declared war on Austria, the bulk of Prussia's army was deployed in a 250-mile arc around the borders of Bohemia from the Elbe River to the Oder. The Prussians had been holding their forces back, not certain what the Austrians would do. They wanted to be sure they had enough troops to block a sudden Habsburg thrust toward Berlin or into the coal-rich Prussian province of Silesia. Within a few days,

however, it became apparent that the Austrians had no intention of taking the offensive; they were too disorganized. So on June 22, the order went out from headquarters in Berlin to the First Army in Lusatia and the Second Army in Silesia: "His Majesty commands that both armies march into Bohemia and seek a juncture in the direction of Gitschin." (These orders also affected the Elbe Army in Saxony, which was considered subordinate to the First Army.)

The man giving the orders was Helmuth von Moltke. That was by no means foreordained, since the chief of the General Staff had not, until this point, been in operational control of field armies. Traditionally the General Staff had been subordinate to the minister of war, who in turn reported to the king. But Moltke's stature had grown since his successful role in the Danish War. He had won the right to report directly to the king, bypassing War Minister Albrecht von Roon. On June 2, 1866, Wilhelm had gone further and given Moltke the right to issue orders in the king's name. Since this command structure was new, the little-known chief of staff was not always able to get his way with the strong-willed generals in the field. One division commander, upon receiving an order, was said to have exclaimed, "This is all quite correct, but who is General *Moltke*?"

The slight confusion caused by the Prussian change in command was as nothing compared to the chaos that gripped the Austrian high command. The commander of the Austrian Northern Army was Lieutenant General Ludwig von Benedek. A Hungarian Protestant and the son of a doctor, Benedek had established his reputation by fighting gallantly in a losing cause against France in 1859. He had spent virtually his entire career in Italy and knew nothing of Bohemia. When Franz Josef tried to offer him the job, he declined, finally agreeing only after the emperor insisted. Benedek was no military intellectual like Moltke; he was a "muddy boots" general who mocked "professors in shoulder straps" and enjoyed drinking with enlisted men. In his view, "the only talents required in a staff chief are a strong stomach and a good digestion."

Nor did Benedek have a competent staff to make up for his deficiencies. His chief advisers were cautious and pessimistic. Austria had its own general staff, but its work was shoddy and slipshod. One staff officer who was sent on a mapping expedition to central Germany in the early 1860s made a beeline for the casinos at Bad Ems. He wrote back to Vienna that his work wasn't very important anyway; the staff could learn everything they needed to know by perusing Baedeker's guidebook.

Compounding the Habsburg army's problems was its polyglot nature. Nine languages of instruction were used in peacetime, ranging from Serbo-Croatian to Rumanian. In battle, all orders were issued in German, which many soldiers did not understand. Since they were part of a multiethnic

empire, Habsburg soldiers lacked the kind of national cohesion that bound together their Prussian foes, whose battle cry was "With God for King and Fatherland!"

Austria, unlike Prussia, did not undertake wide-ranging reforms to improve its governance after suffering defeat at Napoleon's hands. The state structure remained rickety, its administration corrupt and inefficient, its finances uncertain, its ideology reactionary. The chief focus of the monarchy was repressing its own population, not mobilizing it to defeat outside threats. Austrian soldiers were brave and well motivated but poorly led. Benedek and the other top generals displayed a curious passivity even as the bulk of the Prussian army descended upon them. They placed their faith not in rapid movement but in antiquated fortresses such as those at Josephstadt and Königgrätz. Instead of moving decisively against any one of Prussia's three armies, they hesitated everywhere, thus ceding the initiative to the invaders.

The Prussian forces crossed the Bohemian frontier on June 23. Three days later, as they were emerging from the Giant Mountains, they made their first sustained contact with Austrian defenders. The results did not bode well for the Habsburg army. In the village of Hühnerwasser, one Prussian company used its needle guns to annihilate two Austrian battalions that were foolish enough to attempt a bayonet charge over open ground. The Prussians lost 50 men, the Austrians 277. A Prussian witness wrote that "the wood and the road were plastered with dead and wounded. There were Austrian bodies and backpacks as far as the eye could see. Trees had been stripped of their bark by our fire and the cries of the wounded were heart-rending."

