When a *Spiel* is not a Game
The Prussian Kriegsspiel *from 1824 to 1871*

Jorit Wintjes
Seminar für Alte Geschichte, Julius-Maximilians-Universität Würzburg,
D-97070 Würzburg, Germany
jorit.wintjes@uni-wuerzburg.de

Abstract

The nineteenth century saw dramatic changes in military technology that profoundly changed the nature of warfare, and integrating the performance of that new technology into the existing operational and tactical thinking became hugely important. In Prussia, from 1824 onwards, the *Kriegsspiel*, the world's first professional conflict simulation in official use, became a key element for learning how to make best use of the new technology. Between 1824 and 1871, the rules went through several different editions, each one revised according to the latest technological and tactical developments. The paper will provide a brief historical introduction, then concentrate on the impact of technological innovations on the rules, and finally show that the *Kriegsspiel* and its non-Prussian counterparts are essential for understanding how military establishments in and beyond Europe reacted to the impact of technology on war.

Keywords

The nineteenth century saw dramatic and technological progress of unprecedented speed and scale, transforming both everyday life and the nature of warfare almost beyond recognition. Military decision makers on all levels had to adapt to these dramatic changes over the course of their careers. To take but one example: a Prussian infantry officer born in the early 1820s, who would have begun his career as a young lieutenant in the early 1840s, would then have experienced the transition from rifled percussion muskets—itself already

a significant improvement over weapons from the Napoleonic period—to needle guns, a transition which caused an extensive reshaping of infantry tactics due to the vastly different capabilities of the two weapons (Wawro 1996, 22–25). Assuming a standard career progression, he might then have been promoted a few times throughout the following twenty years before seeing the introduction of modern rifled breech-loading artillery in the early 1860s (Bailey 2004, 206–211). Now in his mid-forties and perhaps at the rank of a major, he could then have gained combat experience in the Second Schleswig War of 1864, the Austro-Prussian War of 1866, the Franco-Prussian War of 1870/71, or even all of them, experiencing personally the impact of the new weaponry on the battlefield. He would then have seen yet more changes in the aftermath of the Prussian victory of 1871, with a new—and again vastly more capable—infantry rifle replacing the needle gun, and with field telegraphy gaining importance. By the time of his discharge in the early 1880s he might even have witnessed the first experiments with machine guns, as the Prussian army had acquired its first Gatling guns already in 1867 (Müller 1873, 277) and by the end of the century machine guns had found their way into the unified German army.

Thus, while officers from an earlier age had been able to trust their own experience and that of their predecessors to remain valid throughout their careers, anyone serving between the 1820s and the 1880s would have had a very different experience. With technological progress making established knowledge about military matters quickly obsolete, it became necessary to re-learn as soon as new technology was adapted by the military. Essentially, the rapid technological progress between the 1820s and the 1880s created a race between knowledge about tactics and technology becoming obsolete and military decision makers trying to keep up to date. Training officers throughout their career became therefore essential; a constantly changing combat environment left little room for those clinging—willingly or unwillingly—to outdated ideas and concepts.

In the Prussian army, one important instrument for transmitting the effects of technological change to young officers was the *Kriegsspiel*. The impact of the *Kriegsspiel* today sometimes appears to be slightly underrated, judging by the limited amount of scholarly research it has so far attracted (brief overviews in Peterson 2016, 4–15; Wintjes 2016; Wintjes 2015; Van Crefeld 2013, 145–153; Peterson 2012, 221–240; Vego 2012; Berger 2000; Hohrath 2000; Pias 2000, 180–183; Perla 1990, 35–45; Knoll 1981, Young and Lawford 1967, 3–4; McHugh 1966, 27–58). At the time, however, and particularly in the early 1870s, it was seen by many contemporaries as one of the key reasons for the rise of Prussia to continental Europe's foremost military power. The present paper will therefore take a closer look at the Prussian *Kriegsspiel* and its character as a training

instrument in the face of the nineteenth-century technological revolutions in land warfare.

When a *Spiel* is Not a Game—The Prussian *Kriegsspiel*

The Prussian *Kriegsspiel* has a fairly complex prehistory which to explain in detail is beyond the scope of this paper. Two aspects of that prehistory, however, warrant some attention. One, many of the *Kriegsspiel*'s predecessors (see Table 1) were developed by civilians and not by soldiers. In fact, of seventeen inventors known at present for the period from 1664 to 1824, nine were civilians while only six are readily identifiable as military men (in two cases their biographies lie in the dark), and of the latter, one turned to war game development only after his career in the military had ended. Military men, or so it seems at the moment, did not play a dominant role in the *Kriegsspiel*'s prehistory, nor were the games invented before 1824 exclusively—or even mainly—aimed at them, even if they were to some extent attracted by them as shown by surviving lists of subscribers (Hellwig 1780, v–x).

This may be at least partly due to the second important aspect that nearly all predecessors of the Prussian *Kriegsspiel* known at present have in common: they were games first, with any potential use beyond recreational gaming coming only at a distant second. That is, they were never intended to train military men in actual warfare. A *Kriegsspiel* invented by the Brunswick engineer Georg Heinrich Venturini is a notable exception. In the introduction of the last version of his game published in 1804 after his death he wrote about his invention that it "should not, as one will realise when practising it, be called a game" (Venturini 1804, 2).[1] There is also some evidence for the employment of one of the early *Kriegsspiels* as an educational tool at a military school (Mauvillon 1822, 295–296), but although individual officers may have viewed them with some interest, they did not make any impression with military establishments. An anonymous review of Venturini's game probably captured the 'official' attitude towards the early *Kriegsspiele* in general: "In our opinion all these various *Kriegsspiele* do not offer the benefits their inventors claim to have." (Anon. 1785, 399).[2]

Common to all pre-1824 war games was a competitive interaction between players, whose capabilities were directly pitted against each other. Actual

---

1   "Das aber, wie man bey dessen Ausübung fühlen wird, wohl nicht mit dem Worte: Spiel bezeichnet werden sollte."
2   "Nach unserem Dafürhalten leisten alle diese verschiedenen Kriegsspiele nicht den Nutzen, welchen sich ihre Erfinder davon versprechen."

TABLE 1   Kriegsspiel *prehistory*

Inventor	Inventor's Profession	Publication Date	Type of Conflict Resolution	Type of Map
Christoph Weickmann	civilian	1664	chess-based	point-to-point grid
M. M.[A]	?	1770	chess-based	modified chess (11 × 11, b/w squares)
Johann Christian Ludwig Hellwig	civilian	1780, 1782; 2nd ed. 1803	chess-based	customisable square grid; 1617–2000 squares, 63 different terrain types
Johann Baptist Allgaier[B]	civilian	1796	chess-based	customisable square grid (25 × 24); 5 different terrain types
Johann Georg Julius Venturini	soldier	1798; 2nd ed. 1804	chess-based	customisable square grid; 20+ different terrain types
Christian Ernst Bogislaus (H)overbeck	soldier	1806	chess-based	modified chess (b/w squares)
Johann Ferdinand Opitz	civilian	invented 1746; publ. 1806	dice	square grid
Friedrich August Hagen[B]	civilian	[before 1812]	[unknown, probably chess-based]	[unknown, probably square grid]
Friedrich Ludwig von Tschiersky[B]	civilian	[before 1812]	[unknown, probably chess-based]	[unknown, probably square grid]
Carl Phemel[B]	civilian	[before 1812]	[unknown]	[unknown]

conflict resolution—determining the outcome of an engagement between two units—lay with the players who decided either by simply taking the opponent's piece during their turn (as in chess-based war games, of which there were a lot), by throwing dice (something frowned upon by chess-based war games inventors in particular) or by consulting tables to calculate losses (see Table 1). These activities also produced considerable social interaction between the players, something usually seen as an important and desirable aspect of any shared gaming activity. Indeed, the title of the 1803 version of the war game invented by the Braunschweig mathematician Johann Christian Hellwig is rather explicitly titled, "The *Kriegsspiel*: An attempt to demonstrate the truth of various rules of war in an *entertaining* game" (Hellwig 1803).[3]

---

3 *Das Kriegsspiel: Ein Versuch, die Wahrheit verschiedener Regeln der Kriegskunst in einem unterhaltenden Spiele anschaulich zu machen* [emphasis added].

