

***Mos geometricus* v. Reality: Quantity, Quality, Time and Information in Combat Simulations since the Middle Ages**

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*Fühllos selbst für ihres Künstlers Ehre, / Gleich dem toten Schlag der Pendeluhr,
Dient sie knechtisch dem Gesetz der Schwere, / Die entgötterte Natur.*

Friedrich Schiller, *Die Götter Griechenlands*

A braggart, a rogue, a villain, that fights by the book of arithmetic!

William Shakespeare, *Romeo and Juliet*, Act III Scene 1

Abstract – The non-lethal simulated training of lethal reality, whether it be single combat or war, was historically a question of life and death.

We provide an analytical framework for evaluating historical precedents in fight simulations by focussing on two key questions: What was the philosophy guiding the conception of reality – in particular, did historical practitioners see reality as deterministic, and if not, how did they see it? And how did the simulations deal with the elements of quantity, quality, timing, and information?

The analysis shows that our ancestors' perception of the reality of fighting changed over time, as their interpretations of reality for the world at large changed. Considerable intellectual effort and ingenuity were invested into attempts to understand reality and formulate corresponding realistic simulations, making these ludic artefacts reflective, sometimes iconic for, and occasionally ahead of their historical-cultural context. Seemingly irrational phenomena, such as the persistence of lethal duelling, had perfectly pragmatic elements.

Keywords – *mos geometricus*, duel, fencing, HEMA, Jomini, Clausewitz, war game, tabletop gaming

I. INTRODUCTION – THE *MOS GEOMETRICUS*

I.1. Introduction

Our objective in this brief article is to look at the development of combat simulations over time. Until the advent of computers, tabletop gaming was the only form of

wargaming available (other than full-fledged field exercises); until the final demise of duelling after World War I, single combat with sharp blades and so the chance of serious or even fatal injury was, at least in certain circles, an ever-present risk. So simulating combat for the purposes of preparation and training, and the conceptual paradigm for those simulations, were without exaggeration a matter of life or death.

As our analytical framework, we shall at each stage in the development of these simulations consider how the elements of quantity, quality, time, and information are dealt with.

- By “quantity”, we mean the attack or defence value of a given game-piece or move, expressed as a number; e.g. in chess, the attacking piece’s value is always 1, the attacked piece’s defensive value is always 0.
- In some simulations, this numerical value can be modified up or down, reflected in such concepts as morale, fatigue, or experience, or by external factors such as terrain or weather. This “quality” element can either be under the control of the player (e.g. the player can earn or buy improvements, or lose value through combat), or it is aleatory – determined by the throw of dice or a similar random value generator.
- The key distinction in “time” is whether a simulation is turn-based; in a turn-based simulation, while one player is active, the other player must remain passive, and cannot react. Games with more complexity seek to deal with this by spreading some moves over several turns, so introducing a window for reaction.
- “Information” asks whether both parties have the same information, and access to all available information; in chess, both parties have the same information, and have total information – it is not possible to hide a piece or its properties.

The concept of “simulation” implies the effort to approach reality.¹ We shall therefore also consider how reality was conceived at stages during the period under review.

Today, combat simulations come in two guises: Wargaming and martial arts, in their historical forms as tabletop gaming and historical martial arts (commonly referred to as HEMA, Historical European Martial Arts). The two pastimes are characterised by two commonalities: a significant constituency of their practitioners is deeply concerned with reflecting “reality”;² but they are unlikely to ever be called upon to use their knowledge and skills in a “real” situation, so cannot definitively test the veracity of their interpretations.

¹ In the terminology of Schuurman, *Models*, the “reality” is the model which guides the simulation; Deterding, *Living Room*, pp. 34-35.

² For single combat: Gassmann/Gassmann/Le Coultre, *HEMA Practices*, p. 128; for gaming, see e.g. Chandler, *Medieval Baltic*.

The history of wargaming and simulated single combat are each extensive areas, and we do not attempt to deal representatively with either. We have deliberately chosen selected witnesses who, to our mind, allow us to illustrate a development or are representative of a certain philosophy. In doing so, we tend to present a one-sided account of that person's views or that school, when in reality their position was more differentiated or changed over time. We also leave out other witnesses who may have been influential on the subject. This was unavoidable, and the secondary literature should help rectify these sins of commission and omission. Still, our findings on the historical perceptions of reality and our ancestors' means of addressing the resulting challenges in our view help us understand and appreciate the lessons that can be learnt from both the historical precedents and today's practice.

I.2. The *mos geometricus*

Renaissance and Humanism – and the Reformation – removed theology as the universally applicable touchstone for truth in Christian Europe. Instead, philosophers sought to anchor truth in *ratio*. By way of the *mos geometricus*, the geometrical method, it was proposed that verities could be deduced with mathematical certainty from a narrow set of self-evident axioms. The *mos geometricus* was applied to jurisprudence as much as to philosophy.³

By the 18th Century, not least under the impression of Newton's gravity mechanics and their application to the motion of celestial bodies, the notion that mathematical rules not merely reflected, but shaped reality, including human endeavour, had considerable weight of evidence and secular academic opinion in its favour, even if it may not have been universally accepted (and was certainly opposed by the Catholic⁴ and Protestant churches). Tractates claiming to treat their subject *more geometrico* (or similar words to that effect) abounded.

I.3. Translations

Translations are ours unless otherwise indicated.

II. FRAMING REALITY: THE GEOMETRY OF FIGHTING

The importance of geometry and mathematics in the warfare of the early modern times is obvious. Standardised gunpowder formulations, machined barrels and precise projectile calibres made artillery (the *ars telorum*) calculable, and the notion of angles of fire

³ Meder, *Rechtsgeschichte*, pp. 261-262; Schmelzer, *Pacheco*, pp. 339-340; Dubouclez, *Descartes*; Margot, *Descartes y Spinoza*. In war: Guerlac, *Vauban*, pp. 67-68. The title of Baruch de Spinoza's 1677 *Ethics* is explicit: *Ethica ordine geometrico demonstrata*.

⁴ The Church censor called upon to rule on the *imprimatur* for Rada certainly considered the issue and found Rada compliant: Gayol, *Imagen*, p. 428.

determined the geometric layout of the fortifications of the *trace italienne*.⁵ Navigating the oceans required solid mathematics.

This chapter considers the relationship between perceived reality on one hand and geometry and mathematics on the other hand, in the context of single combat – for practical purposes, by reference to the fight manuals that use the terms (predominantly in connection with fencing).

II.1. *Geometria* and the *artes mechanicae*

Drawing on sources in Antiquity, Scholasticism refined the distinction between the *artes liberales* and the *artes mechanicae*, typically translated as “arts”, though “crafts” or “skills” would be more appropriate. A definitive canon of seven *artes liberales* – the *trivium* of *grammatica*, *logica* and *rhetorica*, and the *quadrivium* of *arithmetica*, *geometria*, *astronomia* and *musica* – was established fairly early on and remained unchanged. Though an attempt was made to summarise the *artes mechanicae* into seven as well, the categories were never agreed, and it was acknowledged that there was no need to provide a definitive catalogue.⁶ In any event, there is no disagreement that fighting is an *ars mechanica*.⁷

Masters in an *ars mechanica* seeking to boost the standing of their discipline invoked the importance of *artes liberales* in their *ars*; Ruy Lopez did so for chess in his early 16th Century treatise.⁸ In fencing, Filippo di Vadi in his ca. 1480 *de arte gladiatoria dimicandi* declared that fencing is *scienza vera e non è arte* because *la geometria e musica comparte / le loro virtù scientifiche in la spada / per adornare el gran lume de Marte*.⁹

Used in this sense, the appeal to mathematics is unrelated to the conception of physical reality; the empirically found mathematical aspects of fighting are used to justify the transcendental, metaphysical positioning of the art, and not as a tool to assist the practitioner in the execution of the art.¹⁰

⁵ Guerlac, *Vauban*, pp. 68-71; Bomprezzi, *Pensamiento militar*, pp. 777-779.

⁶ See discussion with Rubio, *Las Artes*; Costa, *Siete Artes*.

⁷ Jaquet, *Fightschools*, pp. 48-49; though the German authors are no less fluent in Aristotelian concepts: Burkart, *Hs. 3227a*, pp. 456 and 475-478.

⁸ See paragraph IV.1.

⁹ “True science and is not [mere] craft” because “geometry and music impart their scientific properties to the sword to adorn the great light of Mars”; Rubboli/Cesari, *Vadi*, pp. 36-37. Already in the early 15th Century, the Bolognese fencing master and professor for geometry at the University of Bologna, Filippo di Bartolomeo Dardi, had obtained his chair thanks to a treatise on the relationship between geometry and fencing, now lost: Rubboli/Cesari, *Anonimo Bolognese*, p. 9; Mondschein, *Fencing*, pp. XVI-XVII.