The outcome was equally one-sided in the village of Podol later that same day (June 26). In a murderous nighttime fight to control one of the crossings over the Iser River, the Prussians cleared out the Austrians house by house. When the Austrians tried a frontal attack, the needle gun again proved an efficient killer. A force of two thousand Austrians suffered 50 percent casualties.

Those engagements set the pattern for the next three days. As one Prussian force after another popped out of the mountain passes, the Austrians tried to block their way, only to be mowed down by the needle gun. On the one occasion when the Austrians prevailed, the victory was a pyrrhic one. At Trautenau on June 27, the Austrians managed to repel the vanguard of the Second Army, but in the process they lost 5,780 casualties to the Prussians' 1,280. And the Austrians had to pull back anyway when the bulk of Prussia's Guard Corps arrived. The outcome might have been very different if the Austrians had gambled by throwing a large force against one of the Prussian armies when it was most vulnerable, while making its way through the narrow mountain passes. But the irresolute Benedek hesitated to commit himself.

The opening rounds of the war cost the Austrian army thirty-one thousand casualties, including a substantial number of prisoners, and left its commander deeply dispirited. On June 30, Benedek sent a desperate telegram to the emperor: "I beg Your Majesty urgently to make peace at any price. Catastrophe for the army is unavoidable." Franz Josef was puzzled by this defeatist talk from a general who had yet to fight a major battle. He wired back, "To conclude peace is impossible." And then he (or, rather, one of his ministers) added a barbed question: "Has a battle taken place?"

The demoralized Benedek began to pull back his forces to avoid getting caught in the Prussian pincer. On July 1, his Northern Army occupied a camp site near the fortress of Königgrätz. Benedek's decision to pause here has been the subject of much puzzled discussion by contemporaries and historians alike. As a defensive position, the plain in front of Königgrätz was a curious choice, since the Elbe River was at the army's back, cutting off its lines of retreat. Some suggest that Benedek deliberately chose this position because he felt pressured by the emperor to force a major battle that might never have happened if he had continued retreating over the Elbe. Others argue that Benedek had no such premeditation, that he had no intention of fighting a battle with the river at his rear; he simply hoped to delay the Prussian army to allow his forces to escape. It may be that not even Benedek himself was sure exactly what he was up to. One of his generals later testified that on July 2 the Austrian commander "was physically and morally a broken man." The confusion of the Austrian high command was intensified by Benedek's decision, taken under pressure from the emperor, to sack his chief of staff on the very eve of the battle.

But whatever his motivations—whether to cover his continued retreat or to prepare for a decisive battle—Benedek did order some entrenching work to be done on the left bank of the Elbe. On July 2, artillery batteries were positioned on a series of hills to cover the approaches from the west. As the work continued, Benedek's spirits lifted. He began to think that perhaps he could prevail after all, "if my old luck does not desert me." Not unreasonably. Moltke himself later wrote that the Austrians occupied "an extremely strong position."

BLUNDERING INTO BATTLE

At the time, the Prussian high command had no idea of the enemy's dispositions. For all the vaunted capabilities of the telegraph, the Prussians were operating in an information blackout. Their scouts had entirely lost contact with the main body of the Austrian army. The Austrians likewise had no

idea where the Prussians were, even though by July 2 the two armies' outposts were less than five miles apart.

After having issued orders by telegraph from Berlin to his forces in the field, Moltke decided this was no longer sufficient. "War cannot be conducted from the green table," he believed, referring to the desktop at headquarters where troop dispositions were displayed. "Frequent and rapid decisions can be shaped only on the spot according to estimates of local conditions." With a battle brewing, Moltke decided he had to be on the spot himself. On June 30, the king, Bismarck, Moltke, and a large retinue journeyed in six railway cars from Berlin to join the First Army at Gitschin, a Bohemian town that more than two centuries earlier had served as Wallenstein's headquarters.

Upon his arrival, Moltke discovered an exhausted, badly supplied force. For all the General Staff's voluminous planning, logistics had been badly bollixed up. The staff had placed too much reliance on railways. They expected, for instance, that army bakeries in Cologne would be able to send their bread all the way to the Bohemian border by rail, not realizing that this would take so long that the resulting loaves would be inedible. The staff also had not made adequate arrangements for supplying the army once it moved out of reach of the railroads, which happened once it started crossing the Giant Mountains. There was inadequate provision for horse-drawn vehicles to ferry supplies from railheads to troops who were advancing on foot and horseback.