TABLE 1

Inventor	Inventor's Profession	Publication Date	Type of Conflict Resolution	Type of Map
Philipp von Wussow[B]	soldier	[after 1812?]	[unknown]	[unknown]
Georg Leopold von Reiswitz	civilian	1812	[unknown]	customisable square grid; 3d terrain tiles
Ivan von Glöden	soldier	1817	chess-based	hexagonal board of 600 triangles
J.A. Messmer	soldier	1819[C]	dice	topographical map + point-to-point grid
Ludwig Senft von Pilsach	civilian	1820	chess-based	modified chess (standard board + 3 × 24 squares, b/w)
Franz Dominic Champblanc	?	1824[D]	chess-based	customisable square grid (20 × 23); 6 different terrain types
Georg Heinrich von Reisswitz	soldier	1824	dice/table	topographical map

A. The "Neues Kriegsspiel oder verbessertes Schachspiel" was anonymously published in 1770 in Prague.
B. On Hagen, Tschiersky, Phemel and Wussow, whose games apparently were all unpublished, see Wintjes 2016, 59–60. The games by Hagen and Tschiersky were most likely based on Hellwig's game (see Reiswitz 1812, xi). Whether Wussow's game was eventually published is at present unknown.
C. Messmer's game appears to have been fairly popular: both Dutch and French versions published in 1819 are extant.
D. Champblanc's game was not only reprinted at least once in 1827, but also published in a Dutch translation in 1833.

The Prussian *Kriegsspiel* of 1824 (Reisswitz 1824) was radically different, even though it was directly developed from one of its predecessors (Reiswitz 1812). Invented by a serving officer, it was aimed exclusively at his fellow officers and was, after its official introduction to the Prussian army, soon used for instructional and planning purposes. In its fully developed form the "players"—or more fittingly "participants"—were separated from each other and unable to see either their opponents' actions or, in its later incarnations, even their faces. Instead of playing on a gaming board or on schematic maps (pre-1824 *Kriegsspiele* were usually played on boards made up from squares; see Table 1), actual topographic maps were employed, thus requiring familiarity with their use. As a side effect Prussian *Kriegsspiel* therefore also taught its participants the use of maps. Playing pieces, which in earlier war games had mostly served to distinguish between the different arms of service, now represented units of different sizes and formations and were designed to roughly represent the

space taken up by the unit. Consequently, the space occupied by units on the ground and their movement could be correctly depicted and real-world constraints of motion had to be taken into consideration.

Even more importantly, *Kriegsspiel* participants were no longer involved in the actual combat resolution process that now fell to the umpires, without whom the *Kriegsspiel* would not work. Any communication between the players and the umpires—and, depending on the scenario, even between the players in one team—had to done in writing, the *Kriegsspiel* ideally taking place in total silence to replicate the reality of divided military commands who could not interact directly at a real engagement. The 1862 *Kriegsspiel* rules state this quite clearly: "All talk is to be avoided as it does not only prolong the game, but also prevents participants from making decisions" (Tschischwitz 1862, 9).[4] Thus, while some of the contemporary literature on the *Kriegsspiel* stresses how it could serve to strengthen the camaraderie within the officers' corps (Troschke 1869, 294), in fact, the Prussian *Kriegsspiel* was much more of a command exercise than a game.

In ongoing experiments with students at this author's institution, playing a "recreationalized" version of the *Kriegsspiel* that shares many of its general mechanics but allows direct player interaction, has been compared with running an actual *Kriegsspiel* based on a 1867 revision of the 1862 rules mentioned above (Tschischwitz 1867). What regularly strikes all participants as particularly obvious are the vastly different atmospheres created by the two activities: The recreational war game after a few turns produces something best described as noisy excitement, the actual *Kriegsspiel* has the outward appearance of an exam, with the room being almost totally silent and the participants intensely checking maps, keeping lists and writing orders (see Figure 1). This rather different character appears to be authentic, at least to some extent, as the 1862 set of rules quite clearly states that, "all conversation is, if possible, to be avoided" (Tschischwitz 1862, 9).

Experiments have also shown that while for a recreational war game a good knowledge of the rules is sufficient for successful participation, the *Kriegsspiel*'s participants require a solid knowledge of actual military affairs, as the rules mainly cover how the action is depicted on the map. In fact, the rules' primary purpose is to serve as aids to the umpires rather than the participants. To give just one example: the rules explain how to turn the playing pieces representing infantry battalions for transition of column to line formation, but they do not explain under which circumstances it is useful to do so.

---

4 "Alles Sprechen ist womöglich zu vermeiden, da hierdurch nicht bloß das Spiel verlängert, sondern auch mancher Sprecher am Handeln verhindert wird."

FIGURE 1   *Team of Kriegsspiel participants during a 2017 experiment at Würzburg University. From left to right, S. Krause, I. Bachmann (team leader), and J. Klein.*

Conversely, the participants do not need to know the rules in all their details, as they are not involved in the actual game mechanics. To stay with the example just mentioned, the participants decide when to turn their battalions from column to line formation, but they are not involved in moving the actual pieces on the map. As a result, compared with its predecessors the *Kriegsspiel*'s appeal to the general public must have been rather negligible, as the lack of suitable military expertise made it extremely difficult to successfully "play" (if indeed that is the right word at all).

On the whole, the *Kriegsspiel* experience could best be described as a manoeuvre on a map, something reflected by later, albeit unsuccessful, attempts to have it renamed *Planmanöver*, or "map manoeuvre" (Reichenau 1879, 5–6). Given its rather "un-gamely" nature and its unmatched realism in depicting tactical movements of the period, it is little surprising that it soon gathered a considerable following particularly among younger officers. At the same time,

many older officers developed serious reservations about its value and appropriateness, resulting in lively discussions within the officers' corps (Dannhauer 1874, 531). With "real" manoeuvres being a rare occurrence due to the cost involved in running them—Prussian artillerymen in the 1820s and 1830s rarely if ever took their guns to the field, let alone fired a shot, as Karl von Decker complained in 1835: "I have been a brigadier for eight years, and I never commanded artillery in person during a peace manoeuvre, so I am lacking any practical experience" (Müller 1873, 88)—the *Kriegsspiel* allowed officers to get at least a vague idea about how to handle larger formations.