¹⁰ Similarly Mondschein, *Fencing*, pp. XVII-XVIII.

II.2. The *verdadera destreza de las armas*

The Spanish *verdadera destreza*, the “true skill”, is a vast and specialised subject-matter that cannot be done justice in a few paragraphs, but the ubiquity of geometrical sketches in the school’s works obliges us to consider the issue. We shall focus here on one aspect only, the appeal of the masters to geometrical (or mathematical) principles.

Already the Milanese engineer Camillo Agrippa (?-1595?) had thoroughly geometrified fencing techniques in his 1553 *Trattato*.¹¹ The first Spanish author of note to expand on Agrippa’s lead and propound the *verdadera destreza* is Jerónimo Sánchez de Carranza (1539?-1607?); originally from Seville, he attended the Duke of Medina Sidonia and died in Honduras, having served there as governor.¹² He was followed closely by Luis Pacheco de Narváez (1570-1640), fencing master to King Philipp IV of Spain.¹³ The last major author of the Spanish school was Francisco Lorenz de Rada (1660-1713); born in Spain, he was at one time governor of Vera Cruz, Mexico, later advanced to a high position in the colonial administration, and died in Mexico City.¹⁴

Carranza’s *Philosophia* (1582) is structured as four dialogues written in the typical Renaissance manner, drawing heavily in style and references on authors from Antiquity, and emphasising that a comprehensive Classical and Scholastic education was indispensable to the true *diestro*.¹⁵ Pacheco, writing shortly after Carranza, annotated Carranza and focused on aligning Carranza’s philosophy-heavy disquisitions with practical implications, but later distanced himself from Carranza.¹⁶ Rada’s *Nobleza de la espada* (1705) is a milestone in the *verdadera destreza*.

For Pacheco, writing in 1600, the *verdadera destreza* is founded in the *quadrivium* of the *artes liberales*, providing its propositions with perfection, infallibility, certainty and truth; more

¹¹ Agrippa, *Trattato di Scientia d’Arme, con vn Dialogo di Filosofia* – the “philosophical dialogue” appended to the work (fol. 64r-70r) refers to the scientific grounding of the techniques in mathematics and geometry, but does not engage in the *artes liberales/mechanicae* discussion. Mondschein, *Fencing*, pp. LV-LVI; Gayol, *Imagen*, p. 435; Wetzler, *Fechtkunst*, p. 71.

¹² Valle Ortiz, *Destreza*, pp. 326-329; Bomprezzi, *Pensamiento militar*, pp. 774-775.

¹³ Valle Ortiz, *Destreza*, pp. 335-337; Bomprezzi, *Pensamiento militar*, pp. 775-776.

¹⁴ Gayol, *Imagen*, p. 438.

¹⁵ Hierónimo Sánchez de Carança, [*libro ...*] *que trata de la philosophia de las armas, y de su destreza, y de la aggression y defension christiana*. Gayol, *Imagen*, pp. 433-437; Mondschein, *Fencing*, p. XXIX. As an interesting aside (that cannot be further explored here), Margot (*Descartes y Spinoza*, p. 87) argues that the literary form of the dialogue *en vogue* at the time was a device to escape the strictures of proper syllogistic argument, a failing which the *mos geometricus* sought to remedy; yet Carranza (among others) used the format to propound a strict geometrical reasoning.

¹⁶ Pacheco de Narváez, *Libro de las grandezas de la espada: en que se declaran muchos secretos del que compuso el Comendador Gerónimo de Carrança: en el qual cada uno se podrá licionar y deprender a solas sin tener necesidad de maestro que le enseñe*. Valle Ortiz, *Destreza*, pp. 329-331 and 335-337; Gayol, *Imagen*, pp. 436-437; Mondschein, *Fencing*, pp. XXIX-XXX.

than that, the *verdadera destreza* is superior to the (theoretical) sciences in that it is manifest in practices and, like the Pole Star, guides man on true paths.¹⁷

As regards Rada, a century later than Pacheco, our impression – following Gayol – is that the philosophical, mathematical and geometrical references no longer had the primary focus of raising fencing from a mere craft to an *ars liberalis*,¹⁸ and despite proposing scientific verities, nor were the practices promised to result in scientifically inevitable victory. The focus seems more to provide a social differentiation, where the cultivated individual's education was required for a true understanding of the arcana of the science of fencing, and an immersion in fencing was in turn an essential element in the formation of the noble – in both the social and ethical sense of the word – individual.¹⁹

Indubitably, the techniques of the *verdadera destreza* were (and are) highly effective in terms of fencing. But as Bomprezzi shows, the school's techniques, for all their manneristic feel, also train the intellectual management of space by means of geometry, which in turn was key to understanding the early modern battle-field – and the school's main proponents were all accomplished soldiers.²⁰ The *verdadera destreza* thus distinguishes itself and its adepts from the *destreza vulgar*, the “common skill”, which in the view of the *verdaderos diestros* aims for wins by any gimmick, while the true *diestro* is focused on control.²¹

The appeal to social differentiation can be seen in some Italian masters (where of course the Kingdom of Naples/Both Sicilies was ruled by an Aragonese branch),²² but is largely lacking in the pragmatically oriented German *Fechtbücher*.²³ International contemporaries understood it as a cultural artefact, as is shown by Mercutio's diatribe against Tybalt,

¹⁷ Schmelzer, *Pacheco*, pp. 341-343; Pacheco, fol. 1v: “La *destreza*, por lo que tiene de verdad [...] siempre sale vitoriosa” (“The *destreza*, since it partakes of truth, always emerges victorious”).

¹⁸ Having said that, Rada in 1695 wrote a 234-page *Respuesta filosofica y mathematica en la qual se satisface à los argumentos y proposiciones que à los profesores de la verdadera destreza y philosophia de las armas se han propuesto por un papel, expedido sin nombre de autor* (“Philosophical and mathematical response in which are addressed the arguments and propositions made in an anonymous pamphlet against the professors of the true skill and philosophy of arms”) arguing just that, in the manner of Pacheco (esp. pp. 12-31); Gayol, *Imagen*, pp. 438-439. In his *Nobleza de la espada*, though he discusses the elements of the *quadrivium* (not paginated – in the message to the reader preceding Book 1, 2nd and 3rd page) and the distinction between the *artes liberales* and the *artes mechanicæ* (Book 1, pp. 15-17), we read especially the latter passage as arguing that the dichotomy is a false one, merely describing different aspects of the same process. Rada instead uses the terms *ciencia*, *arte*, *experiencia* (in our view to be transposed as “theory, skill, practice”), which have to come together in the true *diestro*. Gayol, *Imagen*, pp. 449-451, though we here diverge from Gayol.

¹⁹ Gayol, *Imagen*, pp. 448-456; Valle Ortiz, *Destreza*, p. 334.

²⁰ Bomprezzi, *Pensamiento militar*, pp. 777-779; also Schmelzer, *Pacheco*, p. 344.

²¹ On the *esgrima vulgar*. Bomprezzi, *Pensamiento militar*, pp. 776-777; Moya Montes, *Esgrima vulgar*.

²² E.g. the late 15th Century Filippo Vadi: Rubboli/Cesari, *Vadi*, p. 34. Deacon, *Purposes*, pp. 72-73, suggests that Vadi may have been motivated more by self-aggrandisement and positioning.

²³ Jaquet, *Fightbooks*, pp. 49-51; Deacon, *Purposes*.

where the initial Shakespeare quotation is taken from. In Spain, too, the lofty and exclusive claims of the *verdadera destreza* were fodder for the sharp satire of social critics like Miguel de Cervantes.²⁴

On comparison, all four of our criteria are clearly present in the *verdadera destreza*. Though the immersion into mathematical concepts is comprehensive and profound, we see them as tools to analyse and understand reality and to better react to it, not to control reality or to divine the deterministic precepts of geometry.

II.3. Gérard Thibault

No discussion on geometry in fencing can omit Gérard Thibault.²⁵ His 1630 *Académie de l'espée* is lavishly illustrated with intricate geometrical drawings, explained in length and breadth by the author. In his arguments, Thibault – entirely in line with his teacher Pacheco²⁶ – no longer sought to improve fencing's standing by borrowing the lustre of the *artes liberales* – fencing was itself a science as precise and infallible, as open to proof and falsification, as mathematics. While there were fencers who dominated their opponents through gimmicks or sheer force, they *ne comprennent pas les secrets d'une Armure si noble; & que tout ce qu'ils font n'est fondé en aucune raison de vraye & solide Theorie, mais en simple & mal asseurée Pratique, de façon que de vouloir comparer leur Escrime au vray Art de manier les armes, c'est tout autant que de mettre en parangon le manuel des œuvres Mechaniques avec les inventions des Mathematiques; dont les unes se contentent d'obtenir seulement l'effect, encor que ce fust par hazard; & les autres n'advouent rien pour bon qui ne soit fondé sur des regles infallibles.*²⁷

Thibault's infallible rules did not encompass just the techniques; timing, too, is of the utmost importance. Windows of opportunity may be open for only an instant, and he stressed the power of an attack into the opponent's *tempo*.

