

AN ABSTRACT OF THE DISSERTATION OF

Tamara Lee Caulkins for the degree of Doctor of Philosophy in History of Science
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Title: The Science of Becoming Noble: Rationalizing Aristocracy through Diagrammatic
Notations for Dance and Drill in the Age of Enlightenment

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Anita Guerrini

Abstract

During the eighteenth century, diagrams increasingly became an important aspect of scientific inquiry. Diagrams employed simplification as a strategy for representing complex information, played a role in standardizing scientific language, and served as instruments of reason to think through and communicate problems and findings in mathematics, physics, chemistry, astronomy, natural history, and other areas. I argue that the application of scientific diagrammatic practices to the sociocultural realm extends recent historiography on data visualization beyond inquiry into the natural world. Furthermore, in contrast to studies that indicate increasing individuation over the course of the Enlightenment, my research reveals the rise of people moving together in groups in increasingly coordinated ways in dance and drill.

In eighteenth-century France (and in much of Europe and North America), court dance and the command of troops were closely connected practices that had been the preserve of the aristocracy since the middle ages. The publication of diagrams

rationalized aristocratic dance steps and mapped the movements of ever larger armies. These diagrams for dance and drill visually record a change from complex individual steps in court dances to simplified patterns of contredanse, and from more loosely organized troops to tightly regimented masses of marching soldiers.

The intellectual movement known as the Enlightenment postulated human potential to be much greater than had previously been believed. Guided by the light of reason and emboldened by new venues for discourse such as the *Encyclopédie*, Enlightenment thinkers used diagrams, alongside texts, to forward their ideas. Diagrams played a decisive role in eighteenth century thought and practice by extending scientific practice to social practices. Instruction manuals with diagrams for dance and drill – and the movement practices they represent – have been an overlooked resource for understanding the development of science during the Enlightenment.

My research analyzed graphic strategies used to notate *La Belle Danse* of the court of Louis XIV, contredanses that became the rage after 1760, and military drill for both the manual drill (i.e. use of firearms) and field exercises (i.e. marching in large groups). Employing methodology from visual studies, my research indicates cross-fertilization of diagrammatic practices across the sciences and cultural practices such as dance and drill, as diagrams became increasingly abstract, standardized, and precise.

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The Science of Becoming Noble:
Rationalizing Aristocracy through Diagrammatic Notations
for Dance and Drill in the Age of Enlightenment

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Tamara Lee Caulkins

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APPROVED:

Major Professor, representing History of Science

Director of the School of History, Philosophy, and Religion

Dean of the Graduate School

I understand that my dissertation will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my dissertation to any reader upon request.

Tamara Lee Caulkins, Author

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CHAPTER ONE

INTRODUCTION: DIAGRAMMING NOBLESSE

The science of the communication of ideas is not confined to putting the ideas themselves in order; it must also encompass expressing each idea as sharply as possible, and thereby perfect the signs which represent them.

“Prospectus,” Jean de la Rond d’Alembert, *Encyclopédie*¹

Diagrams as Epistemological Tools

In 1766, a chemistry professor introduced the use of an “X,” a chiasm, to teach a formula for visualizing the hypothetical strength of forces acting in chemical reactions.² This simple “X” is often considered the first use of a diagram in chemistry, hence historians of science have been interested in how Joseph Black (1728-1799), the professor who had his students copy this diagram, came to invent this visual aid. Black’s diagram emerged out of a rich culture of diagrammatic images.³ In class, students practiced drawing diagrams in their lecture notebooks; outside class, students had been dancing the same patterns – crosses, symmetrical lines, and figure eights – for decades.⁴

¹ “La science de la communication des idées ne se borne pas à mettre de l'ordre dans les idées mêmes ; elle doit apprendre encore à exprimer chaque idée de la manière la plus nette qu'il est possible, & par conséquent à perfectionner les signes qui sont destinés à la rendre.” Jean le Rond d'Alembert, “Prospectus,” in *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers*, edited by Denis Diderot and Jean le Rond d'Alembert. 28 vols. Paris: Brisson, 1750-1772. I have referred to the online version at the University of Chicago: ARTFL Encyclopédie Project, Autumn 2017 Edition,, edited by Robert Morrissey and Glenn Roe. <http://encyclopedia.uchicago.edu/>. In addition to this online version, I have consulted an original copy of the first edition held by special collections at Oregon State University Valley Library. All translations in this dissertation are mine unless otherwise noted.

² Matthew Daniel Eddy, “How to See a Diagram: A Visual Anthropology of Chemical Affinity,” *Osiris* 29, no. 1 (2014): 178–96.

³ John Bender and Michael Marrinan, *The Culture of Diagram* (Stanford, CA: Stanford University Press, 2010); Barbara Maria Stafford, *Artful Science: Enlightenment, Entertainment, and the Eclipse of Visual Education* (Cambridge, Mass.: MIT Press, 1994); Johanna Drucker, *Graphesis: Visual Forms of Knowledge Production* (Cambridge, MA: Harvard University Press, 2014).

