



# Colour-Coded Manuscript Maps in the Military Enlightenment

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## Colour-Coded Manuscript Maps in the Military Enlightenment

### The Circulation of Map-mindedness

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#### Résumés

##### Français English

Les cartes militaires manuscrites opéraient selon un code couleur spécifique, renforcé au dix-huitième siècle par une réforme des académies militaires. Elles attestent de l'esprit cartographique spécifique aux lumières militaires britanniques. Les carnets d'étudiants et les cartes manuscrites sont des documents avec un faible taux de survie mais ils furent largement utilisés pour l'entraînement et la pédagogie militaire, circulant dans un réseau transnational d'officiers et d'ingénieurs qui diffusèrent les innovations en cartographie militaire. Outre des compétences en perspective et en géométrie, l'ingénieur militaire devait non seulement maîtriser les techniques d'aquarelle de paysage, mais aussi le code couleur militaire et ses contraintes matérielles. Cet article analyse le curriculum de dessin à l'académie royale militaire de Woolwich, offre un historique de l'adoption du code ainsi qu'une biographie matérielle des six pigments qui lui étaient spécifiques, et montre que la qualité artistique de ces cartes faisait partie intégrante de leurs fonctions.

Manuscript military maps operated according to a specific colour code, reinforced by reformed military academies in the eighteenth century. They attest to the specific map-mindedness of the British military enlightenment. Student notebooks and manuscript maps have a poor survival rate, but they were extensively used for military training and pedagogy. They circulated within a transnational network of officers and engineers who disseminated innovations in military cartography. The skills required for these maps added to perspective and geometry skills the mastery of landscape watercolour techniques and the knowledge of a color-coding specific to the military and its affordances. This article analyses the drawing curriculum at the royal military academy of Woolwich, offers an overview of the colour code's adoption as well as a material biography of its six specific pigments, and shows that the artistic quality of these maps was an integral part of their function.



## Texte intégral

An earlier version of this paper was read at the 2020 Consortium on the Revolutionary Era, at the Presidential Panel on the Military Enlightenment in a Global Context, chaired by Christy Pichichero (George Mason University). I am grateful for the generous feedback received then, and for Dr. Christine Haynes' comments during and after the conference. My thanks also to Ellen McCallister Clark, Library Director at The Society of the Cincinnati Library for her help during my 2019 Society of the Cincinnati Library fellowship, and to Dr. Faith Acker for an expert reading of my first draft.

## Introduction

- 1 Hand-coloured military manuscript maps in the modern period were rarely accompanied by map legend keys with colour boxes to explain the colour's meaning. The maps were intended for circulation within the military ranks and were produced by a community of professionals – the military engineers – who shared a certain *esprit de corps*. Their training was shaped by the praxis of the Board of Ordnance, whose Engineer-in-Chief was in charge of the design, upkeep and survey of fortified infrastructure from the middle of the seventeenth century. This article reconstructs the meaning behind the military colour code, how this code derived from the specific training in drawing received at military academies and how it was dependant on the properties of the pigments themselves – which also opens alleys to understand the use of colours in more diverse maps.
- 2 While the military colour code for maps was first laid out in Vauban's 1685 *Directeur général des fortifications* and detailed in Hubert Gautier's 1686 *L'art de laver*, these conventions circulated in manuscript maps well before coming into print and were inherited from surveyance and architecture practices. Tied both to the visual grammar of military architecture and surveyance, and to the constraints of pigments, the colour-coding of maps remained taught and practiced in military academies in Britain until the end of the nineteenth century, even when large-scale fortifications became obsolete, and watercolours were replaced with easily carried coloured pencils. In general, the teaching delivered in academies adapted slowly over the course of the eighteenth century, but this was more apparent in the instruction of technical skills, and therefore the military colour code's long usage delivers insights on the inertia of professional-skills instruction.
- 3 Studying the use of colours in these military maps reminds us of the extent to which practices are conditioned by the affordances of materials. This helps us reassess the long-held assumption that colour use in maps was generally perceptual. Colour as a meaningful element of cartography is deemed to rest largely on its distinctness and the ease with which the map reader can interpret them perceptually (Robinson; Andrews). However, map historians' analysis of the use of colours is influenced by their focus on the passage from hand-coloured to mechanical printed maps, when colour use switched from an addition – sometimes decorative and often optional – to a standardized and often structural piece of information. By focusing on the passage from hand-coloured to mechanical printed maps, historians often conclude that a more rational and standardized use of colours existed in print than in hand-coloured versions, seen as haphazard results. As technical innovations replaced hand-colouring by colour printing, the aspect of topographical, reference and thematic maps did indeed evolve, and the range of colours increased (Cook). However, the colour code for military manuscript maps remained remarkably stable as well as efficient. Manuscript and printed practices continued to overlap, and the perseverance of manuscript practices for sketching and



reconnoitring ensured that the affordances of transparent watercolour pigments remained fundamental to the apprehension and representation of one's immediate environment well into the nineteenth century.

- 4 It is therefore essential to study the logic that underpins this resilient and efficient colour code. Military theorists increasingly believed that “a rational approach would beget desirable martial and moral outcomes” (Pichichero 7). The colour code is yet another mark of the cosmopolitan and European-wide efforts deployed to rationalize warfare, organize the defensive territory, and standardize military practices which are an essential part of what Christy Pichichero has identified as the military Enlightenment. The term ‘military Enlightenment’ stresses the efforts of the military personnel themselves to overhaul the strategies, training and administration of the army, and reform it according to Enlightenment views, deploying experimental efforts in their quest to make war more rational, and just. “These reformers in effect ‘operationalized’ Enlightenment thought within the armed forces, turning theories into realities as spaces of war on the continent and abroad became laboratories or ateliers in which new-fangled theories were put to the test” (Pichichero 11). The use of the term “ateliers” is essential for this study and reminds us of the military personnel’s care for the practical details and the technical implications of Enlightenment theories which can be seen at work in their selection of manuscript maps’ conventions, and its rapid adoption in Europe.
- 5 The eighteenth century saw the concept of a divinely ordained and just war fade from view. A lowering of the gaze and narrowing of focus, at work in the visual arts in the period, produced a “reasoned concern with the tangible [...] a deflection of man’s attention from the cosmic to the terrestrial, from the infinite to the human” which is made particularly visible in military maps (Roston 108). This military Enlightenment was rooted in the assertion of the human and humane character of war, which was for example reflected in the choice of cadastral scale. Their military perspective gaze diverged from the god-like gaze of atlases by focusing on reconnoitring and troop movement and keeping to the scale of the artillery range. They thus evolved more slowly than atlas and printed cartography did from profile to plan landscapes. This specific military map-mindedness also originated from the draughtsman’s training put in place in military academies, which put a high premium on landscape and its artistic mastery, which afforded resistance to the adoption of plan landscapes perspective.
- 6 Both the colour code and the cadastral scale inherited from the drawing classes of the academy were symptomatic of the motivations at the heart of the military Enlightenment. It aimed to transform military training into a tactical science based on utilitarian skills. The visuals of military Enlightenment remained influenced by the artistic training specific to the geometric visuals of artillery drills and to the architecture draughts, as well as to the centrality of fortification design in military engineers’ education, which entrenched a static, positional warfare imagination. The training the military engineers received, and the material constraints associated with the creation of a manuscript map ensured that a specific military map-mindedness perdured. The focus on a cadastral scale which called on artistic mastery of landscape features, and the perdurance of the colour code were *in fine* aimed at a more secure and rational circulation of knowledge, specifically built around the notions of ongoing monumental projects and works, the symbols of an ever growing fiscal-military state.