The staff had expected that the troops could live off the land, but they had not reckoned on the massive increase in army size. Living off the land worked tolerably well for a seventeenth-century army of thirty thousand men; it was much more difficult for the quarter of a million men of the Prussian army in 1866. Moltke tried to ameliorate this problem by spreading his troops out over hundreds of miles, but this offered only a partial solution. Prince Friedrich Karl and his First Army staff were reduced to surviving on potatoes and a few bottles of champagne. On the day of the battle itself, Moltke told his wife he had nothing to eat beyond "two chocolate bonbons and a small piece of bread." Luckily for the Prussians, Austrian logistics were just as bad.

On the evening of July 2, some Prussian cavalrymen galloped into the First Army headquarters with news that they had discovered the main Austrian force at its campground in front of Königgrätz. Without consulting anyone or seeking instructions, Prince Friedrich Karl resolved on an attack the next morning with the First Army and the Elbe Army. He sent a dispatch to the Second Army headquarters, asking his cousin, Crown Prince Friedrich Wilhelm, to dispatch a corps to cover his flank in the coming battle. Only then did he bother to send another rider to the king's headquarters to notify Moltke of his intentions.

When the dispatch arrived at 11 P.M., Moltke was awoken to read it. Groggy though he was, the chief of staff made an instantaneous and accurate evaluation of the situation. He realized that Friedrich Karl was facing the entire Austrian Northern Army, and that it would take not just one corps but all of the Second Army to prevail against such a powerful foe. Moltke immediately sent riders of his own to the Crown Prince's headquarters with fresh orders: "Your Royal Highness will be good enough immediately to make the necessary arrangements to be able to advance with all your forces in support of the 1st Army against the right flank of the enemy's probable advance, and in so doing to come into action as soon as possible."

It is upon such snap judgments, made with incomplete information and without the leisure of reflection, that wars—and empires—are won or lost.

The vanguard of the Second Army did not start marching until 7:00 A.M. It was a hard slog. Because the roads were not big enough to contain so many men, they were forced into fields that were turning muddy in the driving rain. Pulling the artillery through the oatmeal-like goop proved especially difficult. Not until 12:30 P.M. did the Second Army's advance units join the battle, falling on the vulnerable right flank of the Austrian line as Moltke had intended.

Benedek had received intelligence more than an hour before about the imminent arrival of another major Prussian force, but he had not been able to sufficiently strengthen his right wing because so many of the troops from that area had been sucked into the desperate fight in the Swiepwald against Fransecky's 7th Division. Most of the Austrians on the right were not even aware that another Prussian army was about to hit them. When the Second Army arrived, many Austrians were so surprised they surrendered without a fight. "Good God! Where do they come from?" startled Austrian officers wondered.

The Prussian high command knew exactly where these late arrivals had come from; their only wonder was why it had taken them so long to show up. Watching from the hill at Roskosberg, the king and his chief of staff breathed a sigh of relief once they saw through their spyglasses the dark blue coats and black *Pickelhauben* of the Second Army coming into contact with the white-coated Austrians. "The success is complete," Moltke supposedly told the king. "Vienna lies at Your Majesty's feet." Not quite. Much hard fighting remained. But to a strategist of Motlke's caliber, who had played out such scenarios in many war games, it was not hard to project forward several hours and realize the inevitable result of his flanking maneuver now that it was finally under way.