⁴ These patterns included circles, knots, and stars. While the patterns only began to be written down in a systematic way in the eighteenth century, they were in common use much earlier. John Playford’s 1651 *English Dancing Master* may be one of the earliest printed manuals to describe figures in text (though not fully developed diagrams). By the seventeenth century, the patterns were well known. In 1671, for example, John Baltharpe started a poem, “The Straight’s Voyage,” with the line, “Sometimes to passe sad Cares Away On Fore-castle we dance the Hay,” the “Hay” being a figure-eight interweaving pattern

These patterns began to be published as diagrams in manuals for dance and drill at the beginning of the eighteenth century.

I am arguing that the visceral, embodied knowledge of danced and drilled patterns informed the diagrammatic notations in science that have been the subject of recent research in natural history, anatomy, geology, and other fields.⁵ As Matthew Eddy and others have argued, Black's visual aid was not a unique invention but rather emerged out of a cultural context in which diagrams increasingly informed visual literacy, knowledge production, and cognition.⁶ This cultural context, I argue, did not only consist of "teaching diagrams," in science as Eddy and others have claimed, but of diagrams for dance and drill. My research contributes to the historiography on visual studies through the study of diagrammatic systems of notation for court dance and military drill, two closely connected practices that have been rarely juxtaposed in the historiography.⁷ They

followed by three or more dancers. Quoted in Marcus Rediker, *Between the Devil and the Deep Blue Sea: Merchant Seamen, Pirates and the Anglo-American Maritime World, 1700-1750* (Cambridge: Cambridge University Press, 1989), 190.

⁵ Bertrand Daugeron, *Collections Naturalistes Entre Science et Empires, 1763-1804*, Archives (Paris: Muséum national d'histoire naturelle, 2009); Janice Neri, *The Insect and the Image: Visualizing Nature in Early Modern Europe, 1500-1700* (Minneapolis, MN: University of Minnesota Press, 2011); Daniela Bleichmar, *Visible Empire: Botanical Expeditions and Visual Culture in the Hispanic Enlightenment* (Chicago: University of Chicago Press, 2012); Nicholas Jardine and Isla Fay, eds., *Observing the World through Images: Diagrams and Figures in the Early-Modern Arts and Sciences* (Boston: Brill, 2014); Barbara Maria Stafford, *Body Criticism: Imaging the Unseen in Enlightenment Art and Medicine* (Cambridge, MA: MIT Press, 1991); Sachiko Kusukawa and Ian Maclean, *Transmitting Knowledge: Words, Images, and Instruments in Early Modern Europe*, Oxford-Warburg Studies (Oxford: Oxford University Press, 2006).

⁶ Matthew Daniel Eddy, "How to See a Diagram: A Visual Anthropology of Chemical Affinity," *Osiris* 29, no. 1 (January 1, 2014): 180. See also Barbara Maria Stafford, *Artful Science: Enlightenment, Entertainment, and the Eclipse of Visual Education* (Cambridge, Mass.: MIT Press, 1994); and John Bender and Michael Marrinan, *The Culture of Diagram* (Stanford, CA: Stanford University Press, 2010).

⁷ An exception is Melissa D. Andrews, "Step in Time the Ritual Function of Social Dance and Military Drill in George Washington's Continental Army" (M.A., Florida State University, 2006). In addition to the examples discussed in the chapter on drill, a 1784 recruitment posters promised dancing lessons (as well as instruction in mathematics, drawing, and weapons) as an enticement for joining the military. Hélène Guilcher and Jean-Michel Guilcher, "L'Enseignement Militaire de La Danse et Les Traditions Populaires," *Arts et Traditions Populaires* 18, no. 1/3 (1970): 275.

are practices, however, that were closely connected in eighteenth-century culture, as I will demonstrate in later chapters.

I argue, in addition, that the diagrams used in these manuals represent an application of rational, scientific principles of direct observation and analysis to the study of bodily movement practices associated with the nobility. Noble dancers distinguished themselves with visible grace in beautiful movement which served as an outward sign of inner noble virtues and visibly demonstrated their right to privileges of the nobility. Military leadership positions were traditionally held by members of the aristocracy. Again, their physical bearing bespoke their (supposedly innate) noble virtues of composure and courage. Dance diagrams broke down the postures and steps of courtly dance into distinct smaller movements that could be recombined differently for different dances. Drill diagrams provided tools for the officer to visualize drill formations on paper, identifying basic group patterns – turns, changes of direction, movements from lines into columns, etc. These patterns then could be rearranged depending on tactics and terrain. The publisher of a 1776 manual offered “sets of small Platoons in Ivory or Wood, for Perfroming the Manoeuvres” to accompany sixty-two copperplate engravings detailing drill patterns.⁸