Also, while it was not a substitute for actual combat experience, the *Kriegsspiel* could at least to some extent simulate the fog of war created by a combat situation, as the participants do not have direct control over what happens on the map. Instead, in its fully developed form they have to plot the movement of both their own forces and those of the enemy based on the information given to them by the umpires. Experiments have shown that as a general rule the side with better overall awareness of the whereabouts of its own troops usually wins, and that gaining and maintaining this awareness is a difficult process, as both sides can grossly miscalculate not only the position of the enemy but also of their own forces. For an example see Figure 2, noting in particular the discrepancies in the positions of the red and blue forces on their respective maps when compared with the umpire's map, *for the same turn.*

Having to make decisions under stress induced by the lack of information was an important experience particularly for those officers lacking any combat experience—something that most young officers born after 1800 did not have. As a command exercise, it could of course not prepare its participants for how it felt having rounds buzzing by. It could however at least to some extent prepare them for the insecurity and stress experienced when exerting command in a fog-of-war situation. The *Kriegsspiel* thus fell on fertile ground because it offered a learning experience that otherwise was difficult to get unless one went to the costly extreme of staging large-scale manoeuvres, something the Prussian army rarely if ever did in the decades between the Napoleonic Wars and the 1840s.

Prussian *Kriegsspiel* and the Changing Combat Environment, 1824 to 1875

If the *Kriegsspiel* was to be used for educational purposes, it needed to be realistic—which admittedly sounds at first like stating the blindingly obvious. Yet given that the nineteenth century was characterised by dramatic
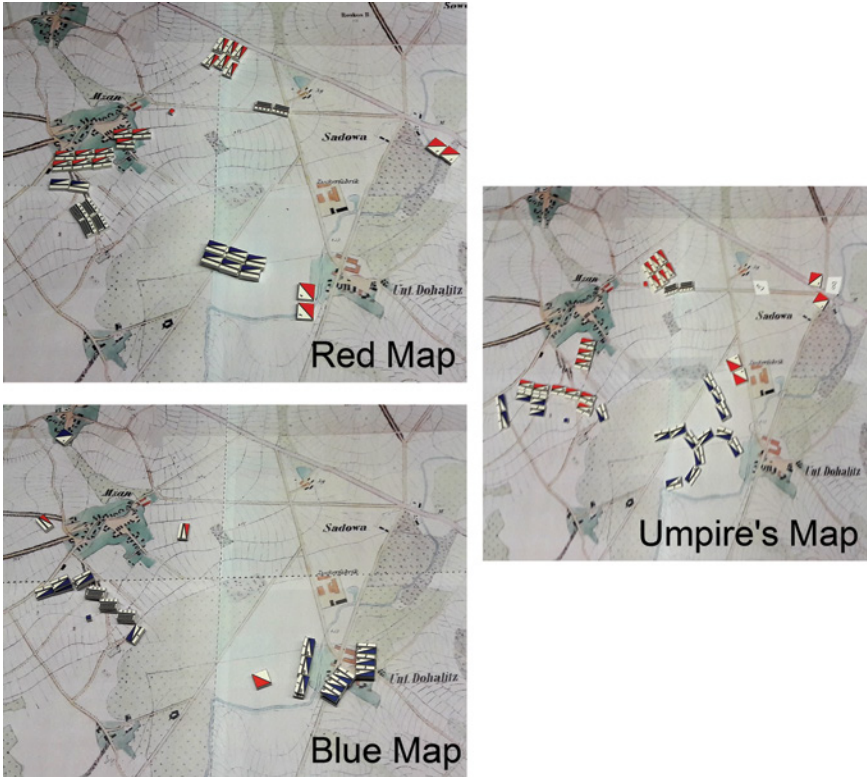
FIGURE 2   *The fog of war in a* Kriegsspiel: *red, blue and umpire's maps of the same turn.*

technological progress, retaining "realism" in the *Kriegsspiel* soon became quite a significant challenge. Already the very first *Kriegsspiel* designers had wrestled with the issue of correctly depicting the effect of gunfire, and while the 1824 *Kriegsspiel* explicitly referred to weapons test results published in 1813 (Scharnhorst 1813; cf. Reisswitz 1824, 9–10), the need for a revision was soon realised. Accordingly, in 1828 a *Supplement* to the existing rules was published which, among other things, reduced the effectiveness of artillery fire significantly (Anon. 1828a, 69). The 1824 rules together with the 1828 *Supplement* then formed the set of rules with which *Kriegsspiele* were run in Prussian garrisons and at the staff academy for the next twenty years.

In this context, it is worthy of note that apart from Georg Heinrich von Reisswitz, to whom the invention of the 1824 rules is usually ascribed, others had an important part in the development of the rules as well (Wintjes 2016, 65–66), among which the already mentioned Karl von Decker probably was the most prominent. Von Decker was a prolific military writer and one of the

leading tacticians of the 1830s and 1840s, serving as an instructor at the Prussian *Kriegsschule* and publishing several tactical manuals (Decker 1819, Decker 1822, Decker 1828a, Decker 1828b, Decker 1833), which were republished several times. Von Decker was the first in a line of military theoreticians directly involved in war game development; as a result, ever since the late 1820s onwards *Kriegsspiel* development would be closely related to the development of military theory and tactics.

By the 1860s, realism had become an increasingly pressing issue for *Kriegsspiel* rule designers, as the nature of warfare had begun to undergo dramatic changes. Three examples stand out in where it is particularly easy to trace the reaction of rule designers to the changing combat environment—battlefield communication, musketry and artillery fire. The rules in the Prussian *Kriegsspiel* covering battlefield communications, which during the first half of the nineteenth century were mostly confined to staff gallopers and other messengers significantly enhanced the realism of the *Kriegsspiel*. One fundamental disadvantage of all pre-1824 *Kriegsspiele* had been their overall approach to the handling of troops: as the participants directly interacted with each other and were in full control over their own forces, units could be used like robots, always ready and willing to do whatever they were supposed to. There was no mechanism that allowed to simulate the uncertainties of the overall commander who in a real-world situation always had to worry whether his orders were properly acted upon, if they had even been properly understood in the first place. However sophisticated they may have been, then, the pre-1824 *Kriegsspiele* failed to take into account one of the most important characteristics of any military conflict: friction (to be fair, of course, Clausewitz only enunciated friction in his *Vom Kriege* of 1832).

The Prussian *Kriegsspiel* was fundamentally different in that it gave the umpires the power to create as much friction as they saw fit, given that they were in total control of the game mechanics. Also, from early on the rules stipulated that only those participants could interact with each other who were in direct contact; giving orders to units located more than 900 paces (720 m) away took as many turns as it took a staff galloper to move from the position of the overall commander to the unit commander (Tschischwitz 1862, 8; Tschischwitz 1867, 8–9; Tschischwitz 1870, 10). On a larger battlefield, this could result in messages arriving with information that was considerably outdated by the time they arrived at the headquarters. In its developed form in the 1860s and '70s, *Kriegsspiel* rules explicitly suggested, particularly for large-scale scenarios, to bodily separate the overall commanders on each side from their subordinates, allowing communication only through the umpires (Tschischwitz 1862, 8; Tschischwitz 1867, 9; Tschischwitz 1870, 10; Tschischwitz 1874, 11). While these constraints

on communication significantly increase the workload of the umpires (as our recent experiments have shown), they at the same time add an important layer of realism to the overall command experience of the participants, significantly limiting the capability of handling complex formations over larger areas due to the lag in communications on the field.