Overall, Thibault in our view saw his fencing technique marrying the aspects of quantity and time, without any room for quality, and one must presume that the perfection of the system eliminated the need to deal with information: *Car quand on aura fait une digne recherche de leur Verité, & de leur importance, on verra que l'incertitude de la fortune n'y a nulle part, & que les seules regles de la science y dominant en telle perfection, quel Amateur, qui s'en sera rendu capable, empruntera mesme le courage & l'assurance des armes, qui manque à la foiblesse des ses forces de la*

²⁴ *Don Quixote* was published between 1605 and 1615; Gayol, *Imagen*, pp. 427-428; Schmelzer, *Pacheco*, pp. 344-345.

²⁵ Majar/Várhelyi, *Thibault*; Greer, *Academy*; Wetzler, *Fechtkunst*, p. 72; Mondschein, *Fencing*, p. XXIX.

²⁶ Greer, *Academy*, p. 1.

²⁷ Are “not comprehending the secrets of so noble a weapon. All that they do is founded not on any reason of true and solid theory, but on simple and uncertain practice, so that to wish to compare their fencing to the true art of handling arms is just the same as to put the manual of mechanical works on the same level as the discoveries of mathematicians. The former are content to obtain the effects that they intend and nothing more, while the others state nothing for certain which is not founded on infallible rules”; trans. Greer, *Academy*, p. 57.

*certitudo & dexteritas de leur usage.*²⁸ The science is deterministic – it shapes the fencer’s reality.

II.4. *Geometria* and *mos geometricus*

Evidently fencing masters incorporated geometry into their fencing theories, and there can be no doubt that an awareness of distances, angles and so on is helpful to understanding the dynamics of fencing. It is also clear that fencing masters saw the geometrical element as introducing a measure of science into fencing, a craft that is otherwise mainly characterised by doing, by practice. No doubt the scientific appeal also resonated with their clientele in a time when the mathematical laws of nature were perceived to determine significant aspects of life and reality.

Still, at least other than Pacheco and Thibault, the appeals to *geometria* appear to have been driven either by a backward-looking desire to elevate fencing from a (mere) *ars mechanica* to an *ars liberalis* within the hierarchy of late scholasticism, or as a scientific approach to reality, i.e. that fencing, like all aspects of nature and human endeavour, is amenable to geometrical and mathematical analysis. It is only with Pacheco and Thibault that we see the argument characteristic of the *mos geometricus*, that *ratio* can control reality, that the analysis can determine the one perfect and of necessity infallible technique to apply.

III. TACTICAL LITERATURE: JOMINI AND CLAUSEWITZ

Didactically effective wargaming requires an intellectual framework to define the reality being simulated. Tactical literature abounds from the 16th Century onwards, and focused on attempts to capture the chaos of war in prescriptive, preferably scientifically mathematical terms. The Sieur du Praissac in his 1614 *Briefve Methode Pour Resoudre Facilement toute question militaire proposée* (Brief Method for Easily Resolving Any Military Question Asked) proposed a contraption of nine concentric discs turning around a central pivot, each containing six options on the question asked: The outermost ring was on the question “whether”, i.e. whether to make war, peace, truce, etc. The next ring was on the question “with whom”, i.e. allies, enemy, etc. By the time one had worked through the nine questions, the approach to the problem was spelled out.²⁹

Reflections on the underlying principles of warfare did not come until the late 18th Century. The epitome of the quantitative approach is probably the Prussian aristocrat Baron Heinrich Dietrich von Bülow, reflected in his 1799 *Geist des neuern Kriegssystems*

²⁸ “For when an honest inquiry is made into their verity and importance, it will be seen that the incertitude of fortune has no part in them, and that the rules of science alone dominate it with such perfection, that the lover of this art, who will render himself capable of it, will borrow courage and assurance of arms, even if he lacks the certitude and dexterity of their usage by the feebleness of his forces”; trans. Greer, *Academy*, p. 71.

²⁹ Praissac.

(Spirit of the New System of War),³⁰ which provided a foil to two authors of the time who both still inform today's discussion: Jomini and Clausewitz.

III.1. Baron Antoine-Henri de Jomini

Antoine-Henri Jomini (1779-1869) was born to an *haut bourgeois* family in Payerne, in the Bernese subject territory of Vaud, Switzerland. Destined for a banking career, he was sent to Paris in 1796. Caught up in the revolutionary fervour of the times, he eventually signed up with Michel Ney, later one of Napoleon's most enthusiastic followers and trusted lieutenants. Ney was impressed by Jomini's early work, the first two volumes of the *Traité des grandes opérations militaires* (Treatise on Major Military Operations, 1803), and highly valued the young Vaudois' talents as a staff officer. Jomini rose rapidly in rank and respect, and was awarded a barony in 1807 following the Peace of Tilsit. On Ney's and later Napoleon's staff, he continued to publish his thoughts on tactics and training of tactics, to critical acclaim.

Jomini's status was always ambiguous – he was Swiss, not French, and a pure autodidact, without military pedigree or formal training. He also seems to have made enemies easily. For a while, Jomini held both French and Russian commissions, and after Waterloo 1815, he again took Russian service. Throughout, he was always employed in a staff capacity, he never had line command of units of any size.

Jomini published numerous works on military science, writing prolifically, lucidly and to friendly reception into his old age. His 1803 *Traité* was followed in 1806 by the *Résumé des principes généraux de l'art de la guerre* (Summary of the general principles of the art of war) and in 1830 *Tableau analytique des principales combinaisons de la guerre* (Analytical picture of the principal combinations in war). The most well-known one is the 1838 *Précis de l'Art de la Guerre* (Short Treatise on the Art of War).³¹

III.2. Carl von Clausewitz

Carl Philipp Gottfried (or Gottlieb) von Clausewitz (1780-1831) was born into a Prussian ministerial family of dubious nobility. Already in the army at age twelve, he saw action in the French Revolutionary and early Napoleonic wars as a front-line subaltern in skirmishing infantry. Inducted into the *Kriegsakademie* (war college) in 1801 and graduating top of his class 1803, he was gazetted major and subsequently held staff appointments. Clausewitz was taken prisoner after Prussia's defeat at the Battle of Jena and Auerstädt in 1806 and spent two years as a POW in France. Released in 1808, his *Kriegsakademie* teacher Gerhard von Scharnhorst recruited him to implement the radical reorganisation of the Prussian military and state, which would turn the Prussian army from a hidebound shadow of its Friederician self into Europe's most modern force.

³⁰ Palmer, *Frederick the Great*, pp. 114-119. Not to be confused with his elder brother, General Count Friedrich Wilhelm von Bülow, commander of Blücher's IV Corps at Waterloo. Not specifically referencing Bülow: Hilgers, *Kriegsspiele*, pp. 125-126.

³¹ Shy, *Jomini*; Abegglen, *Influence*, pp. 5-7.

Disgusted by Prussia's subservience to Napoleon in the Russia campaign 1812, Clausewitz joined Russian service and was instrumental in persuading Ludwig Yorck von Wartenburg to neutralise the Prussian corps following Napoleon's losses in Russia. During the Hundred Days Campaign 1815, Clausewitz was chief of staff to Thielemann, whose III Corps tied down Grouchy's army at Wavre, allowing Blücher to send his IV and II Corps to Wellington's aid at Waterloo. After Waterloo, Clausewitz was appointed administrative director of the *Kriegsakademie*, where he served until 1830, dying of cholera on campaign in 1831 without having completed the work he is famous for, *Vom Kriege* (On War), on which he had been working since 1816. Clausewitz' widow, Countess Marie von Brühl, a highly educated and independent woman from old-line German nobility, edited Clausewitz' notes and had *Vom Kriege* printed in 1832.³²

III.3. Jomini v. Clausewitz

The juxtaposition "Jomini v. Clausewitz" is a perennial subject of controversy in literature on the history of military theory; some authors emphasise the commonality of their views, some the deep chasm between their respective philosophies.

The "commonality" argument can be traced to two factors:

- Jomini outlived Clausewitz by decades, and was able to react to Clausewitz' criticism of his work in his later writings, as is evident from several passages in the *Précis*,³³ and
- Both were practical men, working contemporaneously with the same tools in an eminently practical field, both had personally experienced military success and failure, and both had studied military history from the point of view of an expert practitioner. It is not particularly surprising that in their analyses of, or proposed solutions to, practical problems, they would arrive at very similar results.