## The ability to draw

### The Royal Military Academy’s curriculum

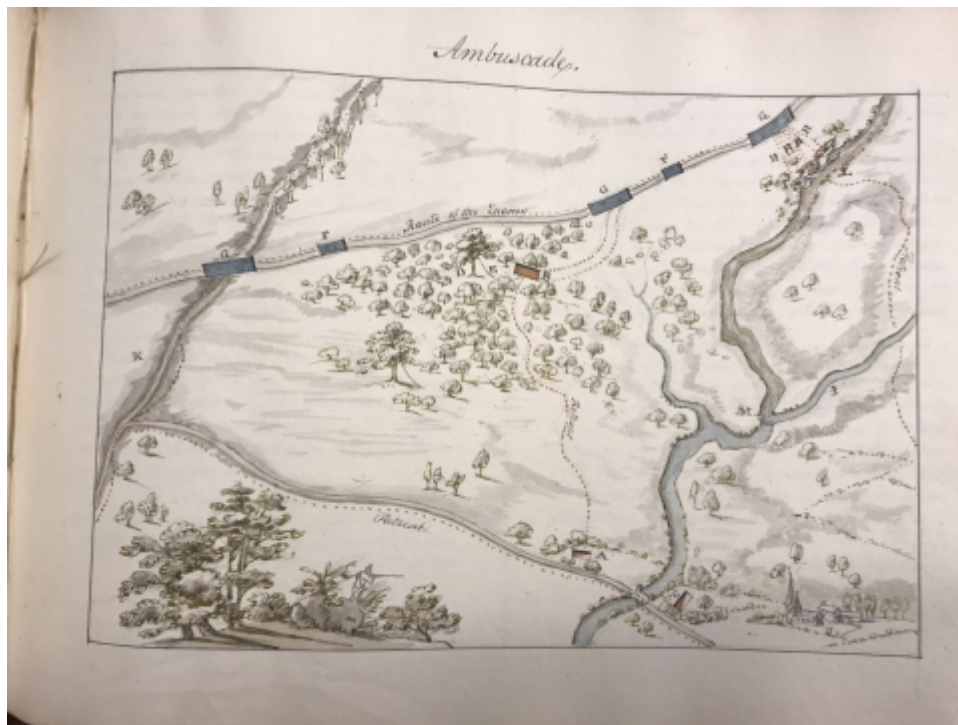


In Britain, the Royal Mathematical School at Christ’s Hospital founded in 1673 required by 1683 that their engineers “be perfect in Architecture, Civil and Military, [...]”

to draw and design the situation of any place in their true prospects upright and perspectives, [...] to keep perfect draughts of every fortification" (King's MS 70, "Additions"). In the same vein, the corps of the Royal Engineers founded in 1716 closely modelled its training on that of topographer-surveyors at the Board of Ordnance. They were officers with no military rank, but their training increasingly differentiated them from civil engineers, especially as the two professions became distinct through the establishment of separate societies and training institutions in the course of the eighteenth-century military Enlightenment. The regimentation of surveyors and engineers, as armies became professionally specialized, meant they were increasingly trained academically, on the model of the *École royale militaire* founded in 1751 in Paris. The *École royale militaire* gradually increased its teaching on drawing and mathematics in the second half of the eighteenth century, but although this curriculum was innovative pedagogically, it was not a departure from former models (Jacobs). It perpetuated the "architect-artist school [...] [which] promoted an artistic vision of architecture focusing on buildings' aesthetics (buildings as works of art and spectacles)" (Bousbaci and Findeli 247-48). The influence of the "architect-artists school" on the Royal Military Academy at Woolwich, was propounded by the fact that Isaac Landmann, the professor of artillery and fortification from 1777 to 1816, had taught at the *École royale militaire* in Paris.

- 8 Although in general military academies favoured technical and scientific education and verged toward the utilitarian, the Royal Military Academy's military engineers were still required to produce finished draughts to the chain of command, and these were often judged on their aesthetic qualities (Marshall, *British Military Engineers* 111-30) (Figure 1).

**Fig. 1. Thomas Sunderland, "Ambuscades" in "Light infantry exercise & c. selected by Thos. Sunderland lieut. col. commanding the Ulverston Volunteer Light Infantry," 1804. Watercolour, 24 x 34 cm. MSS L1992.1.81 [Bound] Society of the Cincinnati Library.**



Photograph by Bénédicte Miyamoto, from the collection of the Society of the Cincinnati Library

- 9 The training in drawing at the military academy put a high premium on artistic mastery, beautifying landscapes and turning the engineers' draughts into potent symbols of the ever growing fiscal-military state's control over the territory (Buisseret 57-123; Mukerji 655-76). Looking at the Royal Military Academy's curriculum and yearly step-by-step increase in the subjects' difficulties, we understand how an uneasy alliance was forged between scientific measurement and aesthetic style, making for the grammar of forms distinctive of Enlightenment map-making (Withers 195-200). It only



took three years from the Royal Military Academy's foundation in 1741 for a drawing master to be added permanently to the staff, and the position quickly became permanently seconded, with teachers who were also proficient artists, such as Paul Sandby from 1768 onwards.

- 10 In mathematics, on the other hand, the low turnover of teaching staff led to a lack of innovation in the discipline (Bruneau). Military landscape training was related to the prospect of the artillery range, and therefore clearly viewed as a practical result of perspective and geometry skills – and thus landscape skills corresponded to the possessive exploration of the surveyor and was indeed an exercise of power over space (Cosgrove). If the teaching of perspective and arithmetic at Woolwich tilted heavily towards the practical attainment of fortification building and design, the drawing skills, on the other hand, gained in artistic proficiency, and the mastery of colour and landscape became the crowning subjects to complete a diploma. Third year classes were taught “Landscape and Military Embellishments” in the Lower Academy, and “Landscapes coloured from Nature” in the Upper Academy, for example (Table 1).

**Table 1. The course of instruction at the Royal Military Academy at Woolwich for the year 1772, devised from the Records of the Royal Military Academy, 1741-1892, published 1892.**

	Mathematics	Drawing
<b>Lower Academy</b>		
<b>1<sup>st</sup> Class</b>	Elements of arithmetic	Simple and easy drawings in Indian Ink
<b>2<sup>nd</sup> Class</b>	Elements of arithmetic applied to practice	Easy but instructive drawings in Indian Ink
<b>3<sup>rd</sup> Class</b>	Vulgar and decimal fractions extracting square and cube roots	Landscapes and military embellishments
<b>4<sup>th</sup> Class</b>	The principles of algebra as far as quadratic	Theory and practice of perspective
<b>Upper Academy</b>		
<b>1<sup>st</sup> Class</b>	Elements of fortification	Landscapes in Indian Ink
<b>2<sup>nd</sup> Class</b>	Attack and defense of fortifications, Practical geometry, Art of surveying	Large and more difficult landscapes, colored
<b>3<sup>rd</sup> Class</b>	Conic sections	Landscapes, colored from nature
<b>4<sup>th</sup> Class</b>	Laws of motion and resistance	Perspective applied to buildings Fortifications

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- 11 This emphasis towards aesthetic attainments mirrored public calls for British youth to be trained in design, a skill increasingly looked upon as deficient in comparison to Europe. Its inclusion in the education plans of many industries was therefore seen as patriotic (Puetz; Craske). This resulted in officers attaining capacities at the Royal Military Academy that outweighed the usual technical requirements of military mapmaking. In 1750, a Gentleman Cadet under the direction of Gamaliel Massiot, the drawing master from 1744 to 1768, wrote back home after a few months at the Royal Military Academy boasting that he had “drawn a Cannon and a Mortar-bed by a scale and begun a Landscape after the Mezzotinto manner” (*Records of the RMA* 11). The latter was an innovative attainment disproportionate to the skills of topographic surveying, at least according to the widely circulated compendium map representing “all the elements necessary to the military architecture or the art of fortification” engraved in 1679 by the map-seller and bookseller Roussel (Figure 2).