As a result of the introduction of the field telegraph in European armies in the decade before the Franco-Prussian War of 1870/71, the overall communications situation on the battlefield somewhat improved. While the new technology still faced considerable challenges ranging from obstructing administrations, generals unaware of the capability of the new technology, indifferent officers, and common soldiers cutting down poles for use as firewood (Buchholtz 1880, 6), the field telegraph had by 1870 found its way into the *Kriegsspiel* rules, which allowed communication between two distant corps by means of the telegraph. Now the message had to be delayed for just one turn, regardless of the distance (Tschischwitz 1870, 11). As one might imagine, experiments with asymmetric communications layouts have demonstrated the significant advantages the new technology offered. At present it is not known whether the introduction of the field telegraph to the *Kriegsspiel* resulted in the new technology gaining more acceptance in the Prussian army, yet one would assume that any participant in a *Kriegsspiel* harbouring doubts about the new means of communication, having experienced the impact it could have on the outcome of a simulated battle, was at least inclined to change his mind if not become an enthusiastic supporter.

Throughout the nineteenth century, musketry underwent even more dramatic changes than battlefield communications, and these changes likewise found their expression in the development of *Kriegsspiel* rules. During the first two decades of the century infantry had been still relying on the smoothbore musket, a weapon with rather limited capabilities. Available sources suggest that during the Napoleonic wars the more conservative British infantry often opened fire only at very short ranges of 90 m or less, and other armies regularly opened fire from around 180 m (Muir, 2000, 82–83). Contemporary handbooks from the post-Napoleonic period show that during the first quarter of the nineteenth century, German armies considered 200 paces (around 160 m) to be the maximum effective range for infantry fire (Flammenstern 1823, 22; Peschel 1825, 222; Anon. 1828b, 213–214). Anything beyond that was considered extremely long range at the time and at those ranges, musketry usually had very little effect apart from cloaking the battlefield in smoke (Muir 2000, 24–25). An Austrian handbook rather dryly noted that in order to hit anything at 300 paces (around 240 m), one had to aim at a point about 30 cm above the target, resulting in an 'unpredictable shot' (Flammenstern 1823, 23), while a

Prussian handbook helpfully added that when raising the musket at an angle of 25 degrees, the ball would hit the ground at around 1400 paces (1120 m), though it would have lost any penetrative power well before that (Anon. 1828b, 213–214).

In general, the key characteristics of the smoothbore musket differed little from the weapons used a century earlier in the Marlburian age. In some cases like the standard British infantry musket, the weapons actually originated from the end of that age: the famous "Brown Bess" was first introduced to the British army in 1722, the year in which the Duke of Marlborough died. Earlier firearms were similar in their ballistic capabilities. At the beginning of the seventeenth century, matchlock muskets were effective to a maximum range of around 80 m, and, as the century went on, the invention of flintlock mechanisms did little to improve effective range, though it allowed for a greater rate of fire (Lynn 1997, 458–464). For more than two centuries, then, firearms technology had made only gradual progress, resulting in no dramatic changes in the actual capabilities of firearms-equipped infantry.

Then came the nineteenth century, and within a few decades, the infantryman's main weapon evolved from a simple, inaccurate, single-shot, short-range weapon through several stages into to a sophisticated, breech-loading rifle. The successive introduction of percussion firing, rifling, Minié bullets and their like, and breech-loading systems, increased the range of the weapon dramatically. By the end of the 1870s infantry was capable of hitting the enemy at almost ten times the range of a musket (compare Table 2 and Table 3). At the same time artillery, which as late as the Napoleonic period was still quite limited in its effectiveness, had by the early 1870s developed into a powerful weapon capable of engaging opponents with a precision and at a distance unknown of only a few decades before.

The consequences for the battlefield were quite dramatic. During the Napoleonic period, keeping a distance of about 250 m from formed-up infantry on an open field meant safety. Even if the opponent had opened fire at what at the time was an absurdly long range, only very few musket balls would have found a target. Half a century later anyone that close to formed infantry would have found himself well within the kill zone of the enemy, with a hail of rifled bullets directed against him. This new character of the battlefield was perhaps best summarised by the later Marshal Foch in his famous work on the principles of war published in 1903:

> In front, there is a, so to speak, "impassable" zone; no defiladed ways of access are left; a hail of bullets sweeps the ground in front of the first line. But success has not yet been secured; "nothing is done so long as something remains to be done" (Frederick). The laurels of victory are at

TABLE 2   *Prussian standard army rifles, 1824–1875. Data from Götz 1978 and Götz 1981*

Introduced	Rifle	Caliber	Range (Sights)	Notes
1809	M/1809	18.57 mm	*ca.* 120 paces (90 m)[A]	smoothbore flintlock musket
1839	M/1839	18.04 mm	150 paces (112 m)	smoothbore percussion musket[B]
1848	Dreyse M/1841	15.43 mm	850 paces (637 m)	rifled breech loader ('needle gun')
1855	M/1839/55 (Minié bullet)	17.76 mm	1000 paces (750 m)	rifled conversions of M/1839 and U/M
1867	Dreyse M/1862	15.43 mm	700 paces (525 m)	rifled breech loader ('needle gun')
1872	M/1871	11.00 mm	1600 m	rifled breech loader

A. Frontsight only.
B. Percussion conversion of M/1809.

TABLE 3   *European standard army rifles, around 1875. Data from Anonymous 1883*

Introduced	Rifle	Caliber	Range (Sights)	Country
1872	M/1871	11.00 mm	1600 m	Prussia/Germany
1871	Martini-Henry	11.43 mm	1280 m	United Kingdom
1874	Fusil Gras M80 Modèle 1874	11.00 mm	1800 m	France
1870	Berdan Nr. 2	10.66 mm	1000 m	Russia
1877 (1867)	Werndl 73/77	11.00 mm	1575 m	Austria

the point of enemy bayonets. They must be plucked there; they must be carried by a fight hand to hand, if one really means to conquer (Foch 1920, 320–321).[5]

---

5   "Devant elle s'étend une zone en quelque sorte infranchissable; de cheminements il n'y en a plus qui soient défilés; la pluie de balles bat le terrain avec une implacable rigueur. Cependant on ne tient pas encore le succès;" "rien n'est fait tant qu'il reste quelque chose à faire." (Frédéric.) "Les lauriers de la victoire flottent à la pointe des baïonnettes ennemies. C'est là qu'il faut aller les prendre, les conquérir par une lutte corps à corps, si on les veut."

During the nineteenth century, musketry was thus turned from a tool useful mostly for cloaking the battlefield in smoke to an instrument allowing the infantry to unleash the hail of bullets mentioned by Foch.