One might be tempted to see Jomini as the journeyman stage of military craft, and Clausewitz as the master class, taking craft to art. However, there is a fundamental difference in approach between Jomini and Clausewitz. Tempered though they are by common sense and experience, Jomini's works are based on a mechanistic, deterministic view of warfare, involving scientific rules manipulating facts that can be quantified.³⁴ The quantifications determine the actions to be applied. In terms of our categories, one might

³² Paret, *Clausewitz*.

³³ Abegglen, *Influence*; Jomini was also not above criticising Clausewitz: *Précis*, p. 27: *Les ouvrages de Clausewitz ont été incontestablement utiles quoique souvent ce soit moins par les idées de l'auteur que par les idées contraires qu'il fait naître. Ils eussent été plus utiles encore si un style prétentieux et pédantesque ne les rendait pas fréquemment inintelligibles* (The works of Clausewitz have undoubtedly been useful, if often less for the author's ideas than for the opposing ideas they give rise to. They would have been even more useful if a pretentious and pedantic style did not often render them unintelligible).

³⁴ Jomini, *Tableau*, p. 1 (*Avertissement de l'auteur*); Shy, *Jomini*, p. 148; Schuurman, *Models*, p. 452; Crevel, *Wargames*, p. 174.

say that Jomini sought to subsume issues of quality and timing into quantity,³⁵ and thus as matters that have, when properly analysed and categorised, an unambiguous, scientifically correct and learnable answer – the aspect of information is glossed over.³⁶ This approach lends itself to being formulated into didactical precepts – and Jomini, regardless of the extent to which he sought to accommodate Clausewitz' critiques, always saw his works as primarily didactical.³⁷ He wrote for an audience and cast his writings in a form and terms that his audience expected and which appealed to it. To some extent, Jomini is not a household name precisely because modern military manuals consciously or unconsciously are based on his didactic approach.³⁸

Clausewitz does not deny that warfare is a craft with skills that can be taught and learnt, but he emphasises that in actual life, reality intrudes, thus negating the infallibility of mechanistic solutions.³⁹ He is no less grounded in the natural sciences, geometry and mathematics, but he sees their application to the art of war as probabilistic, not deterministic. Quantifications do not, and must not, rule; with this, Clausewitz rejects the applicability of the *mos geometricus* in warfare.⁴⁰

³⁵ Shy, *Jomini*, p. 173.

³⁶ Jomini, *Précis*, p. 28: ... *si l'on rassemblerait ... un comité composé de toutes les notabilités stratégiques et tactiques du siècle ... ce comité ne parviendrait pas encore à faire une théorie parfaite absolue et immuable ... de la guerre ...* (if one assembled a committee of all the strategic and tactical luminaries of the century, this committee would not yet be able to create a perfect, absolute and immutable theory of war) [emphasis ours].

³⁷ Jomini, *Précis*, p. 27; Abegglen, *Influence*, p. 3.

³⁸ Abegglen, *Influence*, pp. 4-5. Coincidentally, the Napoleonic era saw the demise of the hitherto predominant, thrust-focused small-sword in favour of cut-and-thrust sabre: Wetzler, *Fechtkunst*, p. 74; Gevaert, *Saber*, pp. 105-109.

³⁹ Clausewitz, Book 6, Cap. 30 (p. 368): *Wir bekennen also, daß wir in diesem Kapitel keine Grundsätze, Regeln oder Methoden anzugeben wissen, weil uns die Geschichte nichts dergleichen darbietet ... Aber darum ist es nicht unnützig, die Geschichte auch in dieser Beziehung zu studieren. Wo es auch kein System, keinen Wahrheitsapparat gibt, da gibt es doch eine Wahrheit, und diese wird dann meistens nur durch ein geübtes Urteil und den Takt einer langen Erfahrung gefunden. Gibt also die Geschichte hier keine Formeln, so gibt sie doch hier wie überall Übung des Urteils* (So we confess that we cannot in this chapter know of any principles, rules or methods which we could propound, since history does not offer any anything of the sort... Still, that does not render pointless the study of history in this respect. Though there may be no system and no truth machine, there is nevertheless a truth, and this is then commonly found only by practiced judgement and the measure of long experience. So while history does not offer formulae, it does offer *practice of judgement* [emphasis in the original]).

⁴⁰ Beyerchen, *Nonlinearity*. Clausewitz, Book 1, Cap. 1, Section 21 (p. 18): *Wir sehen also, wie von Hause aus das Absolute, das sogenannte Mathematische, in den Berechnungen der Kriegskunst nirgends einen festen Grund findet, und daß gleich von vornherein ein Spiel von Möglichkeiten, Wahrscheinlichkeiten, Glück und Unglück hineinkommt, welches in allen großen und kleinen Fäden seines Gewebes fortläuft und von allen Zweigen des menschlichen Tuns den Krieg dem Kartenspiel am nächsten stellt* (So we see essentially that nowhere in the calculations involved in warfare does the absolute, the so-called mathematical, find firm grounding, and that from the very beginning a play of possibilities, probabilities, luck and misfortune intrudes,

Clausewitz is connected with (among others) two key concepts:

- “Friction”, “the force that makes the apparently easy so difficult”, i.e. the vagaries of weather or random chance; terrain, fatigue, morale, physical threat, etc.; delays in transmitting orders, having them understood correctly, and relying on subordinates to execute them as expected; as well as, importantly, enemy action;⁴¹ and
- “Fog of war”, the realisation that information is of necessity incomplete, irrelevant or potentially faulty, and correct and complete information is not obtainable at all or not within realistic time.⁴²

This means that commanders *at all levels* must assess the available information critically and adapt to realities as a factor of time (and must have the freedom to adapt to them). Since these influences are by definition unknowable, Clausewitz cannot provide prescriptive solutions, but is confined to raising awareness for them and suggesting principles for finding a solution.

IV. WARGAMES: CHESS, HELLWIG, REISWITZ, WELLS

A war game, through its rules, crystallises a paradigm of reality – in what is relevant and what is not, what is rewarded, and so on.⁴³

The first army to use wargaming in their officer training was the Prussian Army, beginning in the early 19th Century, and for about half a century, until Prussia’s victory against France in the war of 1870/71, they remained the only ones to do so.⁴⁴ Wargaming itself has a much longer pedigree; already in the early 16th Century, the Hessian count, adventurer and military engineer Reinhard zu Solms published a set of cards to be used for wargaming. Unfortunately, little is known about how they were used.⁴⁵

which continues into the warp and weft of its fabric, and places war closest to, among all walks of human endeavor, a game of cards).

⁴¹ Paret, *Clausewitz*, pp. 202-203. The use of the term “friction” is no accident – Clausewitz deliberately wanted to emphasise that one could not assume that warfare worked like the perfect machine, modelled after Newton’s celestial motions, as portrayed by mechanistic writers and bemoaned by Schiller in the introductory quotation, but that the banal, the unexpected and enemy action grind and gum up its gears: v. Hilgers, *Kriegsspiel*, p. 57; Clausewitz, *Vom Kriege*, Book 1, Cap. 7, 8 (pp. 47-49); Schuurman, *Models*, p. 450.

⁴² Technically, “fog of war” is an aspect of friction. We have separated it out here to emphasise a key difference between (most) wargames and reality: Gamers usually view the “battle-field” from the “God perspective”, seeing perfectly all their own and their opponent’s units. Schuurman, *Models*, p. 451.

⁴³ Deterding, *Living Room*, pp. 34-35.

⁴⁴ Wintjes, *Kriegsregierung* p. 16; Choy, *Wargaming*, pp. 5-6.

⁴⁵ Wintjes, *Kriegsregierung* pp. 23-33. For fencing, a group of fencers have developed a card game called *Audatia*: players can mount attacks, counters, counter-counters etc. by laying down cards with

Maurice and Louis William of Nassau, so instrumental in creating the pike and shot tactics that could defeat the Spanish *tercio*, in the late 16th Century used tin soldiers on a table top to figure out how authors of Antiquity might have intended the formations described in the texts, and it was reputedly here that they came up with their counter-march manoeuvre, but they do not seem to have used their set-up for gaming.⁴⁶ Successive inventors tinkered with the principles of chess and then went far beyond to devise more realistic gaming and military education experiences, and we here present a selection of the exponents.⁴⁷

IV.1. Chess and Ruy Lopez

Chess probably came to Christian Europe via Moorish Spain in the 9th Century. It rapidly became popular.⁴⁸ But chess was only one of the mathematically infused games medieval intellectuals delighted in; Hilgers describes *conflictus numerorum* from the 11th and 12th Centuries, in which the objective was to arrange one's counters on the opponent's side of the board through moves obeying the rules of arithmetical, geometrical or musical harmonies.⁴⁹

The first Christian treatise on chess is Ruy Lopez de Segura's *Libro de la Inuencion Liberal y Arte del Juego del Axedrez* of 1561. For Ruy Lopez, *este juego sea invencion belica*, and references to Vegetius and to military aphorisms by other authors from Antiquity abound.⁵⁰ It is also a scientific game, a mathematical contrivance based on the *artes liberales* geometry and arithmetic.⁵¹ His book though does not include any diagrams.

the corresponding correct techniques. It teaches Italian and German longsword terminology and stimulates tactical discussion: < audatiagame.com > (queried 20th November 2018).