**Fig. 2. Anna Beeck and Gaspar de Baillieu, “Carte qui représente toutes les pièces qui sont comprises dans l'architecture militaire, ou, l'art des fortifications” in A Collection of Plans of Fortifications and Battles, 1684-1709 [S.l. : s.n., 1709]. Based on a 1679 engraving by Mr. de Roussel, Paris. Watercolour, ink, 56 x 40 cm. G1793 .B4 1709 Library of Congress.**





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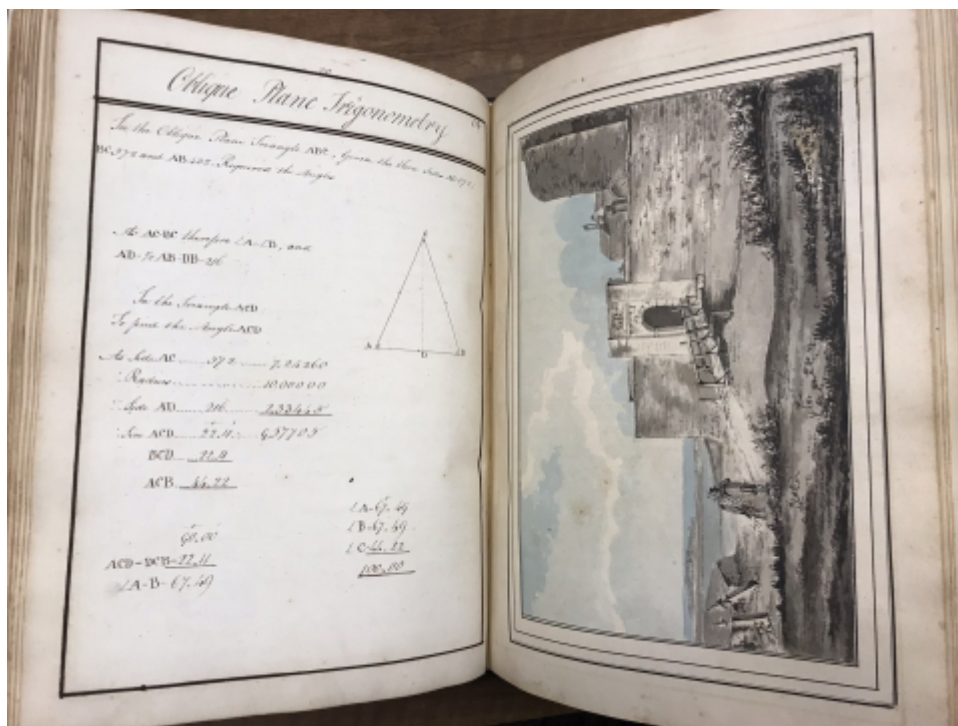
- 12 The skills of “Military embellishments” or “Landscapes coloured from Nature” can seem a disproportionate requirement for engineers, topographers, and surveyors, but corresponded to the cartographic and architectural culture of the Board of Ordnance. The Board of Ordnance was responsible for providing supplies to the army such as munition and weaponry. This expanded to the upkeep of the fortifications and arsenals to store these supplies. Providing plans and maps for these building as well as training able mapmakers became a crucial mission of the Board of Ordnance, and as the Royal Engineers moved in 1752 to permanent premises in the Tower of London, their drawing room became an expert centre of cadastral mapmaking, a skill which was later perfected in the Ordnance Survey. The Tower of London engineers therefore operated according to a distinct education and practice which was to have a lasting influence on map-making in the army, and which was needed for such activities as fortifying, reconnoitring, and castrametation. The Ordnance drawing methods became the reliable standard in the army, which in the tradition of artillery drill schematics, troop movement and strip maps, was accustomed to the large-scale and detail-oriented cadastral ratio of about 1:1250, which enabled a focus on human activities, human intervention on the landscape, and human movement in the landscape. The Tower of London’s Drawing Room teachings and methods were duplicated by the drawing masters at Woolwich, and this standardisation was reinforced by the fact that the Ordnance Master-General was responsible for the Royal Military Academy cadets’ examination (Sloan 121-22; Parnell). In the 1760s, for example, all the classes of drawing were examined on the subject of ‘Landscapes’ only, which established a strong link between the necessary cadastral scale and the virtuoso attention to details and embellished visuals. Drawing abilities and aesthetic finish remained important to obtain qualifications as a military engineer, and a commission in an army corps. For example, upon examination, in December 1780, a student obtained a commission in the prestigious Royal Artillery because he had “finished the completest series of Drawings ever produced at the Academy [...] finished the completest book [...] [he] draws exceedingly well and is sufficient for any service” even though he had been found “not conversant in Algebra” (*Records of the RMA* 15). By 1783, labour was divided between the cartographers in both drawing rooms. The Board of Ordnance at desk duty fulfilled its purpose as a centre for carto-reproduction in the Tower of London, while the army

was tasked to field duty at Woolwich (Marshall, *Military Maps of the Eighteenth-Century* 21). But virtuoso drawing remained on the academy's curriculum until the 1850s.

## Drawing skills to circulate knowledge in the military

- 13 What was this “completest of books” that students were to produce, as in the example above, and what was its purpose? Student books were the measure of students' attendance, as well as a record of class exercises, often added to with extract or *in extenso* fair copies of printed manuals. They served as advertisements for the young academy's instruction, which probably tilted the curriculum even further toward embellished visuals (Eddy 278-79). As such, these student books offer clues to the bookscape of the British army, by showing us which passages from the continental art of war manuals were set for frequent copy by the training staff and which duties and skills were deemed essential in the professionalization of British military officers (Gruber 65-136). The professors required the students to “fairly transcribe in books, or preserve in portfolios, such parts of their performances as may be necessary, from time to time, to show the proficiency they have made in their different studies” (Ordonnance Office Tract, rule 11, article 18). This participated both in the increasing level of bureaucratic oversight in the military Enlightenment, and the need for excellent graphic and written copying skill, given the secretive, as well as highly technical nature of military information (Gruber 30-35) (Figure 3).

**Fig.3. Student copy book of Thomas Chambers, “Plan of Education,” from the Royal Academy at Portsmouth, 1798-1801. 38 cm folio. MSS L1999G48 [Bound] Society of the Cincinnati Library.**



Photograph by Bénédicte Miyamoto, from the collection of the Society of the Cincinnati Library