The strong point of the Austrian lines, the key to the whole position, was the hill at Chlum. From here a plethora of artillery batteries had been

pounding the Prussian First Army to the west all morning. The Hungarian troops who were manning the small village of Chlum were caught utterly by surprise when they were assaulted from the *north*. Their regimental commander, upon being told that blue-coated troops were advancing up the hill, thought they must be Saxon allies. "You are seeing phantoms!" he roared to one subordinate who insisted they were actually Prussians. Around 2:30 P.M. the phantoms burst from the fog and tall grass that had shielded their advance and routed the panicked Hungarians. Officers tried to stop the retreat, beating soldiers with the flats of their swords, yelling, "You cowards! Stand there, you yellow dogs!" But those who stood and fought were methodically cut down by the needle guns. One Austrian artillery battery put up a particularly brave resistance, but they did not last long. A few minutes of rifle fire killed fifty-two men and sixty-eight horses. Today, visitors to Chlum can see an obelisk monument commemorating the "Battery of the Dead." The Prussians that afternoon did not give much thought to the corpses around them. They wheeled their own cannons to the top of the hill and turned them on the Austrian troops spread out on the plain before them like sheep ready for slaughter.

Benedek was informed of the fall of Chlum at 3:15 P.M. In the next several hours he threw everything he had into an attempt to retake the heights. The Austrian reserve artillery opened up a withering bombardment of Chlum and the neighboring village of Rosberitz. "The air was literally filled with shells, shrapnel and canister," wrote a Prussian officer; "branches of trees, stones, splinters flew around our ears and wounded many . . ." Then came the Austrian infantry, fighting their way house by burning house through Rosberitz. At heavy cost, the Austrians retook Rosberitz and then moved on to Chlum.

Wave after wave they came, Austrian troops charging madly up the hill, bayonets pointed, legs pumping, voices screaming hoarsely. And down they went, wave after wave, scythed by the relentless roar of the Prussians' needle guns and cannons. Within less than an hour one Austrian corps lost more than six thousand men. The relatively small number of Prussian guards who were holding the hill might nevertheless have been overwhelmed by the sheer weight of the Austrian assault were it not for the arrival at 4:30 P.M. of another entire army corps. The Prussians now had overwhelming numbers to hold Chlum. All hopes of a successful Austrian counterattack had ended.

Across the battlefield, nine miles to the south, the other side of the Austrian line was also crumbling. After having been held at bay all morning, the Elbe Army managed to turn the flank of the Saxons who were holding the left side of the Austrian position. Seeing what was happening on the two flanks, at 4 P.M. Moltke gave the long-awaited order for the First Army to advance in the center. The Prussian soldiers, who had been shot at all day,

surged forward, a war correspondent noted, "with loud cheers and drums beating."

For the Austrians, the battle was lost. Benedek wired the emperor: "The catastrophe I warned you of two days ago happened today." The only remaining question was whether Moltke would be able to complete the grand envelopment that he had envisioned. Thanks to the suicidal bravery of the Austrian cavalry and artillery, he could not quite pull it off. Benedek, displaying a calmness in defeat that he had not exhibited when victory was still within his grasp, sent his horsemen forward to stop their Prussian counterparts from turning what was already a retreat into a rout. The Austrians lost more than 1,100 men and 1,600 horses to a barrage of Prussian artillery and rifle fire, but in the process they bought a precious half hour that allowed the Austrian reserve artillery to wheel their batteries forward. The gunners kept up a steady fire for hours, sacrificing themselves to prevent the Prussians from pressing the fleeing infantry too closely.

Hordes of Austrian soldiers streamed east, losing all semblance of order along the way. Hundreds drowned in the Elbe. Others made it over makeshift bridges only to find the gates of the Königgrätz fortress closed against them. It took hours to convince the fortress commander, who was terrified of being invaded by the Prussians, to open up. In the meantime, Austrian troops were crushed and suffocated in the rush to get inside the walls. In the next few days the Austrians continued their headlong retreat. The Prussians let them go. They were too tired themselves to set off in pursuit; "many of them had been 19 hours on the march and 10 hours engaged with the enemy," according to the official Prussian General Staff history. The victorious army made camp on the battlefield, eating whatever crumbs they could find before sinking into sleep.

Some commentators have faulted Moltke for letting the bulk of the Austrian army slip from his grasp, but it was no great loss. The Austrians and Saxons left behind all their artillery and most of their supplies. Even a month later, a reporter found the fields "literally covered with knapsacks, scabbards, cartridge pouches, cooking pots, and all the various articles which soldiers carry with them." In addition to their materiel, the Austrians left many men behind. They lost 19,800 taken prisoner and another 24,400 dead, wounded, or missing—44,200 in all, or 21.5 percent of their total strength. The Prussian casualties were much lower: 9,172 men killed, wounded, and missing, just 4 percent of their total force. The losses were highest among those on both sides who had fought in the Swiepwald and on Chlum hill.