In the *Kriegsspiel* rules, this development can be traced with considerable precision in the rules published between 1862 and 1874 by Wilhelm von Tschischwitz, which were enormously popular and enjoyed a wide circulation. When Tschischwitz published the first edition of his *Kriegsspiel* rules in 1862, the needle gun had fairly recently been introduced in the Prussian army but had yet to see service in a major conflict. A battalion (the standard infantry element in the Prussian *Kriegsspiel*) in close order was assumed to cause 200 casualties when firing at formed infantry at ranges of up to 80 m, falling to only 16 casualties firing at its maximum range of 720 m (Tschischwitz 1862, fig. 3). Five years later the Prussian army had made actual combat experience with the needle gun in the Second Schleswig War (Feb.–Oct. 1864) and the Austro-Prussian War (AKA Seven Weeks' War; June–Aug. 1866), and when Tschischwitz published a new and revised edition of his rules in 1867, there were significant changes to the effect of a battalion's musketry: close range firing at up to 80 m now was assumed to cause 320 casualties, 60% more than the casualty number assumed in the 1862 rules; the maximum range at which a battalion's fire was assumed to have any effect was slightly reduced to 640 m, with the same 16 casualties expected (Tschischwitz 1867, fig. 3). The 1867 rules saw another revision in 1870, which did not affect the depiction of musketry fire.

The Franco-Prussian War did however cause another major change, as the Prussian army, realising that the Dreyse needle gun was significantly outclassed by the French Chassepot rifle, hastened to introduce a rifle with comparable capabilities, the *Infanteriegewehr 71* (Götz 1981, 32–41; see also Tables 2 and 3). As a result, for his final 1874 edition of his *Kriegsspiel* rules, Tschischwitz adjusted the fire for a battalion once again. The maximum number of casualties at close range was now set at 500 men, more than a 50% increase in the casualty numbers of the 1867 and 1870 rules. Rifle fire was now supposed to be at least somewhat effective up to 1,600 m, or twice as far as in the preceding editions, and at up to 1,600 m a battalion could still cause up to 50 casualties (Tschischwitz 1874, fig. 3). Thus, within 12 years, infantry fire at close range as depicted in the *Kriegsspiel* rules had increased by 150%, while the maximum range had doubled (see Figure 3).

Similar observations can be made with regard to the effectiveness of artillery fire, which formed part of the "hail of bullets" meeting the advancing infantry on a battlefield in the late nineteenth century. Prussia had entered the second half of the century with the 6-pounder C/42 as the mainstay of its field artillery. Developed from 1835 onwards, the C/42 was a conventional
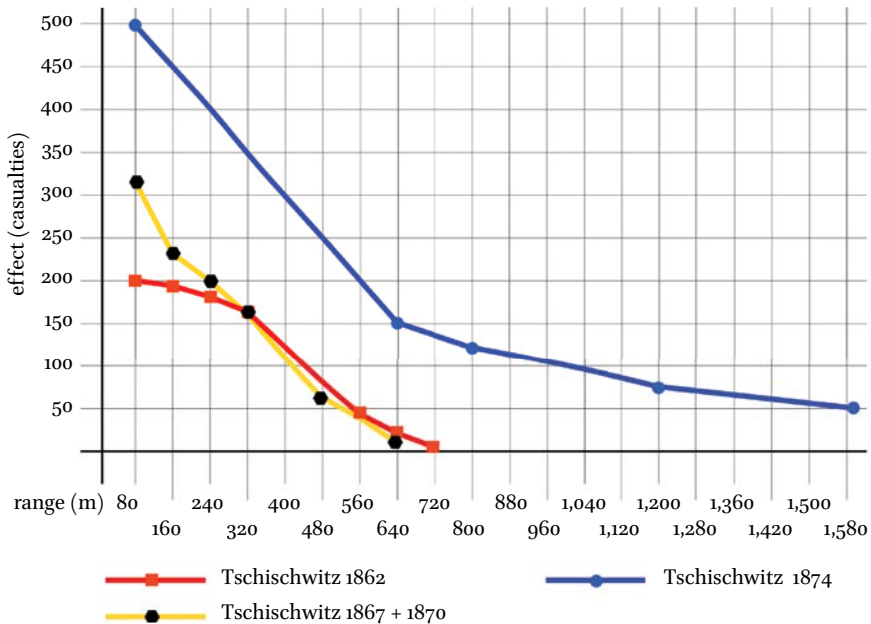
FIGURE 3   *The development of rifle fire in Wilhelm von Tschischwitz'* Kriegsspiel *rules, 1862–1870.*

smoothbore muzzle loader firing roundshot, shrapnel, or grape, with traditional roundshot making up two thirds of a typical ammunition (Müller 1873, 36). Already in 1851 however first experiments with rifled field guns took place, which by 1857 had resulted in the development of a new, rifled breech-loading 6-pounder field gun. As the new gun produced excellent test results it was introduced in the Summer of 1860 with field artillery regiments throughout the Prussian army. Replacing older 12-pounder smoothbore guns, it became known as the 6-pounder C/61 (Müller 1873, 167–170). Further improvements to the breech mechanism then resulted in the introduction of the 6-pounder C/64 (Witte 1867, 1–2).

The Second Schleswig War of 1864 and the Austro-Prussian War of 1866 allowed the Prussian army, which entered the latter conflict with around 875 guns, around 60% of which were rifled breech loaders (Müller 1873, 265–266), to gain actual combat experience with its rifled artillery. As a result, the remaining smoothbore guns were quickly pulled out of service, and already in 1867 Prussian field artillery was uniformly equipped with rifled guns (Müller 1873, 275–276). In that year, further modifications resulted in the 6-pounder C/67, which served during the following years alongside the C/64 guns. The Prussian army thus entered the Franco-Prussian war with two different variants of its
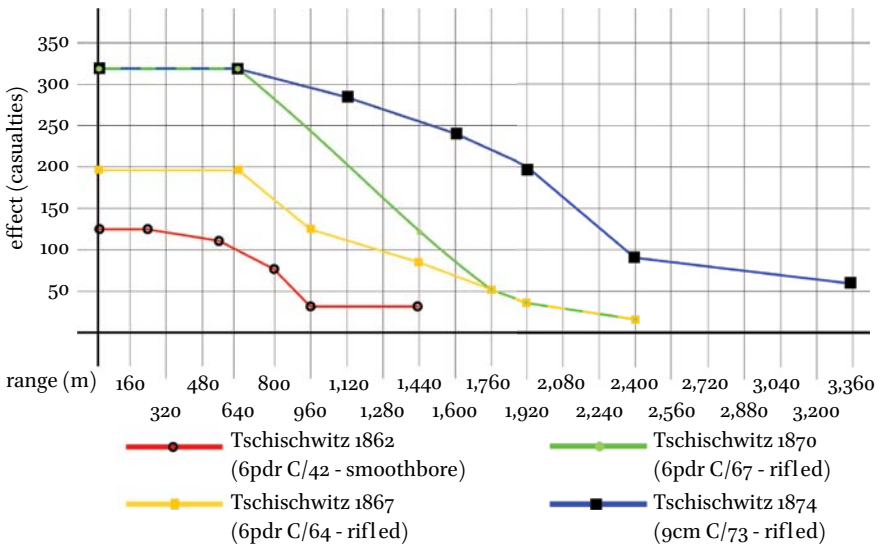
FIGURE 4   *The development of artillery fire in Wilhelm von Tschischwitz'* Kriegsspiel *rules,*
            1862–1874.

main field artillery piece. That war held a rather unpleasant surprise in the
range of the French Chassepot rifle: both the C/64 and the C/67 guns lost rap-
idly in effectiveness beyond 800 m, a range at which infantry equipped with
Chassepot rifles could still engage the field gun crews with considerable effect
(Müller 1873, 336). As a result, already during the closing stages of the war ex-
periments were undertaken with a new gun designed by Krupp, which would
eventually enter service in 1873 as the 9 cm C/73 (Anon. 1875, 548–549), which
was significantly more powerful than the preceding 6-pounder guns and could
easily outrange even Chassepot-equipped infantry.