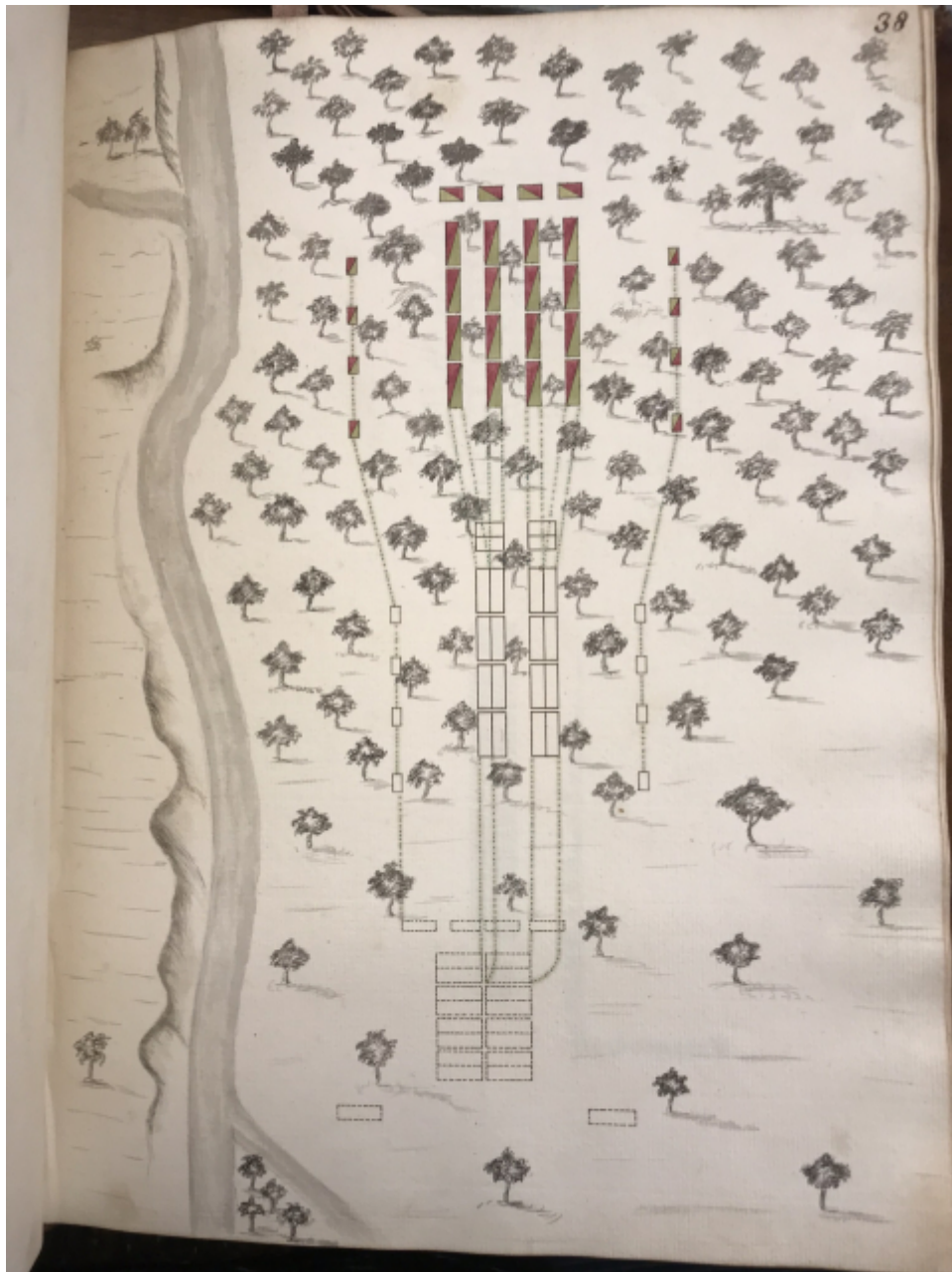
- 14 Copy books, as well as personal castrametation guides and ready reckoners were frequently made by hand by mathematicians, engineers and draftsmen from the army corps. Extant copies can still be found in collections, bound and in varying state of completion, but often with elaborate title pages listing the corps and the name of copyist, yielding invaluable information on these military engineers' training in draughtsmanship. In his diary kept during the American Revolution, Captain Johann von Ewald of the Field Jaeger Corps of the British Army also writes about another sort





of fair copy when he writes that “several among their [American] officers had designed excellent small handbooks and distributed them in the army” (Ewald 108, quoted by Powers 791). The copying of manuals was a palliative to the difficulties of the printing press and of the scarcity of continental manuals on the American market but was also very much a military practice habitual in both American and European armies. The training in surveyance, map-making and drawing to scale enabled military engineers to provide manuscript copies of illustrated manuals and to reproduce fortification designs and artillery drills for their commanding officers. The Society of the Cincinnati Library holds many examples of such military “evolutions,” the movement or series of movements of troops into battle formation. These manoeuvres or artillery drills are drawn in watercolour and ink on loose sheets, often in folio size and kept in paper covered boards held by cloth ties. They could be copies of printed manuals, or made to order to fit a commanding officer’s own version of drills or designs, and these exercises and manoeuvres were taken down and made into pedagogical visuals by the military engineer (Figure 4).

**Fig. 4. “Military Evolutions – Major Wm Young Esq. Major of the Wiltshire Regt” drawn by R. Mountaine, sheet 38. Watercolour and ink on paper, 21 x 37 cm. MSS L2012F65f [Bound] Society of the Cincinnati Library.**



15 The engineer would also copy the illustrations of continental books that their superior officers were for example engaged in translating, the latter having been learnt copies through their active military sociability at masonic lodges, salons, staff meetings, and campaign encounter (Pichichero 76-90). At these events, and through extensive written correspondence, books and book lists circulated, and helped foster a martial and homosocial sense of community (Powers). Some of the military treatises used these conversations as their organising principle. Returning from the West Indies and tasked to upkeep infrastructure in Paris, Nicolas-François Blondel finds himself “often in company with Engineers, and since [contemporary] sieges offered them many points to ponder on the art of fortifying places, it was the subject of our most ordinary conversations” in his 1683 *Nouvelle Manière de fortifier les places* (Blondel 2). The treaty presents itself as two discourses, and it re-transcribes the discussions comparing existing European fortifications with the fortifications Blondel had encountered in his voyages, while also circulating news about existing books on fortifications. The careers of military engineers were often transnational, and since their position was dependant on patronage, these highly mobile military engineers also advertised their talents to nobility and high-ranking militaries by dedicating translations and compilations of military treatises to them, and by circulating masterful manuscript copies (Virol, “La traduction des ouvrages des ingénieurs”).

16 Such manuscript copies, which often eluded historic inventories and library catalogues, inform us about the books that influenced a corps’ military practice, even though its military officers’ libraries held no printed edition of them (Gruber 235-66). Vauban’s treaty on fortification was only published under his name in 1737 – posthumously and with errors – but circulated in print as early as 1681, with the abbé Du Fay’s *Manière de fortifier selon la méthode de Mr de Vauban*, and many subsequent second-hand publications which already recognized the work as a major reference (Virol, “La traduction des ouvrages des ingénieurs”). Indeed, its fame was already well publicized by manuscript circulation which faithfully reproduced not only its text but its illustrations. These were in turn used for numerous reproductions, for both training and circulation – as evidenced by minuscule holes on the master copies, which were effected at each and every point of the master copy’s original design so as to transfer the pattern of the map or fortification that needed reproduction on to the surface of an underneath sheet of drawing paper. Called pin pricks, these were done most probably with the point of the drawing compass, an instrument readily at hand for the military engineers who used it constantly to reproduce to scale and measure distances, and which linked them to a wider network of craft and science (Baker). When John Muller, the headmaster of the Royal Military Academy, published his 1747 *Attack and Defence of fortify’d places*, its 25 folded leaves of plates representing maps and plans became staples of copy-practice for the Woolwich students (Figure 5).

**Fig. 5. Bound copy-book fortification exercise drawn from plate XI of John Muller's A treatise containing the elementary part of fortification, c. 1760. Watercolour, 31 x 47 cm. MSS L2001F401 [Bound] Society of the Cincinnati Library.**





Photograph by Bénédicte Miyamoto, from the collection of the Society of the Cincinnati Library



- 17 Training in drawing thus ensured a durable and reliable form of transmission up the chain of command by the resident Royal Engineers posted in the garrisons of the United Kingdom and of the British Empire. They were also the atomic basis for larger scale commercial maps of the Empire by cartographers who, gaining access to Board of Ordnance materials, drew from these small-scale military survey data and manuscript maps originally made by the contingent of Royal Engineers (Liebenberg 5-8).