On a percentage basis the casualties were lower than in many battles of years past, but because the overall number of men engaged was so large (Königgrätz was one of the biggest battles fought in Europe to that point), the

amount of suffering was still very great. One reporter noted, "Every cottage in the neighborhood that had not been burnt was full of wounded." There were not enough doctors to tend to them all, and many did not survive. Anyone motoring today near the Czech city of Hradec Králové (as Königgrätz is now known) can still see gravestones and monuments with their inscriptions in German to gallant, long-dead soldiers of both sides.

The Austrians had been so badly roughed up that they would fight no more. The day after the battle, a Habsburg field marshal was sent to seek a truce from the Prussians. "My Emperor no longer has an army," he said. "It is as good as destroyed."

Moltke wanted to follow up by marching on Vienna, but Bismarck restrained him. The prime minister was fearful that if the war continued, France (then considered the most powerful nation in Europe) would ally itself with Austria and force Prussia to fight a two-front campaign for which it was not prepared. To avoid a lengthy conflict and to produce a lasting peace, Bismarck showed magnanimity toward the defeated Austrians. In the armistice negotiations, he did not ask the Habsburg empire to give up one foot of its soil beyond the province of Venetia, which went as a reward to Berlin's ally, Italy; Prussia gave back the occupied lands of Bohemia and Moravia. In return, Austria had to agree to dissolve the German Confederation and to renounce all hope of a leadership role in Germany. Berlin annexed Schleswig and Holstein along with Hanover, Hesse, Nassau, and Frankfurt, thus uniting the two halves of Prussia and swelling its population to over twenty-three million, roughly the same size as France. The rest of the northern German states and free cities—Saxony, Hamburg, Lübeck, Bremen, Thuringia, Mecklenburg—were pressed into the new North German Confederation, ceding control of their foreign and military policies to Berlin. Within a couple of years, Bismarck forced similar treaties on the south German states. The formal announcement of the German Reich only awaited the defeat of France in 1870–71. However inevitable the process looks in retrospect, the creation of a German state would never have occurred, at least not in the form it took, absent the Prussian victory at Königgrätz.

The Austrian state suffered a near-fatal blow in 1866, as intelligent observers perceived at the time. Within a few months of signing the armistice with Prussia, the Habsburgs had to agree to share power with the Hungarians, turning what had once been simply the Austrian Empire into Austria-Hungary, the Dual Monarchy. Its prestige wounded, the sprawling and decrepit empire would be slowly picked apart in the years ahead by its various national components.

While Austria plummeted to new lows, the London *Spectator* observed, "Prussia has leaped in a moment into the position of the first Power of

Europe." And the military itself had become the first power within the Prussian state. The prestige that accrued from its role in uniting Germany by "blood and iron" gave the General Staff almost complete autonomy from the rest of the government. Before long, it was common to joke that Germany, like Prussia before it, was not a state with an army but an army with a state. The price of such military dominance proved to be high. It was the army, with its precise timetables for mobilization, that helped transform a Balkan crisis in August 1914 into a world war. A few years of total war would cost Germany the last vestiges of civilian government. The chief of staff, Field Marshal Paul von Hindenburg, who as a young officer had earned his baptism of fire at Königgrätz, and his ruthless lieutenant, General Erich Ludendorff, would become military dictators. Their stranglehold was broken only by the ignominy of defeat in 1918.

PLANNING TO WIN

While there is general consensus about the momentous consequences of Königgrätz, there is no agreement about why the battle went the way it did. Historians continue to debate whether it was Prussian competence or Austrian incompetence that accounted for the outcome. The safe answer, which has the added advantage of being true, is that it was a bit of both.

There is no question that Benedek played his hand badly. He failed to decisively attack the Prussians when they were at their weakest, while wending their way through the passes of the Giant Mountains. He then failed to take advantage of his initial success at Königgrätz on the morning of July 3. Until the early afternoon, the Austrians had a large numerical advantage over their Prussian opponents. If Benedek had gambled on an all-out offensive, he might have been able to crush the Elbe Army and the First Army before the Second Army arrived. Failing that, Benedek should have retreated while the going was still good. Instead he stayed in place, leaving his right flank dangerously exposed, and suffered the consequences. Moltke later commented that "[n]o one, of course, dreamed" that the enemy would open themselves up in this fashion.