⁴⁶ Hilgers, *Kriegsspiele*, pp. 29-31.

⁴⁷ Schuurman, *Models*; Wintjes, *Kriegsregierung*, pp. 15-23; Vego, *War Gaming*, pp. 106-112; Pias, *Welten*, pp. 163-180; Hilgers, *Kriegsspiele*, pp. 11-71; *idem*, *Anleitung*, pp. 59-60; Deterding, *Living Room*, pp. 23-24. A curiosity is the game developed by the Frenchman Louis Simon Joseph Bernard de Montbrison (*Le Jeu de la guerre de terre et de mer, et les derniers chapitres de Tristram Shandy, trouvés dans les papiers d'Yorick* (Paris: Goujon, 1818)): it purports to be the French translation of a 'rediscovered' additional chapter of Laurence Sterne's mid-18th Century *Tristram Shandy*, elaborating a war game supposedly invented by Uncle Toby (who in the book re-enacts sieges of the War of the Spanish Succession in his garden – Schuurman, *Models*, p. 446, 455).

⁴⁸ Creveld, *Wargames*, pp. 141-145; Vego, *War Gaming*, pp. 106-107.

⁴⁹ Hilgers, *Kriegsspiele*, pp. 12-19.

⁵⁰ Ruy Lopez; the quote "this game is a war-related contrivance" is on fol. 47v; on fol. 7v: *juego en forma de guerra* (a game in the form of war, or battle). Also Hilgers, *Kriegsspiele*, p. 145.

⁵¹ *Ser el juego del axedrez è inue[n]cion mathematica, consta por muchas cosas. La primera, porque el esta fundado sobre los artes liberales, co[n]niene a saber, Geometria, y Arithmetica...*; Ruy Lopez, fol. 1r.

Considering chess on the basis of the four criteria, we find:

- Quantity is the key element, and it is binary; an attacking piece always has the strength 1, the defending piece the strength 0. There is no scenario in which e.g. a pawn in a valid attack on a knight would ever lose the encounter.
- Quality is not a factor – other than the choice of colour at the start of the game, there is no aleatory element. There is no concept of friction, the training, morale or fatigue of the pieces does not affect the game, nor do terrain or weather present challenges.
- Time also is not a factor (leaving aside the time limitations introduced for match-play). Chess is a radically turn-based game, in which each player may only move one piece per turn (leaving aside castling), but also *must* move a piece.
- Information is not a factor – both players have total information.

IV.2. Hellwig's *taktisches Spiel*

Johann Christian Ludwig Hellwig (1743-1831), the court mathematician in the Duchy of Brunswick, in 1780 published his *Versuch eines aufs Schachspiel gebaueten taktischen Spiels von zwey und mehreren Personen zu spielen* (Attempt at a tactical game, derived from chess, to be played by two and more persons).⁵² By its title derived from chess, it utilised a board divided into squares as in chess, but introduced a host of differentiations and innovations meant to render the game more “realistic” and more instructive as a military exercise.

- Quantity: As in chess, the game board was divided into squares, and unit movements were by squares.

As befits a “realistic” war game, different units had different movement values, and he also introduced the concept of artillery, ranged units, which required complex adjustments to the rules. However, Hellwig remained true to chess – and the faith in the mechanistic nature of human endeavour – in that there was no element of probability; a unit within range of an attacked unit invariably “took” the attacked unit on its move.

- Quality: Hellwig introduced different terrains, some of which were impassable, other slowed down progress, yet others could not be overshoot by artillery. Again, these frictions were all evident and calculable.
- Hellwig's game was still turn-based, but with added complications. Some events – like a burning village – continued for several turns, obliging the players to keep track.

⁵² Hellwig, *Kriegsspiel*. A later title read: *ein Versuch die Wahrheit verschiedener Regeln der Kriegskunst in einem unterhaltenden Spiele anschaulich zu machen* (an attempt to make apparent the truth of several rules of the art of war in an entertaining game).

- Regarding information, too, Hellwig's game remains true to chess in that all game counters are in the open, visible to both players.

Hellwig sold his game by subscription, and his initial subscriber list resembles a contemporary military Who is Who. His rules were terse and functional, reading like programming instructions, complete with recursive sub-routines. Over time, Hellwig tinkered with his rules, seeking to accommodate more "reality", but the added complexity soon became unmanageable.⁵³

IV.3. Reiszwitz' *Kriegsspiel*

Georg Leopold von Reiszwitz (1764-1828; also spelled Reißwitz or Reiszwitz) invented the original *Kriegsspiel*, but it was his son Georg Heinrich Rudolf von Reiszwitz (1794-1827) who refined it. Reiszwitz *père* took over from Clausewitz as military tutor to the Prussian princes royal when Clausewitz quit the Prussian Army over Prussia's alliance with France 1812, and introduced his charges to his wargame, at first played in a sand-box. Prince Wilhelm (1797-1888, 1871 the first emperor of the Second German Empire) was so enthusiastic that he persuaded his father King Friedrich Wilhelm III (1770-1840) to commission a demonstration from Reiszwitz, and in response, Reiszwitz a year later produced a massive chest with a fold-out top and drawers to accommodate the different terrain tiles, unit counters, bridges, buildings, and other game elements.⁵⁴

In 1824, Reiszwitz *filis* revised and updated the rules, and again presented them to Prince Wilhelm. Wilhelm this time bypassed his father and went straight to Field Marshal Baron Karl von Müffling, during Waterloo Blücher's liaison officer to Wellington and now chief of the newly created Prussian General Staff. The initially sceptical Müffling was impressed by the game, and especially by the fact that it was now played on actual topographical maps, which the Prussian military had begun to produce in high quality. Müffling ordered it included in the curriculum of the *Kriegsakademie*.⁵⁵

Though the game was very much a feature of officer training, it was also played by private clubs.⁵⁶

⁵³ Hellwig, *Kriegsspiel*, Pias, *Welten*, pp. 164-172; Wintjes, *Kriegsregierung* p. 20; Vego, *War Gaming*, pp. 107-108; Deterding, *Living Room*, p. 23; Creveld, *Wargames*, p. 146. On the trade-off between realism and complexity/playability: Schuurman, *Models*; Creveld, *Wargames*, p. 154.

⁵⁴ Hilgers, *Kriegsspiel*, pp. 57-59; *idem*, *Anleitung*, pp. 62-69 (both with pictures); Creveld, *Wargames*, p. 147.

⁵⁵ Hilgers, *Kriegsspiel*, pp. 65-67; *idem*, *Anleitung*, pp. 70-73; Vego, *War Gaming*, p. 111; Creveld, *Wargames*, pp. 149-151. Müffling may have been the inspiration for the character *der Hauptmann* in Johann Wolfgang von Goethe's 1809 novel *Die Wahlverwandtschaften* – Hilgers, *Kriegsspiel*, p. 69.

⁵⁶ Pias, *Welten*, p. 181; Creveld, *Wargames*, p. 151.

The strict or rigid game

The Reiswitz' gaming rules anticipated most elements current in today's gaming.⁵⁷ The heightened complexity was solved by introducing a third party, the *Vertrauensperson* (umpire), who was charged with the administration of the rules and the performance of the calculations; the players themselves no longer needed to understand the underlying algorithms to effectively and enjoyably play the game.⁵⁸

In its refined version, the game was meant to be played by two teams of up to ten members each. Each team would be structured as a commander in chief with subordinate unit commanders. Orders were written on slate tablets and handed to the umpire; the umpire would hold on to the tablet for as many game turns as he thought it would take to arrive with the subordinate commander, and then hand it over.

Players could also "hide" units by informing the umpire of their location, but not representing them by counters. A subordinate commander reconnoitring in force and "discovering" an enemy unit would confidentially inform the umpire of his actions, and the umpire would hold back the subordinate commander's report to the C-in-C for as many moves as the umpire estimated it would take for the galloper to reach the C-in-C; only then would the enemy unit counter be added to the table.