## The ability to colour: colour-coding and the constraints of watercolour

### Developing the military map's colour code

- 18 Research has underlined the social role of drawing for Royal military engineers and how receiving a curriculum-based training “illustrated the complexity of the professional positioning at play” (d’Orgeix 317). Teaching line and perspective classes had complex political repercussions also, especially on the issues of boundary making and empire building (Crampton; Harley). This article demonstrates there was a similarly complex social and political role of colour-coding and its circulation in the military. The choice of colour was essential to the map-mindedness that animated military engineering as a profession (Edney). These engineers experienced the place they surveyed as records of fortifications – erected in red and projected in yellow for example – and the instant visualizing of the materials these defence lines were made of was essential to their perception of the territory. The colour code was indeed used as a tool to promote projects and glorify the military’s power over territory through lavish map-making.
- 19 The colour code specific to military maps amounted to much more than simply clarifying the boundaries (and visually pulling rank) between civil and military engineers. The use of colours in cartography, and in military map in particular, has been loosely characterized as a “harmonic combination of four or five main colours with varying degrees of brightness and intensity” or perceptual colours than can be intuitively distinguished by the recipient (Medyńska-Gulij and Żuchowski; Robinson *et al.*) Many of the choices of the military map key were indeed meant to reproduce





colours as perceived in nature, as recommended by the French academic architectural tradition that championed the use of colours as expressly mimicking nature for the purpose of scientific or technical knowledge. Colours thus became a key element of scientific objectivity (Daston and Galison 84-98; Kusakawa). Harmony of colours had also been a quest of painting handbooks since at least the sixteenth century. For example, Charles Boutet's 1673 *L'Ecole de la Miniature*, in its English translation *The Art of Painting in Miniature*, was contemporary to the handbook which first published in great detail the military colour code, Hubert Gautier's 1686 *L'art de laver*, and which will be discussed extensively below. Handbooks such as Charles Boutet's *Art of Painting* did indeed devote a large part of their internal organisation to the harmonic correspondence of hues and their shadows. This harmonic and perceptual colouring of the map was however limited in military maps to the natural environment surrounding the features. Nicolas Buchotte reminded military engineers that it was to be kept to a minimum of details, in order to reign in any overly artistic velleities: "the different qualities of the terrain that surrounds a plan must be dealt with as naturally as possible, without however departing from the manner proper to wash to engage in miniature painting" (Buchotte 41). All immobile features, however, had to abide by the conventions of the military colour code rather than strive for a naturalistic effect.

20 The circulation of craft skills and technical knowledge between similar professions across borders in the early modern and modern period remained haphazard, as in other professions, even though an increasing number of military professionals took it upon themselves to translate military manuals and works on the art of war from the sixteenth century onwards (Hilaire-Perez and Verna; Sumillera). Not all military maps respected the colour code taught in military manuals, and the written convention spread more homogenously than the practice, since knowledge transfers rarely behave according to a diffusionist model. But the adoption of this colour key was facilitated by the European-wide repercussions of the military Enlightenment project, which actively promoted the art of war as "a science whose end point was strategic and tactical 'perfection' – a science of martial victory" (Pichichero 8, also 55-57). This mutual commitment to military science and to its modern advances entailed upkeep in military ranks a common and cosmopolitan "printscape – the mental mapping of knowledge through owning, reading and making books and other print formats" (Ferlier and Miyamoto 3). Manuscript maps and draughts in all their shapes – from reconnoitring, strip maps and fortification draughts – needed to conform to similarly committed, common and transferable ground rules, and this proved to be a potent professional bond. The new colour code for all immobile features of military plans spread relatively fast. Even if national versions of this printscape of military Enlightenment existed, the number of translations, cross-border compendiums and abridgements promulgated by a mobile and skilled military personnel indisputably brought about a military science on a "supranational context" (Pichichero 12).

21 France was at the epicentre of military cartography in the period, and the writings of French engineers rapidly spread European-wide. The strong current of standardisation and rationalisation at the heart of the *Corps des Ponts et Chaussées* (the corps of the engineers of Bridges and Roads) project was a symptom of absolutist France's centralisation which was shaping the modern state. Publishing treaties and manuals was a common career-enhancing strategy for European engineers, a mobile profession in need of patronage, and this was especially beneficial if they could do it in the language of the court or patron they worked for. But treaties published in French had the added benefit of targeting one of Europe's largest readership (either as mother tongue or as a learned second language), and of benefiting from an efficient network of translators, especially amongst Huguenot *émigrés* in the Low-Countries printing trade hub. Outlined in his 1685 *Directeur général des fortifications* by Sébastien Le Prestre Vauban, then France's *Ingénieur Général* (general engineer), the use of specific colours for strategic elements of military maps was first devised as a contractual security, as a sure method to avoid both frauds and misunderstandings between engineers and entrepreneurs that could result in defective claims, inflated bills and delayed





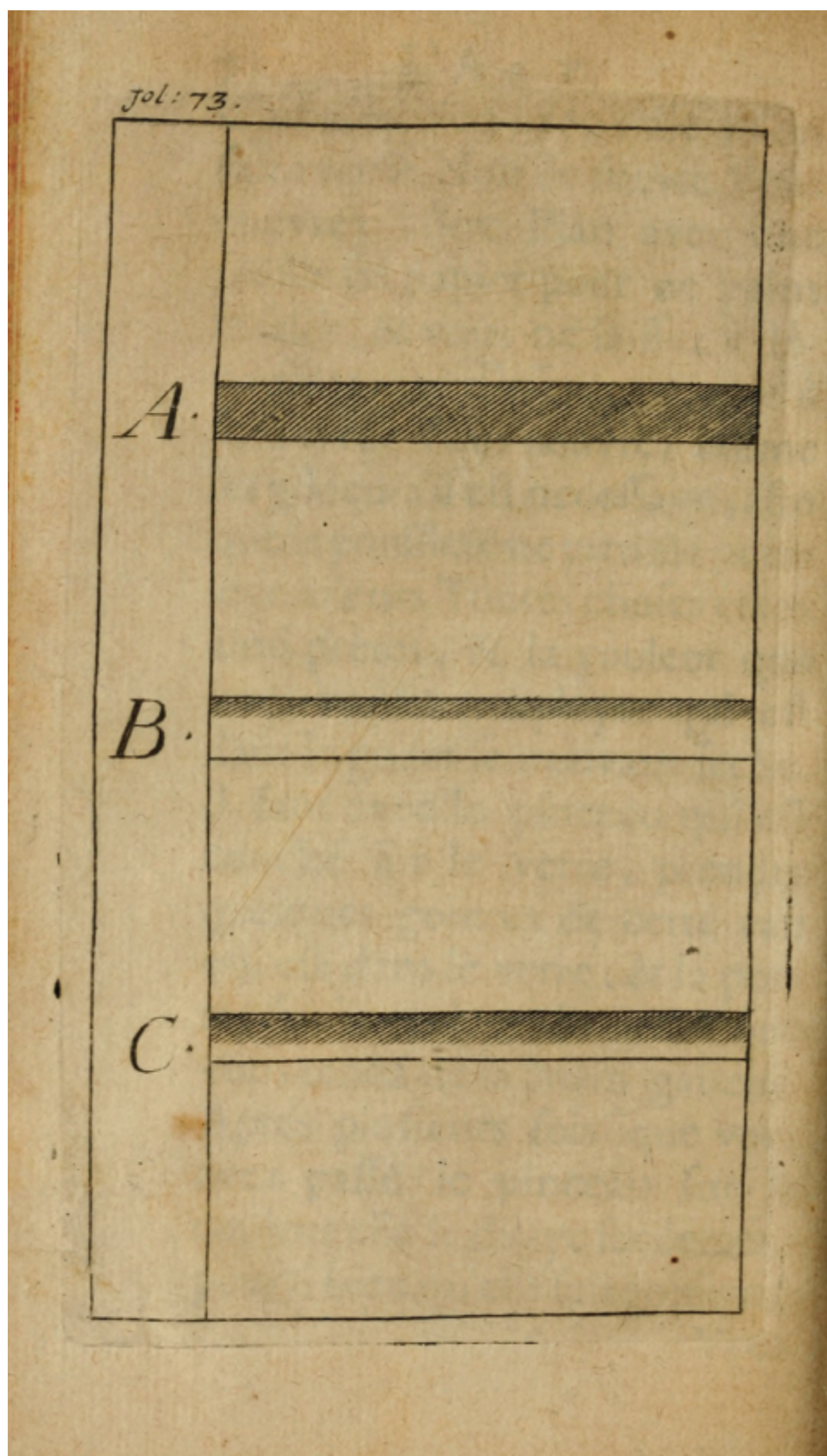
completion – the central anxiety at the heart of the engineering handbook. The mention of colour-coding occurs specifically when engineers responsible for a specific fortified place in the large network of French constructions are enjoined to keep a yearly plan record of completed and projected works – hence the first mention of the respective red and yellow colouring. Interestingly, these were supposed to work as a palimpsest, with hues strengthened as infrastructures were nearing completion, while “parts of the old plan, or of the old buildings that will be erased by the new design, are simply here to be represented by punctuated lines” (Vauban 71). But most importantly – and it was the reason for its long-lasting influence – it was the common visual language that emerged from colour-coding that was recognized as a foundational practice, since it avoided “the confusion that the washing of plans, diversified indiscriminately with all sorts of colours, could entail when the signification of one colour is taken for another” (Vauban 72). Abiding by these conventions, and not washing walls in architectural grey wash as was the practice of civil engineers, also enabled the transfer of information to intaglio versions of the map in print – colours could be added to parts of building that remained carved out and non-inked, and these could not be confused with projected shadows (Buchotte 44).