The needle gun further contributed to the Austrian defeat. Time after time, their superior breechloaders allowed small Prussian units to maul more numerous adversaries. Fransecky's heroic 7th Division never could have held its pivotal position in the Swiepwald were it not equipped with rapid-fire rifles. As Friedrich Engels wrote afterward: "It may be doubted whether without [the needle gun] the junction of the two Prussian armies could have been effected; and it is quite certain that this immense and rapid success could not have been obtained without such superior fire, for the

Austrian army is habitually less subject to panic than most European armies."

Railways also helped determine the outcome. In just twenty-one days, the Prussians transported 197,000 men and 55,000 horses. Their rapid concentration and advance caught the Austrians off guard. The whole conflict lasted just seven weeks. The war against France four years later took slightly longer, because the French people refused to admit they were beaten, but the major combat was also relatively brief, in large part because the Prussians once again were able to transport and concentrate troops more rapidly than their foes.

Of course, railroads and guns do not operate themselves. The human factor must never be lost sight of. Observers generally agreed on the superior motivation and training of Prussian troops. An English journalist found that, in contrast to the peasant conscripts who made up the Austrian ranks in 1866, the Prussian "rank and file are men of education, who know what they are fighting about, not mere machines drilled to mechanical perfection." They were thus "more in earnest, more thoughtful, more willing to risk their lives for a principle, whether false or true, more imbued with a sense of duty."

Prussian commanders were also more thoughtful and more earnest than their Austrian counterparts. Above all, the genius of Helmuth von Moltke towered over the battlefield. As a reward for his service, the chief of staff was awarded a large cash grant by his grateful king, which allowed him to purchase a thousand-acre estate in Silesia. A few years later, his victory over France would earn him promotion to field marshal and the title of count. All those accolades were fully deserved. It is true that Moltke's plans did not work perfectly in 1866; the General Staff did a particularly poor job of meeting the army's logistical requirements. But Moltke and his "demigods" were far ahead of anyone else in harnessing industrial technologies to the demands of warfare. Their only rivals in this respect were Lincoln, Grant, Sherman, and the other Union leaders who had marshaled superior manpower, factories, railroads, and riches—though not superior technology per se (the North and South had roughly comparable weapons)—to crush the Confederacy. But their knowledge was lost after 1865, when the United States disbanded what had been for one brief moment the most powerful army in the world, whereas the German Army continued to develop Industrial Age warfare in accordance with Moltke's high-risk credo: "Great successes in war cannot be gained without great dangers."

The most important military innovation associated with Königgrätz—and the most lasting—was the superb planning that went into the Prussian victory. War had become too complex to be managed by one person, even a great captain like Napoleon, Frederick the Great, or Helmuth von Moltke.

A whole management system was now required, and all across Europe, states copied the Prussian model of the General Staff. All of the continental armies adopted such Prussian innovations as staff rides, war games, and, above all, the writing of complex war plans in peacetime. Many even imitated Prussia's spiked helmets. The Prussians still retained an edge, however, because no other general staff enjoyed the kind of unfettered power that theirs had. This advantage proved much more lasting than any technological edge, which did not—could not—last long in an age of frenetic weapons innovation.

Within days of Königgrätz, every army in Europe was rushing to buy its own breech-loading rifles, many of them superior to the thirty-year-old needle gun. Four years later, when Prussia went to war against France, its infantrymen were at a disadvantage in small arms. The French were armed with a newer breech-loader called the Chassepot that had three times the range of the needle gun. They even had a primitive machine gun called the Mitrailleuse, capable of firing 150 rounds a minute, though they were never able to make very effective use of it. Just as Austrian infantry had been slaughtered charging Prussian rifles in 1866, so Prussian infantry was slaughtered charging French rifles in 1870. Prussia prevailed anyway, ironically enough, because of its artillery. While its cannons had been inferior in 1866, they were superior by 1870. Having seen that muzzle-loaders were outdated, the Prussians scrapped them after 1866 and reequipped their entire force with Krupp's breech-loading rifled cannons made of cheap and durable cast steel. France continued to rely on old bronze muzzle-loaders. Better artillery gave Prussia a crucial edge in 1870 that allowed its gunners to annihilate the French army from long range.