Again, as had been the case with infantry fire, *Kriegsspiel* rules tried to mirror
these developments. The four editions published by Wilhelm von Tschischwitz
provide suitable examples for this development (see Figure 4). When Tschis-
chwitz first published his rules in 1862, Prussian field artillery was still relying
to a great extent on the 6-pounder C/42. The rules assumed a maximum range
of 1,440 m, at which a battery was assumed to cause up to 32 casualties against
infantry in close formation, while at close range of up to 240 m, its fire could
claim a maximum of 128 casualties (Tschischwitz 1862, fig. 3). Five years later,
the introduction of the new rifled breech-loading guns caused Tschischwitz to
publish the second edition of his rules. Field artillery units were now equipped
with the 6-pounder C/64, whose increased combat capabilities found their
way into the rules. At close range of up to 640 m, a battery was assumed to
cause up to 192 casualties, a 50% increase in the casualties from the 1862 rules.

The maximum range increased by two-thirds to 2,400 m, at which the same 32 casualties could be caused (Tschischwitz 1867, fig. 3). Three years later, with the 6-pounder C/67 now in service and deficiencies in Prussian ammunition which had surfaced during the 1866 war corrected, Tschischwitz adjusted the capability of field artillery once again. While the maximum range stayed the same, at close range artillery was now assumed to cause 320 casualties, two-thirds more than the 1867 rules (Tschischwitz 1870, fig. 3). When in 1874 Tschischwitz published the final edition of his rules, the 9 cm C/73 had been introduced to Prussian field artillery the year before. Its capabilities were vastly superior to that of its predecessors, which found its expression in the rules. While there was no change at close range, artillery fire could now reach out to 3,200 m, at which it was assumed to cause 68 casualties. Particularly noteworthy is that at intermediate ranges of 800–1,920 m, where previous guns had rapidly lost capability, the 9 cm C/73 was still extremely effective: it was assumed to cause 200 casualties at 1,920 m (Tschischwitz 1874, fig. 3). Just as in the case of infantry fire, twelve years of technological progress had caused dramatic changes in the capabilities of field artillery, evident in the *Kriegsspiel* rules.

The *Kriegsspiel* in Prussia and Beyond

Throughout the decades between 1840 and 1870, the Prussian military introduced new weaponry in increasingly shorter intervals. In order to preserve realism in the *Kriegspiel*, revision to the existing rules were necessary, and the publication history of *Kriegsspiel* rules shows how the Prussians rose to the challenge. In the three decades between 1846, when the first new set of rules was published since the *Supplement* of 1828, and 1875, no fewer than nine sets of rules were published, publication in each case coinciding with the introduction of new technology or new tactical developments (see Table 4). Just as the pace of technological progress increased significantly from the 1860s onwards, so did the publication of the *Kriegsspiel* rules—of the nine rules published between 1846 and 1875, four were published in the decade between 1860 and 1870 alone. While the basic set-up as well as the core mechanisms of the *Kriegsspiel* remained the same, adjustments focussed on new infantry weapons, new artillery pieces, and changes in infantry tactics.

At the same time when the frequency of *Kriegsspiel* rule publication reached a climax, it also became the object of intensive discussion within the Prussian army. Whereas in the 1820s, the discussion had been between proponents and opponents of the *Kriegsspiel* about its general usefulness, with the *Kriegsspiel* catching on slowly if at all among conservative officers, the 1860s saw a rapid

TABLE 4   Kriegsspiel *rules publication 1824–1875*

Author	Publ.	Reason for Publication	Notes
Reisswitz, von Decker, von Witzleben *et al.*[A]	1824 + 1828	–	"Ur-Kriegsspiel"
Anonymous ("Berliner Kriegsspielverein")	1846	Increased importance of firearms (percussion)	
Weigelt	1848	–	no surviving example known
anonymous	1855	–	identical to 1846 ed.
von Tschischwitz	1862	Rifled guns (infantry)	
von Tschischwitz	1867	Rifled guns (field artillery)	2nd ed.
von Tschischwitz	1870	Rifled guns (field artillery); field telegraph	3rd ed.
von Tschischwitz	1874	Rifled guns (field artillery)	4th ed.
von Trotha	1870	–	
von Trotha	1872	–	reprint of 1870 ed. with minor corrections
von Trotha	1874	Experiences from Franco-Prussian War (1870/71); change from pace to meter	3rd ed.
Meckel	1875	Major changes in game mechanics	

A. The 1828 rules supplement was published anonymously, but it can be shown that it was the work of a group of officers around von Decker and von Witzleben; see Wintjes 2016.

increase in *Kriegsspiel* activities in the Prussian army (Anon. 1875, 723), and a new discussion beginning in the late 1860s focussed exclusively on how to even further increase its realism while at the same time making the actual running of it easier. From that discussion eventually arose the *Freies Kriegsspiel*, where many decisions requiring the use of dice or the consultation of tables in "traditional" *Kriegsspiel* were replaced by decisions by the umpire (on that discussion see Wintjes 2016, 55–56).

Both the increasing rate of publication of *Kriegsspiel* rules and the discussion on how to reform its mechanisms in the 1860s and 1870s show clearly that

the Prussian army was acutely aware of the need to keep the *Kriegsspiel* up to date in a period characterised both by great technological progress and frequent military conflicts. It is a testimony to the importance ascribed to the *Kriegsspiel* as an educational instrument that during a time when most officers in the Prussian army could and did gain combat experience in some way or another, interest in the *Kriegsspiel* did not wane, but in fact increased. Whereas back in the 1820s and 1830s it was the lack of combat experience which had driven many young officers to the *Kriegsspiel*, half a century later the *Kriegsspiel* was both an integral and an important part of the training of a Prussian officer, and had therefore to be adjusted according to latest combat experiences.