22 Although Vauban is one of the first to have mentioned in writing the use of the code specifically for military engineering, the identification of two colours for completed and projected works – respectively red and yellow – was not his own arbitrary invention and was already in practice. The colour code used by military maps was derived from the same surveying and architectural disciplines that had influenced military drawing lessons, and the extent to which the praxis of these professions influenced the career and culture of military engineers cannot be overstated (Skelton, Payne). This was thoroughly codified a year later, in 1686, by the French military engineer Hubert Gautier in his *L'art de laver : ou la nouvelle manière de peindre sur le papier suivant le coloris des desseins qu'on envoie à la cour*. Henri Gautier (1660-1733) is also known as Gauthier de Nîmes, or Hubert Gauthier, and was the author of fortification and surveyance drawing manuals and treaties. Gautier was the first inspector of the *Ponts et Chaussées* – the Roads, Canals and Bridges Public Office of the *Ancien Regime* that promoted France-wide standards and monumental infrastructure works, in its desire for authoritarian control of the French territory. In this technical manual, Gautier applied the code in detail to the many features encountered of washing plans and maps – cultivated agricultural fields or trenches, vineyards or roads, portcullis or parapets. What made this code so precise, however, was not fact that Gautier's alphabetically ordered abridged guide at the end of his handbook ran for some twenty pages, but that, with a craftsman's care, he had specified both the intensity of the hue, and the precise pigment used (Gautier 135-54).

23 First, Hubert Gautier deployed the intensity of the hue as an element of the code when it had only been hinted at in Vauban's discussion of strengthening colours by adding a layer of wash to features as they neared completion. ‘Washing’ means adding watercolour in a transparent tint to a manuscript drawing in a way that does not obscure the Indian ink line, or adding tint to a printed map. It requires careful care in mixing the gummed pigment with the appropriate amount of water. The only illustration to Hubert Gautier's handbook consists precisely in a diagram of three wash expanses painted in between Indian ink lines, to present flat, graded and blended washes – one of the difficulties of watercolour being the handling of wet on wet, and the control of blended or uniform results in its wash techniques (Figure 6).

**Fig. 6. The leaf of plate from Hubert Gautier, *L'art de laver, ou, Nouvelle maniere de peindre sur le papier : suivant le coloris des desseins qu'on envoie à la cour*: Lyon : Thomas Amaulry, 1687. 16 cm (12mo). pp. 72-73. 16 cm (12mo). pp. 72-73. Folger Shakespeare Library.**





Photograph by Bénédicte Miyamoto, from the collection of the Folger Shakespeare Library

24 By specifying the nature of the pigment, Hubert Gautier also ensured a smooth Europe-wide abundance to the code, since outcomes were thus closer to being standardized, making them transferable skills in the curriculums of the emerging European military academies.

25 The use of precise pigment names did not get lost in translation, a common difficulty with colour names being nationally and regionally diverse in the early modern and modern world (Miyamoto). This distinction between colour and pigment is essential to understand the workings of the military map code that coalesced at the end of the seventeenth century. The material constraints and physical qualities of pigments were



indeed foundational for the military colour code. The requirement of transparency for watercolours meant that only a few pigments could be used for washing, as evidenced already in the restrictive list furnished by Claude Boutet's *Art of Painting in Miniature*: Lake (a dye made using metallic salt mordant – often short for red colour), Blue, Yellow, Grass green, Dark-green, Purple and Brown. Hubert Gautier standardized the pigments to use on a military map and military plans, by building upon this selection. Subsequent publications keep to Gautier's text, such as the synthetic and definitive Nicolas Buchotte's *Règles du lavis et du dessin*, 1722 (Buchotte 1-10).

- 26 The limitation is in fact to 6 pigments – rather than colours. This restricted number of coded colours reflected the affordance and affordability of pigments for watercolour washing, and this established colour code remained in place till the end of the nineteenth century, even when watercolours had been replaced for “hastily drawn military maps [...] by coloured pencils that can be carried in the field” (Root 275). Wash, as stated above, is the process of spreading watercolour evenly and most importantly *transparently*. This physical property was necessary for Indian ink draughts to remain visible underneath colouring, and wash was therefore a technique incompatible with most pigments that were opaque or “grainy” (Browne 77). Other constraints also limited the list of pigments available to military engineers. Eleven quality pigments were known to produce the colour red in the early modern period, for example, but although roset was a traditional substitute for carmine, only the latter was recommended for military maps. Roset was transparent over graphite or Indian ink, did not require to be steeped in liquor or boiled in preparation, and it could be stored and thus made portable, but surveyors and map makers found that “it will soon fade and grow lighter” (Laybourne 116; Miyamoto). It is therefore important to use pigment names when describing military maps, rather than colour names which do not communicate price, transparency, vibrancy, fastness to light and ability to mix – all of which impacted the choices of the military colour code.

## John Muller's military handbook and the properties of pigments

- 27 In 1746, the professor of artillery and fortification at the Woolwich Royal Academy published for the use of the Cadets *A treatise containing the elementary part of fortification* – the book, which went through ten similar editions by the turn of the century, was a lasting success and was inscribed on the list of reference books indicated by the Board of Ordnance (Bruneau). It epitomizes the efforts of training institutions to efficiently repackage the knowledge of elite officers and celebrated military heroes and circulate it amongst the lower ranks of the army. The treatise was a compendium of works by “the most celebrated authors,” notably such continental engineers, mathematicians and fortress architects as Daniel Specklin (1536-1589), Johann Wilhelm Dilich (1600-1657), Blaise François Pagan (1603–1665), Nicolas-François Blondel (1618-1686), Sébastien Le Prestre de Vauban (1633-1707), Menno van Coehoorn (1641-1704), and Bernard Forest de Bélidor (1698-1761). It was presented as a work of synthesis, since the author has “examined the methods in each part separately, and pointed out there several deficiencies, [...] with proper corrections” (Muller ix). Most importantly, for the readability of a compendium assembling so many sources, each was reformatted into one, two or three methods of fortification. Blondel's discourse in *Nouvelle maniere de fortifier les places*, for example, was divested of its long-winding discursive mode presented above, while the 1645 *Fortifications du Cte de Pagan* were stripped of their geometry theorems, with all the authors repackaged in as many methods or “manière” as presented in the original, but in a direct and lesson-friendly format. The same spirit of improvement and correction animates Muller's list of pigments for the military map colour code, presented at the beginning of the book, just



after the chapter on measures and scales, as deemed proper for what he considered colour to be – a set of tools rather than decoration and finishing touches (Muller 14-18).