Units were allocated movement and combat values, which were quoted within a range. Within that range, the roll of the die determined the actual value achieved.⁵⁹ As military technology changed, empirical results gathered from battle reports and arsenal trials were fed into updated movement and combat value tables. It was the job of the umpire to derive e.g. the terrain penalty from the information contained in the game map – gradients and the like – and calculate the actual movement applying the tables and dice values.⁶⁰

Play was turn-based; on its turn, each team could perform as many actions as were possible in a two-minute window (the time to reload a front-loading artillery piece).⁶¹

A later update of the rules introduced a "Leroy Jenkins" feature: if a player wanted to order a move that defied all military logic, e.g. order one squadron of cavalry to attack twenty, an initial roll of the die would decide whether the move would be permitted – in

⁵⁷ The convention of colouring own forces blue and enemy red also goes back to Reiswitz – blue was the Prussian uniform colour: Vego, *War Gaming*, p. 109; Creveld, *Wargames*, p. 151.

⁵⁸ I.e. the game mechanics were "blackboxed" – Deterding, *Living Room*, pp. 34-35.

⁵⁹ Schuurman, *Models*, p. 450. The aleatory element of the throw of the dice mirrored the randomness of dispersal of shots, parameters for which Scharnhorst established through crude but systematic trials: Choy, *Wargaming*, p. 8; Creveld, *Wargames*, pp. 149-150.

⁶⁰ More on the rules and play: Hilgers, *Kriegsspiel*, pp. 61-65; *idem*, *Anleitung*, pp. 74-76; Vego, *War Gaming*, pp. 108-110; Schuurman, *Models*, p. 445; Deterding, *Living Room*, pp. 23-24; Creveld, *Wargames*, pp. 149-151.

⁶¹ Pias, *Welten*, pp. 173-180; Creveld, *Wargames*, pp. 149-150.

practical terms, whether the subordinate commander might refuse the order. If the move was permitted, a second roll would determine its effectiveness.⁶²

The free game

Dissatisfied with the strictures and cumbersome mechanics of the Reiswitzian rules, a group of senior officers around General Julius von Verdy du Vernois in 1876 introduced the “free game” – in this version, all fixed rules, combat value tables and dice, as well as the slate tablets for issuing written orders, were dispensed with. Instead, the players moved their units at will, and the umpire would rule on whether, in the umpire’s expert opinion, the move was possible given the terrain and circumstances, and what the chances of success would be.

We shall not further discuss the free game – in terms of military training, the free game became an extremely valuable and powerful tool, but its quality depended on the expertise of the umpire, and the most important part of the game was the expansive discussion where the umpire would query the player’s motivation for a move, and alternative options as well as tactical doctrine were discussed at length. For important war games, the General Staff composed detailed “after-action reports” analysing the game’s lessons.⁶³ But in terms of this article, the realism of this “ruleset” was imported into the game by its players, it was not an artefact of the (largely non-existent) rules.

Quantity, Quality, Time, Information

In the “strict game”, quantity and quality to a large extent merge – they are no longer (fully) predictable, but they become probabilistic, within a realistic range of possibilities.

Time, too, is addressed in a manner, by having very short turns. However, the interruption of game after two minutes is, of course, unrealistic and affords players an opportunity for reflection that is not available in combat. On the other hand, this can be considered a feature, not a bug: The point of the game is educational, and the slower pace allows players to practice situation assessment, decision-taking and formulation of orders – as well as, particularly in the free game, in-depth discussion of tactics and doctrine.

Similarly, the umpire’s role in hiding unit counters until they are discovered by reconnaissance, and delaying information flow, injects this factor into the game.

IV.4. H.G. Wells’ *Little Wars*

The first real civilian wargame, H.G. Wells’ *Little Wars*, may at first be dismissed as just boys playing with toys, indeed the author himself deprecates it as such. It was a simple affair based on using toy artillery pieces launching wooden dowels to knock over tin soldiers, without infantry fire and no qualitative difference between guns or soldiers aside

⁶² Pias, *Welten*, pp. 177-178; *Supplement*, pp. 78-81.

⁶³ Choy, *Wargaming*, pp. 15-17; Creveld, *Wargames*, pp. 151-153; *Sandhurst Free Kriegsspiel*.

from rate of movement in cavalry and infantry.⁶⁴ But it does illustrate general thoughts of what contemporary warfare should be like, though we should still be aware that not only is it divorced from reality as all wargames are, but it does not even have the same goal of near realism that military wargames intrinsically have.

Nonetheless, while he strives to make some things more realistic over the design process (complicating terrain from piles of books to elaborate rivers and villages, preventing guns from firing without crew, two-minute turn times), other decisions are made to remove the vagaries of friction and “return strategy to its proper place”. While in early versions melee is decided by coin flip, the loser removing a model, later versions simply have soldiers kill each other 1:1 until one side is double the amount of the other, capturing them.⁶⁵

If we then analyse it by our criteria of quality, quantity, timing, and information: quality is more complicated than something like chess, but only just. Cavalry and infantry are practically identical, aside from movement rate, and all die equally both in melee and to artillery fire. While this can partially be explained by Wells’ pacifism (everyone dies equally in the horror of war), it is shared by most other wargames of the period. Certain choices however are radically modern, such as the idea of keeping troops in their boxes for moving, both facilitating ease of play and (more importantly) keeping your opponent guessing as to the real size of force until they are revealed by cavalry scouts. Quantitatively both sides are the same, but a lack of perfect information differentiates it slightly.⁶⁶

Others, such as the 1888 *New Game of Invasion* by Lt. Henry Chamberlain of the Royal Navy, again intended for a civilian audience, plays more like a game of checkers with 12 defending British divisions and 8 invading. It simulates defending the south-east of England after a British naval defeat in the Channel. While again it has a political motive, namely to alert the populace to an apparent over-reliance on the navy, the game demands that the British player have a 2:1 advantage in order to take an invading piece. Even this small change in the mechanism evokes an entirely different feeling, namely that the two forces are no longer equal, but that the British defence forces are weaker and far more vulnerable compared to their continental invaders.⁶⁷ By changing the quality of one side and making it asymmetric, even if the British have a slight numeric advantage to compensate, the design speaks to the idea of an army inferior to its opponents. The defending player would have it far too easy if they could beat their opponent in a fair fight, bringing them around to the idea of investing more in the armed forces. Nonetheless, this idea of quantitative differences between forces does not really take hold

⁶⁴ Wells, *Little Wars*, pp. 35-40; Deterding, *Living Room*, p. 24; Choy, *Wargaming*, p. 28; Creveld, *Wargames*, pp. 148-149.

⁶⁵ Wells, *Little Wars*, pp. 43-44.

⁶⁶ Wells, *Little Wars*, pp. 76-77.

⁶⁷ Choy, *Wargaming*, p. 21.

in wargaming until far later, where it becomes (and arguably still is) the most important element of most designs.

V. MODERN GAMING AND HISTORICAL MARTIAL ARTS

V.1. Modern Tabletop Gaming

Most modern military rule-sets either rely on computers to handle the extremely complicated calculations of spotting and ballistics in tactical engagements, ironically to some extent rehashing H. G. Wells' method and using a computer to correctly plot the course of projectiles, or an experienced umpire to officiate a "free game" and keep all things moving at good pace, using dice to inform their decisions when their own judgement will not quite suffice.⁶⁸ While both of these are incredibly interesting, they are unfortunately beyond the purview of our article. Instead, we will be looking at the ways in which civilian military enthusiasts and game designers have attempted to recreate combat.

Wargaming as a civilian hobby enjoyed its renaissance in the seventies, most precursors being strategic- or operational-level board games similar to chess, without the granularity of tactical simulation. Nonetheless, these relatively simple games began experimenting with quality and quantity by e.g. giving alternate defensive and offensive attributes, modifying these attributes by the terrain, morale or supply of participants, etc. From Donald Featherstone's historical wargames to Gary Gygax's *Chainmail*, the lessons of these simpler board games were incorporated into the miniature form of wargaming to greater or lesser degrees.⁶⁹

Miniature wargaming allows for much more granularity when altering the elements of quantity and quality, and even the timing of game pieces and mechanics: A unit of musket men can have attached riflemen; only half of a unit's models may be in cover while the others are still vulnerable; etc. The blessing and curse of miniature wargaming is that it can give the designers just enough rope to hang themselves, making the game far too complex to be played in any reasonable time and driving the players to insanity with a host of rules and exceptions (this is by no means unique to miniature wargaming and can apply to all ludological disciplines, but it is especially vulnerable).

While we mentioned that quality and quantity are the two most frequently used factors to add depth to a design, it is possible to use timing in a few limited ways. For example, in entirely turn-based games like the immensely popular *Warhammer40k*, while players take turns and neither has any real possibility of doing anything on the other player's turn, there is a chance to take first turn despite deploying second. This can radically change the game, as the player who thought they held the initiative can be caught flat-footed, and

⁶⁸ *Sandhurst Free Kriegsspiel*, p. 4.