The importance of the *Kriegsspiel* was not lost on foreign observers either. Although there had been some discussion already in the 1830s of employing conflict simulations similar to the *Kriegsspiel* in military establishments outside Prussia (Aretin 1830 in Bavaria; Leitner von Leitentreu 1847a and Leitner von Leitentreu 1847b in Austria), nothing had come out of it. For nearly fifty years the Prussian army was alone in using the *Kriegsspiel*. The unexpectedly swift victory in the Austro-Prussian War of 1866 and the equally unexpected and stunning victory over France in 1870/71 brought about a dramatic change: suddenly, the Prussian military became fashionable (see *e.g.* Bond 1972, 125–126; Speirs 1992, 245–249 for a discussion of developments in the British army). While the most prominent element copied from the Prussian army was the creation of a general staff in many foreigne forces (Dupuy 1977, 113–114), the *Kriegsspiel* was not far behind. A Spanish 1881 version of the *Kriegsspiel* rules made a direct connection between the *Kriegsspiel*, training in the Prussian army, and the great international interest raised by the latter's military successes:

> As the German Empire currently enjoys the greatest attention by military establishments all over the world due to the perfect organisation and training of its army, it is an excellent occasion to introduce to our country the so-called "game of war," which is now in use in all major European nations and has been so for many years in Germany, where in particular great attention is paid and great importance ascribed to it (Ramos 1881, 1).[6]

---

6 "Hoy dia que el imperio de Alemania viene siendo objeto de la más preferente atención para el mundo militar, por la perfecta organización é instrucción de su ejército, parece ser la ocasión más propicia para dar á conocer en nuestro país el llamado Juego de la guerra, generalizado en todas las principales naciones europeas y en uso, hace ya largos años, en

Accordingly, it took barely a decade for translations to appear in nearly all armies of the industrialised world. And just as the Prussian *Kriegsspiel* designers had worked hard to retain realism while technological progress constantly effected changes on the battlefield, so foreign military establishments adapted the Prussian rules to their own requirements and updated them as necessary.

A good example for the awareness of the direct connection between rulesets and technological progress among foreign armies is the first Austrian version of the *Kriegsspiel* published in 1874 (Mayer 1874). While based on the Prussian rules, the publication also included a lengthy introduction not present in those rules. In that introduction, Mayer not only mentioned that his version of the rules was based on data derived from test firings as well as actual battlefield data, but included a long section actually providing that data (Mayer 1874, 17–27). Mayer was fully aware of the somewhat artificial nature of data gained from weapons tests on a firing range, so he therefore compared this data with actual combat results, noting rather pointedly that the *Kriegsspiel*'s purpose was to simulate a combat situation, not a peacetime manoeuvre (Mayer 1874, 25). Mayer ended up with assuming a general effectiveness for infantry weapons substantially below what he called an "average peacetime effectiveness" (Mayer 1874, 27–28).

By the end of the nineteenth century, the pace of technological progress had slowed down considerably, at least as far as weapons technology was concerned, and by the turn of the century most European armies had introduced much of the equipment they went to war with in 1914. Accordingly, the need for constant revision of the *Kriegsspiel* rules slowly receded, even though between 1875 and 1914 further sets of rules were published. This abating in the publishing of *Kriegsspiel* rules was not a result of the military losing interest in it. Rather, it is a testimony to the close connection between the development of the *Kriegsspiel* and technological progress in the nineteenth century.

Conclusion

The Prussian *Kriegsspiel* had a lasting impact on military education. Its primary importance lay in its ability to let participants gain some experience of how command in a fog-of-war situation might be, thus preparing officers at least for some aspects of military decision making. Its use as an educational tool required a high degree of realism, which in turn caused the *Kriegsspiel* rules

---

Alemania, donde, más principalmente, se le consagra gran atención y concede no pequeña importancia."

to be updated frequently. As a result, the introduction of new technology in the Prussian army was quickly followed by the updating of *Kriegsspiel* rulesets, which in turn enabled officers to gain some experience with the tactical and operational implications of that technology.

The *Kriegsspiel* could therefore also serve to some extent to transmit the capabilities and limitations of new technologies to military decision makers. Its effectiveness in that role, however, was directly related to the nature and source of the technological information implemented in the rules—after all, the far too powerful artillery of the very first 1824 rules was modelled after data acquired from actual test firings. Other *Kriegsspiel* rules however based the modelling of new technology apparently on actual combat results, as was the case in the rules originally published in 1862. These were updated in 1867, now incorporating experience from the Austro-Prussian War of 1866, updated again in 1870 just before the Franco-Prussian war and saw a final edition four years later to incorporate the lessons of that conflict. Only further research into the process of updating the *Kriegsspiel* will tell how close to reality the rules really were.

Works Cited

Kriegsspiel Rules

Anonymous. (1828a). "Supplement zu den bisherigen Kriegsspiel-Regeln." *Zeitschrift für Kunst, Wissenschaft und Geschichte des Krieges* 13, pp. 68–105.

Aretin, Wilhelm Freiherr von. (1830). *Strategonon. Versuch, die Kriegführung durch ein Spiel anschaulich darzustellen*. Ansbach: Dollfußische Buchhandlung.

Hellwig, Johann Christian Ludwig. (1780). *Versuch eines aufs Schachspiel gebaueten taktischen Spiels*. Leipzig: Siegfried Lebrecht Crusius.

Hellwig, Johann Christian Ludwig. (1782). *Versuch eines aufs Schachspiel gebaueten taktischen Spiels. Praktischer Teil*. Leipzig: Siegfried Lebrecht Crusius.

Hellwig, Johann Christian Ludwig. (1803). *Das Kriegsspiel: Ein Versuch, die Wahrheit verschiedener Regeln der Kriegskunst in einem unterhaltenden Spiele anschaulich zu machen*. Braunschweig: Karl Reichard.

Ramos, D. Máximo. (1881). *El Juego de la Guerra*. Madrid: Depósito de la Guerra.

Reisswitz, Georg Heinrich von. (1824). *Anleitung zur Darstellung militairischer Manöver*. Berlin: Trowitzsch & Sohn.

Reiswitz, Georg Leopold von. (1812). *Taktisches Kriegs-Spiel; oder, Anleitung zu einer mechanischen Vorrichtung um taktische Manoeuvres sinnlich darzustellen*. Berlin: Gebr. Gädicke.

Tschischwitz, Wilhelm von. (1862). *Anleitung zum Kriegsspiel*. Neisse: Joseph Graveur.

Tschischwitz, Wilhelm von. (1867). *Anleitung zum Kriegsspiel. Zweite, verbesserte Auf-*
     lage. Neisse: Joseph Graveur.

Tschischwitz, Wilhelm von. (1870). *Anleitung zum Kriegsspiel. Dritte verbesserte Auf-*
     lage. Neisse: Joseph Graveur.

Tschischwitz, Wilhelm von. 1874. *Anleitung zum Kriegsspiel. Vierte verbesserte Auflage*.
     Neisse: Joseph Graveur.

Venturini, Georg. (1804). *Darstellung eines neuen Kriegesspiels zum Gebrauch für Of-*
     fiziere und Militärschulen. Leipzig: Johann Conrad Hinrichs.

Secondary Literature

Anonymous. (1785). Review of (Venturini 18040. *Allgemeine Literatur-Zeitung* 2, p. 399.

Anonymous. (1828b). *Waffenlehre (Handbibliothek für Offiziere Band III)*. Berlin: Fried-
     rich August Herbig.

Anonymous. (1875). "Bericht über die Entwickelung des Kriegsspiels". *Jahresberichte
     über die Veränderungen und Fortschritte im Militairwesen* 1, pp. 718–728.

Anonymous. (1883). *Das Gewehr der Gegenwart und Zukunft. Die jetzigen Europäischen
     Infanterie-Gewehre und die Mittel zu ihrer Vervollkommnung*. Hannover: Hellwig'sche
     Verlagsbuchhandlung.

Bailey, Jonathan B.A. (2004). *Field Artillery and Firepower*. Annapolis: US Naval Insti-
     tute Press.