28 The spelling of Muller's list (below) has been retained and corresponds largely to eighteenth-century British usage. As Paula de Vos evidences,

there was substantial continuity through the early modern period and the continuation of a remarkable degree of overlap between pharmacological and artistic materials especially regarding the use of organic and inorganic pigments.  
(De Vos 278)

These names and spellings were not standardized and varied across regions, countries and periods, but can definitely be traced to the same pigments and have been clearly identified historically (Feller *et al*). Below is the material description of the Indian ink and the six pigments used in military maps, listing their physical properties, their relative cost, how they were processed and lastly their application according to the code.

29 **Indian ink:** This was not a pigment *per se*, but an expensive carbon-base ink, sold in stones, which did not corrode or wash away, unlike the locally sourced iron gall ink widely used for writing. Called Indian ink, or *encre de chine* in French, the material came from China and advertised its worth linked to its origin by being sold in sticks that bore raised-up Chinese ideograms on the side, which were often gilded to emphasis this proto-branding mark. Counterfeits were made in Paris and Holland, and were also widely available on the market, but generally authors of manuals warned against them, and they were declared unequal to the task and “graveleux,” meaning lumpy and grainy (Buchotte 2).

For drawing lines, it must be made very black though not too thick, otherwise it will not so easily flow out of the drawing pen; but when it is for shading, it must be very pale, so as to go over the shading several times, which will make it look much finer and softer than of it was done all at once

recommended Muller (13).

30 It was therefore used in concentrated form for black contours and lines, with the compass, the drawing pen or the ruling pen. To be used as a grey wash, as had long been a staple of architectural drawing, it was diluted with water for grey shading and relief and applied with a brush.

31 **Carmine:** Like lake, Carmine was scale insect-based and sold in powdered form. Very expensive at a guinea an ounce in the eighteenth century, since the extraction method and the breeding of the insects afforded few shortcuts, it could be labelled Florentine, Munich, Paris or Viennese, but these were “all largely fanciful names” and rarely denoted quality or branding (Feller 258). It was to be diluted in gum water, in shells or very small china cups, and care was to be taken to waste as little as possible of this precious pigment, since prepared and unused carmine darkened and could not be reused (Buchotte 6). However, its use in military maps was rarely for extensive surfaces, but rather confined to details. Carmine had traditionally been used in architecture to label the support structure. According to the colour code, carmine was to be used condensed to represent essential sections of masonry, load bearing walls and plans of buildings in bright red and dilute it for simple support elevations. These differences in intensity of the tint were essential to the conventions of the code but owing to the fugitive nature of this pigment over time, mainly due to poor light fastness, the legibility of the maps can now be affected (Figure 7).

**Fig. 7. Service hydrographique de la marine, “Plan d’une partie des environs de Bayonne devant la ville haute et château vieux,” 1747. Detail (Pigment labels added by the author). Pen, ink and watercolour. GE SH 18 PF 58 DIV 4 P 5/1 D. Bibliothèque nationale de France.**







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32 **Gum-bouch:** A vegetable pigment, it needed no addition of gum powder since it carried its own binder from its tree resin origin. It arrived at European colour shops and apothecaries in the seventeenth century only, where it was used mainly as a watercolour pigment, and its name marks its Cambodian source, its only regional origin in the period. It was cheap and sold in stones, but its preparation was recommended in small batches, since it was perishable once prepared. Gum-bouch had the advantages of being both bright and transparent – which made it an ideal candidate for one of the two most important features of the military colour code, which were the conventional colours for completed and projected features. Used diluted, it signified planned structures and infrastructures in progress, and was meant “to colour all projects of works; as likewise to distinguish the works unfinished from those that are so. It serves also to colour the trenches of an attack” (Muller 16).

33 **Indigo:** This plant-based pigment was an imported good but had been readily available since the rise of East Indian trade companies and the start of intensive colonial plantations and had by the eighteenth century largely replaced the use of European-grown woad. Disdained by oil painters from the seventeenth century onwards and replaced by more brilliant and less dusky pigments, it remained a staple of watercolour painting for its brightness, and for its dark blue although transparent colour. Used finely ground and diluted with gum water, sold cheap in small cakes, it became the convention “to colour iron and roofs of buildings, which are covered with slates” (Muller 17). (By the end of the eighteenth century, it was in competition with the recently invented Prussian blue) (Figure 8).

**Fig. 8. Plan of the investment of York & Gloucester by the allied armies: in Sept.r & Oct.r 1778, published by Isaac Collins, [1785]. Detail (Pigment labels added by the author). Engraving with watercolour. MAP L1990.1.79, Society of the Cincinnati Library.**





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For the large expanses of land or water areas, pigments which corresponded to the natural colours of these environment features were easily and cheaply found.

34 **Verdegrease:** The pigment (also called sea-greene) was harvested on copper, copper alloys and copper ores – the ‘rust’ or corrosion that formed at the surface was of a blue-green colour. It “commonly comes from Holland, or Lyons in France, and on sticks in form like our sugar-candy” (*Dictionarium Polygraphicum*, entry Verdigris). It was sold in its liquid form, readily usable since it contained its own binder, and came in sixpenny vials. It could be touched by indigo to correct its colour towards darker blue, and its transparency and its cheapness made it ideal to use for “wet ditches, rivers, sea and in general to represent all watery places” (Muller 14).

35 **Sap-green:** Sold in stone, and cheaper than verdegrease, it made a slightly yellowish green. Even if it was liable to fade, it was often mixed with verdegrease, because it was cheaper, each sap-green stone or stick selling at two or three pence each. It was diluted and used to border watery elements and to represent inclination.

36 **Umber:** The earth pigment was used diluted with gum water to colour dry ditches, sand and land terrain; it could also be diluted with carmine to warm its colour and denote wood. It could be locally sourced, rather than shipped, or replaced by a wash of tobacco leaves infusion for large surfaces.

## The military map colour code and the difficulties of three-dimensional and mobile features

37 Some specificities in the military colour code came from the affordances of watercolour itself. Flat wash in watercolour required from the painter a quick and even brushstroke across the paper surface to achieve a smooth uniform colour. Therefore, the intensity of the hue could be colour-coded but did not allow for gradients or overlays, which explained the complexity of the technique explained in Figure 6 (above). Transitions of value or hue in water-based brushstrokes would have made the code illegible. This was a perplexing state of affairs when shadowing was required by traditional 3D perspective to represent the direction of a slope, or the variations in relief. Grey wash of diluted Indian ink was not up to the task, so increasingly, shadowing was complemented by hatching and dotting (Andrews 277-304 and 289; Medynska-Gulij).