⁶⁹ Deterding, *Living Room*, pp. 27-28; Creveld, *Wargames*, pp. 155-156.

certain factions are capable of achieving it more easily, forcing more caution from the opponent.⁷⁰

Other, smaller games mess with the traditional formula in more radical ways, e.g. *Chain of Command*, a World War II platoon-level game that uses “jump-off points”. Units from reserves may be deployed from these jump-off points, or even suddenly appear to ambush enemy units a distance away before disappearing back into reserves at the cost of a command point. While at a glance less “real” – a bazooka team for example may seem to teleport in and out –, it allows for far more realistic results. Rather than pressing forward on your turn with an armoured spearhead, confident in the fact that all enemy anti-tank weapons are out of range and that your tanks can shoot anyone who shows up on their turn, one may elect to still wait for an infantry screen to prevent an unfortunate ambush despite the lack of definite, on-board threats.⁷¹

Some even eschew the regular turn structure entirely, moving to card activation. In *Muskets and Tomahawks*, each side has a certain number of their cards in the deck based on their chosen units. When one of their cards is drawn, they may perform either one or two actions depending on their type, e.g. only European regulars can perform two consecutive actions but also only have two activation cards in the deck, meaning that Irregulars with four activation cards are far more likely to be drawn and act, but will be able to do less.⁷² It also uses Wells’ idea of hidden units, with the addition that hidden units use multiple dummy markers, adding a fog-of-war element, as the opponent must guess at which marker really represents the location of the unit.⁷³

However, while these are noble attempts at capturing the timing of combat, giving a sense of the *Fingerspitzengefühl* and getting inside the opponent’s timing, they cannot truly teach how to exploit it. This is without even mentioning the lack of implicit danger and time-constraint upon an officer.

V.2. Historical European Martial Arts (HEMA)

As is true for tabletop gaming, so also in one-on-one fighting⁷⁴ does our confidence in what historical practices looked like decrease the further back we reach: the actual

⁷⁰ Kelly, *Codex Dark Eldar*, p. 55.

⁷¹ Clarke, *Chain of Command*, p. 23.

⁷² Buchel, *Muskets and Tomahawks*, p. 9.

⁷³ Buchel, *Muskets and Tomahawks*, p. 14.

⁷⁴ Historical combat techniques are grouped under the term Historical European Martial Arts (HEMA) and include fighting without weapons (wrestling), any variety of bladed weapons, pole arms, fighting in armour, mounted fighting, and so on.

practices of longsword fencing have been mostly lost,⁷⁵ but as we proceed to rapier,⁷⁶ small-sword,⁷⁷ and sabre,⁷⁸ manuals become more explicit, structured, and specific.

We are not aware that any historical source has considered simulated single combat in precisely our categorisations; Pietro Monte in his 1509 *Collectanea* advocated wrestling as training for command,⁷⁹ Clausewitz likens war to an extension of single combat (*Zweikampf*), and also uses the wrestling comparison.⁸⁰

Our reading of the sources and practical experience in HEMA make apparent three realisations:

Quantity, Quality, Timing, Information

Firstly, single combat involves all four elements:

- Quantity is in the technique;
- Quality is in how the technique is executed – misjudged centre of gravity, a wrong angle, misjudged distance, hesitation or lack of power may turn a good and tactically correct technique into a losing move; similarly, fatigue, concentration, focus and morale are immensely important;
- Timing is of critical importance; and
- Theoretically, both players have total information, but realistically, it takes a very experienced fencer to be able to ignore the deceptive “noise” projected by the other fencer and remain sensitive to e.g. creeping encroachments on distance, or feints.

Of all the combat simulations discussed, only single combat simulations reflect the element of timing.

The issues of quality and quantity require differentiation: only in a real fight with sharp weapons, in a duel or on the battle-field, will reliable data be obtained – which would not be a simulation. In a simulation, an umpire would have to judge the likely effect of the hit, both in terms of quantity, i.e. that type of technique to that part of the body, and of quality, i.e. was the hit delivered with sufficient force, correct technique and blade

⁷⁵ Gassmann/Gassmann/Le Coultre, *HEMA Practices*, p. 116 and references.

⁷⁶ See e.g. the *verdadera destreza*, chapter II.2.

⁷⁷ Gevaert, *Saber*, pp. 105-108 and references; Wetzler, *Fechtkunst*, p. 73.

⁷⁸ Gevaert, *Saber*, pp. 108-123 and references; Wetzler, *Fechtkunst*, pp. 73-74.

⁷⁹ Monte, Book 3, chapter I; we are grateful to Mike Prendergast and Dr. Ingrid Sperber for their translation.

⁸⁰ Clausewitz, Book 1, Cap. 1, Section 2 (p. 8): *Der Krieg ist nichts als ein erweiterter Zweikampf. Wollen wir uns die Unzahl der einzelnen Zweikämpfe, aus denen er besteht, als Einheit denken, so tun wir besser, uns zwei Ringende vorzustellen* (War is no more than an expanded single combat. If we wish to understand the innumerable single combats of which it consists as a single element, then we are better off imagining two wrestlers).

alignment to cause damage – as the cutting test discipline at HEMA events shows, these seemingly minor issues are highly relevant to successful actions.

An umpire would need extensive experience in actual combat to be able to reliably judge the likely effect of a hit, something combat descriptions tell us is evidently extremely difficult to predict – some individuals with horrific wounds fight on, others with apparently superficial ones collapse immediately.⁸¹ Needless to say, probably no living person, and certainly none of the currently available HEMA judges, has the requisite background. The alternative is a formalistic approach, awarding points differentiated by target, technique and quality.⁸² Essentially, it is the tension between the Reiswitzian “strict game” and the “free game” described in Chapter IV.3. From historical fencing competition and training rule-sets, we can see that our forebears too chose this formalistic approach – it appears likely that in their time, the reason for doing so was not a lack of experience with reality, but the need to make the simulations socially acceptable: A craftsman could ill afford a crippling strike to the hands or the loss of an eye.⁸³ To put it differently: The rule-set had to be playable.

“Jominian” and “Clausewitzian” Fencing

Secondly, it is perfectly possible to take a “Jominian” approach to fencing. This involves carefully analysing the typical “opening moves” an opponent could be expected to make, developing the ideal response to that opening move, and honing that response to perfection. Of course, if the fencer has only a narrow set of responses, his or her opponents will soon know them and either avoid or counter them. A superior fencer – like a superior chess player – will have acquired a broad repertoire of responses, and it will so be more difficult to find an opening move that the Jominian fencer is unprepared for. Historically, Thibault advocated this approach.

To counter the “Jominian” fencer, it is not sufficient to be an accomplished “Clausewitzian”; if a fencer does not have a wide range of techniques, perfection of execution, superior timing, and acute awareness, then no amount of Clausewitzian mental flexibility will lead to success. The dichotomy is to some extent a false one – it takes the same tactical *nous* to analyse and develop the correct “Jominian” response as it does to come up with the “Clausewitzian” one. Having said that, there is a clear difference between a tactically original fencer and one looking out for the right entry.

Fencing is not a zero-sum game

Thirdly, fencing is not a zero-sum game; if the objective of the simulation is to prepare for reality, then the reality is that both fencers can end up dead. Rule-sets for historical fencing, both historical and modern, reflect that: typically, a clean hit (i.e. a hit capable of killing or wounding and against which the hit fencer is not able to retaliate) will earn high points, whereas a double hit (both fencers striking each other at the same time) or an

⁸¹ See e.g. Kinsley, *Blades*; Chandler, *Comparative Analysis*.

⁸² Gassmann/Gassmann/Le Coultre, *HEMA Practices*, pp. 126-127.

⁸³ Gassmann/Gassmann/Le Coultre, *HEMA Practices*, pp. 127-129.

afterblow (where the hit fencer is able to retaliate within the *tempo*) will earn zero or one point. Within the bout, that does not matter much, as one of the two fencers will still end up with more points and so win the bout. But if in a modern tournament the ranking for the purposes of advancing from the pools to the elimination round is not on the basis of bouts won, but points won, then the pairs where the fencers waste their points-making opportunities on double hits and afterblows will both lose to pairs which may be just as close in terms of point difference, but rack up points by landing clean hits.

Translated into warfare, the favoured tactic is not the narrow application of a marginal advantage, where both the own forces and the enemy forces are ground down with the hope that the own forces will retain a narrow edge; the favoured tactic is the one where both own and enemy forces suffer minimal losses but the decision is clear.

Of course, a similar problem of low point scores arises in tournament play if both fencers are evenly matched experts (though it does not arise in an earnest altercation, as the result will be that both walk away from the event unscathed – surely a win-win). At this point, for HEMA, this is a problem to be aspired to.