Berger, Bernhard. (2000). "Gespielte Vorbereitung auf den Ersten Weltkrieg. Die
     operativen Kriegsspiele." *Österreich-Ungarn. Österreichische Militärische Zeitschrift*
     38, pp. 595–604.

Bond, Brian. (1972). *The Victorian Army and the Staff College, 1854–1914*. London:
     Methuen.

Buchholtz, Felix. (1880). *Ueber die Thätigkeit der Feldtelegraphen in den jüngsten Krie-
     gen. Ihre Bedeutung für die Kriegführung, sowie die neuesten Erfindungen und Ver-
     suche auf diesem Gebiete*. Berlin: Mittler.

Dannhauer, Ernst Heinrich. (1874). "Das Reißwitzsche Kriegsspiel von seinem Beginn
     bis zum Tode des Erfinders." *Militair-Wochenblatt* 59, pp. 527–532.

Decker, Carl von. (1819). *Die Gefechtslehre der beiden verbundenen Waffen: Kavallerie
     und reitende Artillerie*. Berlin: Ernst Siegfried Mittler.

Decker, Carl von. (1822). *Der kleine Krieg im Geiste der neueren Kriegsführung*. Berlin:
     Ernst Siegfried Mittler.

Decker, Carl von. (1828a). *Grundzüge der praktischen Strategie*. Berlin: Friedrich August
     Herbig.

Decker, Carl von. (1828b). *Die Taktik der drei Waffen: Infanterie, Kavallerie und Artillerie,
     einzeln und verbunden, vol. 1–2.* Berlin: Ernst Siegfried Mittler.

Decker, Carl von. (1833). *Beilagen zur Ergänzungs-Taktik der Feldartillerie*. Königsberg:
     Gebrüder Bornträger.

Foch, Ferdinand. (1903). *Des principes de la guerre : conférences faites à l'École supérieure de guerre*. Paris: Berger-Levrault.

Foch, Ferdinand. (1920). *The Principles of War. Translated by* Hilaire Beloc. New York: Henry Holt and Co.

Mauvillon, Friedrich W. (1822). Ueber die Versuche, die Kriegsführung durch Spiele anschaulich darzustellen, und deren Anwendung zum Unterricht in Militairschulen. *Militairische Blätter* 3, pp. 289–344.

Götz, Hans-Dieter. (1978). *Militärgewehre und Pistolen der deutschen Staaten 1800–1870*. Stuttgart: Motorbuch.

Götz, Hans-Dieter. (1981). *Die deutschen Militärgewehre und Maschinenpistolen 1871–1945*. Stuttgart: Motorbuch.

Hohrath, Daniel. (2000). "Prolegomena zu einer Geschichte des Kriegsspiels." In Angela Giebmeyer and Helga Schnabel-Schüle, eds. *"Das Wichtigste ist der Mensch". Festschrift für Klaus Gerteis zum 60. Geburtstag*. Mainz: Philipp von Zabern, pp. 139–152.

Knoll. Werner. (1981). "Die Entwicklung des Kriegsspiels in Deutschland bis 1945." *Militärgeschichte* 20, pp. 179–189.

Leitner von Leitentreu, Thomas Ignaz. (1847a). "Über Kriegsspiele und deren Nutzen." *Österreichische Militärische Zeitschrift* 6, pp. 253–279.

Leitner von Leitentreu, Thomas Ignaz. (1847b). "Über Kriegsspiele und deren Nutzen." *Österreichische Militärische Zeitschrift* 7, pp. 26–39.

Lynn, John A. (1997). *Giant of the Grand Siècle. The French Army 1610–1715*. Cambridge: Cambridge University Press.

Mayer, Edmund Edler von. (1874). *Eine Studie über das Kriegsspiel*. Wien: Verlag des militär-wissenschaftlichen Vereines.

McHugh. Francis J. (1966). *The United States Naval War College Fundamentals of War Gaming*. 3rd ed. Newport, Rhode Isl.: Naval War College Press.

Muir, Rory. (2000). *Tactics and the Experience of Battle in the Age of Napoleon*. New Haven: Yale University Press.

Müller, Hermann von. (1873). *Die Entwickelung der Feld-Artillerie in Bezug auf Material, Organisation und Taktik, von 1815 bis 1870*. Berlin: Robert Oppenheim.

Perla, Peter. (1990). *The Art of Wargaming*. Annapolis, Maryland: United States Naval Institute Press.

Peschl, Carl Friedrich. (1825). *Handbuch der Waffenlehre*. Dresden: Arnold'sche Buchhandlung.

Peterson, Jon. (2012). *Playing at the World. A History of Simulating Wars, People and Fantastic Adventures from Chess to Role-Playing Games*. San Diego, CA: Unreason Press.

Peterson, Jon. (2016). "A Game Out of All Proportions: How a Hobby Miniaturized War." In Pat Harrigan and Matthew G. Kirschenbaum eds., *Zones of Control. Perspectives on Wargaming*. Cambridge, Mass.: MIT Press, pp. 3–31.

Pias, Claus. (2000). *Computer Spiel Welten*. PhD. dissertation. Fakultät Medien der Bauhaus-Universität Weimar, University of Cologne. Online at ftp://ftp.uni-weimar .de/pub/publications/diss/Pias/pias.pdf.

Reichenau, Ernst August von. (1879). *Über Handhabung und Erweiterung des Kriegsspiels*. Berlin: Luckhardt'sche Verlagshandlung.

Rittig von Flammenstern, Andreas. (1823). *Handbuch der Waffenlehre*. Wien: Anton Strauß.

Scharnhorst. Gerhard von. (1813). *Über die Wirkung des Feuergewehrs*. Berlin: G.E. Nauck.

Speirs, Edward M. (1992). *The Late Victorian Army 1868–1902*. Manchester: Manchester University Press.

Troschke, Theodor von. (1869). "Zum Kriegsspiel." *Militair-Wochenblatt* 54, pp. 276–277 and 292–295.

Van Crefeld, Martin. (2013). *Wargames: From Gladiators to Gigabytes*. Cambridge: Cambridge University Press.

Vego, Milan. (2012). "German War Gaming." *Naval War College Review* 65, pp. 106–147.

Wawro, Geoffrey. (1996). *The Austro-Prussian War. Austria's War with Prussia and Italy in 1866*. Cambridge: Cambridge University Press.

Wawro, Geoffrey. (2000). *Warfare and Society in Europe 1792–1914*. London: Routledge.

Wintjes, Jorit. (2015). "Europe's Earliest Kriegsspiel? Book Seven of Reinhard Graf zu Solms' Kriegsregierung and the 'Prehistory' of Professional War Gaming" *British Journal for Military History* 2, pp. 15–33.

Wintjes, Jorit. (2016). "'Not an Ordinary Game, But a School of War' Notes on the Early History of the Prusso-German Kriegsspiel." *Vulcan* 4, pp. 52–75.

Witte, Wilhelm. (1867). *Die gezogenen Feldgeschütze nach ihrer Einrichtung, Ausrüstung etc. nebst einigen Regeln für die Behandlung des Materials*. Berlin: Mittler.

Young, Peter, and J.P. Lawford. (1967). *Charge! Or, How to Play War Games*. London: Morgan-Grampian.