38 Colour-coding in military maps for mobile features predates the immobile features colour code of the 1680s, and even the much-debated “military revolution” which enshrined the strategic importance of siege warfare, fortification, and increased army size (Rogers). It was derived from artillery exercises, infantry drill and castrametation manuals, and followed the conventions of geometry sketches, by presenting on one



plane the asynchronous stages of line formation and troop manoeuvres. French military engineers and cartographers, for example, coloured the rectangles standing for infantry in yellow, cavalry in blue, dragoons in red, and hussars in green, as explained in Dupain de Montesson's 1750 *La science des ombres, par rapport au dessein*, or the science of drawing shadows. If needed, each squadron and battalion could be colour-coded by drawing a diagonal through the rectangle indicating the troop, and colouring the top part with the uniform colour, the bottom part with the troop's pennant flag, or parement (Dupain de Montesson).

39 Two colour codes and grammar of forms thus existed on military Enlightenment maps. Mobile features – such as the narrative of an attack – used a symbolic, geometrical and 2D grammar. Immobile features – the background to the narrative – used a more lavish 3D depiction “grounded in mimesis and empirical evidence, highlight[ing] the perceived systemic affinity between maps and the fine arts” (Brückner 5). Gautier's detailed colour-coding made it possible for the cartographer to articulate a realistic and beautified perception of space and a geometric and strategic one on the same map, one of the reasons why it was soon adopted as a European wide convention.

\*

40 In eighteenth-century military cartography, the necessity to locate physical forms and features on the ground (river, hills and vegetation) created confusion with the teaching of landscape as a picturesque element of style, and the increasing interest in watercolour shading and overlays. The process of sublimation was not applied homogenously, as an important part of the map's function was to elicit an aesthetic response. The depiction of geographical elements in embellished details was later frowned upon and the perspective view discarded from military drawing education by the French Consulate reforms of military education and in the wake of manuals such as J. E. H. Haynes' 1806 *Éléments de topographie militaire* (Liebenberg, Demhardt, and Vervust 269). The modern cartographical concept is now to “avoid too high a degree of subjectivity during the map design process by applying predefined design rules” (Humi and Sell 323-32) for a highly readable, and generalized representation transmuted from detailed geographical data. But the military Enlightenment which spread in the cosmopolitan ranks of European armies and durably percolated in military training created the need for visuals that were both efficient and embellished – and the colour code was a result of both these needs and of the material constraints of pigments and promptly drawn large-scale maps.



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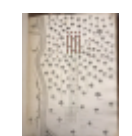


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	<b>Crédits</b>	Photograph by Bénédicte Miyamoto, from the collection of the Society of the Cincinnati Library
	<b>URL</b>	<a href="http://journals.openedition.org/1718/docannexe/image/8039/img-1.jpg">http://journals.openedition.org/1718/docannexe/image/8039/img-1.jpg</a>
	<b>Fichier</b>	image/jpeg, 779k
	<b>Titre</b>	Table 1. The course of instruction at the Royal Military Academy at Woolwich for the year 1772, devised from the Records of the Royal Military Academy, 1741-1892, published 1892.
	<b>Crédits</b>	Copyright Bénédicte Miyamoto.
	<b>URL</b>	<a href="http://journals.openedition.org/1718/docannexe/image/8039/img-2.png">http://journals.openedition.org/1718/docannexe/image/8039/img-2.png</a>
	<b>Fichier</b>	image/png, 95k
	<b>Titre</b>	Fig. 2. Anna Beeck and Gaspar de Baillieu, "Carte qui représente toutes les pièces qui sont comprises dans l'architecture militaire, ou, l'art des fortifications" in A Collection of Plans of Fortifications and Battles, 1684-1709 [S.l. : s.n., 1709]. Based on a 1679 engraving by Mr. de Roussel, Paris. Watercolour, ink, 56 x 40 cm. G1793 .B4 1709 Library of Congress.
	<b>Crédits</b>	© 2021 - The Library of Congress
	<b>URL</b>	<a href="http://journals.openedition.org/1718/docannexe/image/8039/img-3.png">http://journals.openedition.org/1718/docannexe/image/8039/img-3.png</a>
	<b>Fichier</b>	image/png, 11M
	<b>Titre</b>	Fig.3. Student copy book of Thomas Chambers, "Plan of Education," from the Royal Academy at Portsmouth, 1798-1801. 38 cm folio. MSS L1999G48 [Bound] Society of the Cincinnati Library.
	<b>Crédits</b>	Photograph by Bénédicte Miyamoto, from the collection of the Society of the Cincinnati Library
	<b>URL</b>	<a href="http://journals.openedition.org/1718/docannexe/image/8039/img-4.jpg">http://journals.openedition.org/1718/docannexe/image/8039/img-4.jpg</a>
	<b>Fichier</b>	image/jpeg, 848k
	<b>Titre</b>	Fig. 4. "Military Evolutions – Major Wm Young Esq. Major of the Wiltshire Regt" drawn by R. Mountaine, sheet 38. Watercolour and ink on paper, 21 x 37 cm. MSS L2012F65f [Bound] Society of the Cincinnati Library.
	<b>Crédits</b>	Photograph by Bénédicte Miyamoto, from the collection of the Society of the Cincinnati Library
	<b>URL</b>	<a href="http://journals.openedition.org/1718/docannexe/image/8039/img-5.jpg">http://journals.openedition.org/1718/docannexe/image/8039/img-5.jpg</a>
	<b>Fichier</b>	image/jpeg, 703k
	<b>Titre</b>	Fig. 5. Bound copy-book fortification exercise drawn from plate XI of John Muller's A treatise containing the elementary part of fortification, c. 1760. Watercolour, 31 x 47 cm. MSS L2001F401 [Bound] Society of the Cincinnati Library.
	<b>Crédits</b>	Photograph by Bénédicte Miyamoto, from the collection of the Society of the Cincinnati Library
	<b>URL</b>	<a href="http://journals.openedition.org/1718/docannexe/image/8039/img-6.jpg">http://journals.openedition.org/1718/docannexe/image/8039/img-6.jpg</a>
	<b>Fichier</b>	image/jpeg, 1,0M
	<b>Titre</b>	Fig. 6. The leaf of plate from Hubert Gautier, L'art de laver, ou, Nouvelle maniere de peindre sur le papier : suivant le coloris des desseins qu'on envoie à la cour: Lyon : Thomas Amaulry, 1687. 16 cm (12mo). pp. 72-73. 16 cm (12mo). pp. 72-73. Folger Shakespeare Library.





<b>Crédits</b>	Photograph by Bénédicte Miyamoto, from the collection of the Folger Shakespeare Library
<b>URL</b>	<a href="http://journals.openedition.org/1718/docannexe/image/8039/img-7.png">http://journals.openedition.org/1718/docannexe/image/8039/img-7.png</a>
<b>Fichier</b>	image/png, 3,2M
<b>Titre</b>	Fig. 7. Service hydrographique de la marine, "Plan d'une partie des environs de Bayonne devant la ville haute et château vieux," 1747. Detail (Pigment labels added by the author). Pen, ink and watercolour. GE SH 18 PF 58 DIV 4 P 5/1 D. Bibliothèque nationale de France.
<b>Crédits</b>	© 2021 - Bibliothèque nationale de France
<b>URL</b>	<a href="http://journals.openedition.org/1718/docannexe/image/8039/img-8.png">http://journals.openedition.org/1718/docannexe/image/8039/img-8.png</a>
<b>Fichier</b>	image/png, 1,3M
<b>Titre</b>	Fig. 8. Plan of the investment of York & Gloucester by the allied armies: in Sept.r & Oct.r 1778, published by Isaac Collins, [1785]. Detail (Pigment labels added by the author). Engraving with watercolour. MAP L1990.1.79, Society of the Cincinnati Library.
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<b>Fichier</b>	image/png, 7,9M

## Pour citer cet article

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### Articles du même auteur

#### Significant Red: Watercolour and the Uses of Red Pigments in Military and Architectural Conventions [Texte intégral]

Paru dans *XVII-XVIII*, 75 | 2018

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