VI. SUMMARY, CONCLUSIONS AND OUTLOOK

VI.1. Reality

Our focus in this overview was on the perception of reality over time, and here, a clear development can be seen. For medieval man, reality was determined by aprioristic truths. We do not have witnesses for theories of war from this time, but theories of single combat reflect this: Where authors claim geometry as a guiding principle, they do so not because that reflects reality; they do so because geometry partakes of superior truth, and therefore controls reality.⁸⁴ Their intellectual efforts are directed at assimilating single combat to the aprioristic superior truth.

Witnesses from Renaissance, Humanism and Enlightenment – and now we have witnesses from both war and single combat – change one element of the equation but leave another in place: The verity of principles is no longer aprioristic, but based in *ratio*.⁸⁵ What does not change is the belief in a universal, deterministic guiding principle. The intellectual effort now is directed at proving, by scientific means, the verity of the *mos geometricus*, and thus establishing it as the unifying guiding principle.

For the third phase, we are dependent on theories of war, since theories of single combat now focus on different issues – at the cusp of the 18th to the 19th Century, reality is no longer deterministic, but probabilistic, a world-view which natural science would struggle to come to terms with a century later.⁸⁶

⁸⁴ Costa, *Siete Artes*, p. 146.

⁸⁵ Margot, *Descartes y Spinoza*, p. 86.

⁸⁶ Beyerchen, *Nonlinearity*; Creveld, *Wargames*, p. 150.

An important tool in our analysis was our framework of quantity, quality, timing, and information, which allowed us to understand where and to what extent a simulation emulated reality, and where it diverged.

VI.2. Combat Simulations, HEMA and Tabletop Gaming

Reviewing the evolution of historical combat simulation led us to tabletop wargaming and the practice of historical European martial arts. Neither discipline can today test the historical realism of its interpretations, so we traced the history of their respective development in an effort to determine whether that history can assist in making a judgement on this realism.

In tabletop gaming, this is reflected in a search for rule-sets – or tinkering with published ones⁸⁷ – that are playable yet deliver plausible outcomes for a given period when tested against known historical battle scenarios (as reported by contemporary military literature, eye-witness accounts and military historians), and then allow the participants to play out counterfactual scenarios or understand the thinking of the protagonists. Tabletop gaming, with its extensive use of dice, has embraced the probabilistic nature of reality and, as its historical forebears, constantly navigates the trade-off between realistic complexity and playability.

For HEMA, the problem is more complex. Current HEMA techniques are distilled from historical *Fechtbücher*; the challenges in properly understanding the *Fechtbücher* and developing practices that would have been applied in reality are a staple for academics.⁸⁸ Additionally, it is apparent that reality, as the various authors of the *Fechtbücher* understood it, is itself a moving target, further complicating the quest.

It is common ground in the HEMA community that the viability of techniques is tested in a setting under pressure with a non-cooperative partner, i.e. in a tournament.⁸⁹ Purists criticise that the unlimited “lives” a tournament contestant enjoys is itself unrealistic; yet in the absence of socially acceptable alternatives, the formalistic point-scoring offers a probabilistic route to validating successful techniques.

Whether the probabilistic information so obtained confirms the historical accuracy of a technique depends on whether the tournament rule-set rewards those techniques that were in fact used historically.⁹⁰ Unfortunately, again, the accuracy of our judgements in devising rule-sets cannot be tested. Reference to historical rule-sets shows that those are deliberately “unrealistic”, introducing artificial frictions.⁹¹ Our working assumption has to be that our ancestors knew what they were doing when they did so, but the currently known historical witnesses are too disparate and infrequent to provide a consistent

⁸⁷ Deterding, *Living Room*, pp. 35-36.

⁸⁸ See Wetzler, *Fechtkunst*, p. 66; Jaquet, *Fightschools*, pp. 54-55; Deacon, *Prologue*, pp. 69-70.

⁸⁹ For a discussion, see Gassmann/Gassmann/Le Coultre, *HEMA Practices*.

⁹⁰ Gassmann/Gassmann/Le Coultre, *HEMA Practices*, pp. 126-127.

⁹¹ Gassmann/Gassmann/Le Coultre, *HEMA Practices*, pp. 127-128.

picture. Here again, we probably need to take comfort from a probabilistic approach, welcoming a diversity of plausible rule-sets and comparing the data produced by each over time. It is very likely that a fencer who consistently performs well in different rule-sets is doing something right.

VI.3. Conclusions

We have avoided delving into computer-based gaming since there, the reality underlying the rule-set is determined by the game designer and not evident to the players, and even if it is evident, the players cannot change it. The game designer's ideological conception of reality is a given, and the players either have to live within it or not play that game.⁹²

The pre-computer history of combat simulation largely seems to have avoided ideological capture; in fencing, Pacheco and Thibault were the only ones to have based their systems on the *mos geometricus* – the *verdadera destreza* as propounded by Rada still liberally applied geometrical concepts, but did not see them as deterministic. Most fighting theory focused on pragmatic issues and eschewed an ideological framework altogether.

On the warfare side, even as the most accomplished proponents of determinism saw “the end of history” within grasp, simulation went in the other direction, confidently relying on the throw of dice to accurately represent reality even before Clausewitz provided the theoretical underpinning.⁹³

Considering the various historical combat simulations within our analytical framework, each has its shortcomings compared to reality; a comprehensive military education cannot be simulated with any one single tool but requires a combination of them. With that in mind, we believe there is a military reason for the persistence of the duel, especially the duel with bladed weapons, among the military classes⁹⁴ even after developments in gunpowder had rendered mock field battles too dangerous: Of all the simulations reviewed, only single combat is able to effectively teach an appreciation for timing, for recognising an opportunity and seizing it.⁹⁵ It also trains real-time digestion of information – an ability to filter out misleading cues given by the other fencer to disguise e.g. a gradual encroachment into measure or the direction of a strike, while remaining focused on all *relevant* factors. In a duel, as in warfare, these evaluations need to be undertaken

⁹² Deterding, *Living Room*, pp. 34-35.

⁹³ Unfortunately, Clausewitz does not seem have commented on the practice of wargaming, though he must have been aware of it.

⁹⁴ Gahlen, *Duell*, p. 259; Wetzler, *Fechtkunst*, pp. 73-74; Creveld, *Wargames*, pp. 126-136; Gevaert, *Saber*, pp. 129-131.

⁹⁵ In its justification for tolerating a divergence between civilian penal law and officers' obligations, the Bavarian War Ministry – in addition to considerations of honour and social distinction – also referenced utilitarian considerations, in that fencing trained decisiveness, courage and the willingness to risk one's life: references with Gahlen, *Duell*, p. 266. Similarly, though in a different context, Creveld, *Wargames*, pp. 258-259.

while the participant's physical integrity is at risk.⁹⁶ If our analysis is correct, it would go part way toward explaining the remarkable phenomenon that despite the official opprobrium levelled against duelling, until World War I it remained – literally – a *Kavaliersdelikt*.⁹⁷

VI.4. Outlook

Our review unsurprisingly shows that simulation of combat, whether conceived as education or training, was taken seriously since witnesses exist. Intriguingly, though, it also suggests that the creators of historical simulations were very well aware of the tension between realism and (in modern terms) playability. By definition, simulation has to diverge from – for a purist: fall short of – reality (or it would *be* reality). To accommodate playability, simulations emphasised selected elements of the four criteria we have proposed. The most extreme example is chess, where the focus is purely on quantity. Yet chess surely ranks as one of the most playable, intellectually engaging, mathematically challenging, and variant-rich strategy games known. Tactical reductionism is obviously no bar to educational value. It seems to enhance playability – a “law of diminishing returns” seems to apply as complexity is increased for the sake of realism.

The craze for lethal duelling, which continued into the 20th Century, has generally been considered purely under the aspect of honour and social differentiation – broadly as irrational and incomprehensible. By putting the various modes of combat simulations into context and providing an analytical framework for their respective capabilities, our article suggests that duelling did in fact have a pragmatic and hence very much rational (if drastic) aspect within the military context of the time, which has hitherto not received much attention.

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⁹⁶ For Clausewitz, physical danger is an important friction factor: Book 1, Cap. 4 (p. 45).

⁹⁷ Commonly translated as “peccadillo”, the German connotation is “a gentleman's, or honourable, crime”. In 19th Century Germany, duelling was sanctioned with a special, non-dishonouring punishment: *Festungshaft* (house arrest at a military installation without forced labour: §§201-210, §17 and §20 *Strafgesetzbuch für das Deutsche Reich* of 1871). German officers faced a “court of honour”, which could effectively oblige an officer to duel despite the civilian penal code's prohibition, and could generally count on a full pardon: Gahlen, *Duell*, pp. 262-265.

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