Such technological flip-flops were to become common in the Industrial Age, when plummeting manufacturing costs allowed a state to completely reequip an army of hundreds of thousands within a relatively short period. No army could now afford to wait twenty years or more to field a new weapon, as the Prussians had waited for the needle gun. It was even more unthinkable that any army could rely on the same gun for a century and a half, as the British army had relied on the Brown Bess from the 1690s to the 1840s. In the Industrial Age inventions could transform the battlefield within months.

In those circumstances it proved impossible for any state to develop and maintain a lasting technological edge over equally sophisticated adversaries. Europe was swept by arms races in the decades before World War I, but no power gained an enduring advantage. By 1914 all the major combatants had repeating rifles, machine guns, quick-firing artillery, railroads, telegraphs, and all the other inventions that had transformed warfare.

They also had large conscript armies to operate those weapons. Following

Prussia's victories in 1866 and 1870–71, every major European state except Great Britain copied the Prussian system of putting a large portion of its young men through military training, conscripting them for a few years of active-duty service, and then keeping them in reserve for wartime. Just as Prussia had been subdivided into military districts, so too France, Russia, Italy, and other states were subdivided to facilitate mobilization. And just as Prussian mobilization plans had been drawn up by officers schooled in its War Academy, so other European states set up staff colleges of their own (France's École Supérieure de Guerre was founded in 1880) to bring their officers up to Prussian standards.

Amid this growing parity in personnel and weapons, not even the acknowledged excellence of Germany's General Staff was enough to deliver victory against the multitude of foes their country faced. Their previous triumphs led to a dangerous hubris among senior German officers. Moltke's successors—in particular Alfred von Schlieffen, author of the famous war plan that bears his name, who ran the General Staff from 1891 to 1905—thought their forces could defeat any combination of enemies, forgetting that Bismarck and Moltke had been careful to fight their foes one at a time and to avoid protracted conflicts by pursuing limited war aims. In 1914, the German army, its General Staff commanded by the elder Moltke's nephew and namesake, Helmuth von Moltke the Younger, tried an 1866-style strategic envelopment simultaneously against both Russia and France. The Schlieffen Plan came close to succeeding, but after initial victories in both east and west, the war settled down into a vicious stalemate. On the Western Front, parallel trenches stretching 475 miles from the North Sea to Switzerland produced the kind of attritional fighting that Moltke had been determined to avoid in 1866. On the Eastern Front, the sheer vastness of the Russian steppe made it impossible to finish off the czar's battered army until, in 1917, a revolution brought to power a new government in Moscow committed to exiting the conflict.

Everywhere, machine guns and artillery proved much more potent as weapons of defense than offense. This was mainly because they were bulky and hard to move; when troops advanced rapidly, the only weapons they could carry were rifles, which proved pitifully inadequate against the heavy firepower of dug-in defenders. The attackers might have called in artillery support, but it was impossible to accurately coordinate such fire without portable two-way radios, which did not yet exist. Lacking radio communications with advancing troops and afraid of hitting their own men, gunners had to suspend or shift their fire well before the first waves of infantry reached the enemy lines. Defenders simply burrowed underground like moles and then emerged, once the initial artillery barrage had lifted, to riddle the exposed attackers. The triumph of defensive technology consigned an entire

generation of European men to slaughter on a hitherto unimaginable scale. Offensive technologies capable of breaking this deadlock (the tank, submachine gun, radio, and airplane), along with the tactics to take advantage of them, finally emerged in the later stages of World War I, but they would not truly revolutionize warfare until World War II.

While the Industrial Revolution did not give any European power a lasting edge over its rivals, this did not mean that its geopolitical effect was negligible. The skillful use of industrial techniques made possible Prussia's rise from relative weakness into the most powerful state on the Continent. Outside Europe, the new technology enabled the white man to complete his conquest of the world. For while industrialization was leading toward military parity among European states, it was exacerbating the growing disparity between the West and the Rest.