Distinct diagrammatic notation systems developed in the eighteenth century thus provided simplified, standard visual languages for transmitting knowledge that had been exclusively associated with noble practitioners: court dance and military drill. Some of the readers and authors of instruction manuals and diagrams were of the nobility, many were not. Evidence for the use of these diagrams during the eighteenth century,

⁸ William Young, *Manoeuvres for a Battalion of Infantry, upon Fixed Principles: With Seventeen Copper Plates, Including the Late General Wolfe’s Instructions to Young Officers* (London: J. Millan, 1776), cover.

nevertheless, is difficult to find. Authors of manuals gave detailed directions for how to read these diagrams and perform the movements described. Balls took place, battles were fought – the dances and maneuvers described were performed; however, descriptions of the use of diagrams, as intermediary sources of information, are surprisingly rare, at least in published sources.⁹

Diagrams have become an ever more ubiquitous form of communicating ideas. Unlike pictures, diagrams do not attempt to portray the world as it appears to the human eyes. Unbounded by the need to represent the physical world as it is seen, diagrams are used to convey and consider ideas, concepts, and abstract principles. Diagrams are a kind of image (which I am defining here as any visual representation on paper). They are not texts, i.e. they do not consist of combinations of alphabetic letters or signs put together to mimic speech, although letters do sometimes appear on diagrams as labels. Diagrams are abstract drawings that use lines and symbols to express information.

Deemed objective and transparent, diagrams look like value-free, emotion-free representations of content. As such, they are deeply implicated in the practice of science, which aims to be objective, quantitative, and replicable. Diagrams emerged out of specific cultural and social contexts employing modes of simplification, juxtaposition, and standardization in an effort to address some aspect of the society of which it a part. As Eddy explains, diagrams are not “ethereal abstractions...[but rather] a visual genre of

⁹ In her 2014 dissertation, Marie Glon examined marginalia in a copy of M. Dupré, *Méthode Pour Apprendre de Soi-Mesme La Choregraphie Ou l’art de Decrire et Déchiffrer Les Danses Par Caractères, Figures & Signes Démonstratifs* (Mans, France: Charles Monnoyer, 1757). Dupré’s manual did not include diagrams (see my discussion on p. 73). The anonymous reader of this copy made further annotations in the margins indicating a need for more information than was given by Dupré in his text. Marie Glon, “Les Lumières Chorégraphiques : Les Maîtres de Danse Européens Au Cœur d’un Phénomène Éditorial (1700-1760)” (PhD, Ecole des Hautes Etudes en Sciences Sociales EHESS, 2014). See especially chapters 5 and 6. It is unknown if there is manuscript evidence of such uses. My dissertation concerns published sources.

representation anchored in both the material and intellectual skills possessed by the community that created or appropriated them.”¹⁰ In my project, I have researched the contexts in which skill in dance or drill mattered. Diagrams for these disciplines were invented to meet particular needs. At the court of Louis XIV and Louis XV – as well as in other European courts that emulated the French court – advancement and privileges depended on skill in physical presentation. The French court was widely emulated during this period as the most powerful, opulent, and influential in the seventeenth and eighteenth centuries.

Diagramming as Rationalizing Technology

As numerous scholars have demonstrated, diagrams are never merely conduits for the transmission of data in graphic form. Elena Aronova, Christine von Oertzen, and David Sepkoski observe in their essay on “Historicizing Big Data,” that “a meaningful visualization of the data is what constitutes knowledge.”¹¹ Diagrams rationalize the data they display in particular ways, in particular cultural contexts, with particular purposes.¹² The work of graphics designer Edward Tufte inadvertently makes this clear when he reveals the many ways designers of diagrams throughout history have used various visual tools and approaches to guide viewer perceptions. Drawing on his analysis of diagrams, Tufte developed a list of principles to promote techniques for the more persuasive use of

¹⁰ Eddy, “How to See a Diagram,” 180.

¹¹ Elena Aronova, Christine von Oertzen, and David Sepkoski, “Introduction: Historicizing Big Data,” *Osiris* 32, no. 1 (2017): 1–17.

¹² By “rationalize,” I am gesturing toward an Enlightenment sense of the application of reason to the subject at hand, in this case the movement of bodies in dance and drill. “Reason,” in the *Encyclopédie*, is defined as “the sequence of truths that the human mind can attain naturally, without being aided by the light of faith.” The visible signs of nobility in the physical body would be more convincing to reason than the assumption that noble birth conveys virtue.

graphics.¹³ These principles include inducing the viewer to think about the substance of the diagram rather than the diagram itself, encouraging the eye to compare different pieces of data in particular ways, and making sure that every element of a diagram serves the purposes of the designer – to describe, explore, tabulate or decorate the data being presented so that the viewer sees from the perspective of the author.

In this dissertation, I have urged viewers, along with Daniel Rosenberg, Joanna Drucker, James Elkins, and other scholars, to consider diagrams as complex graphic arguments rather than as straight-forward representations of reality. Rosenberg advises readers of diagrams to notice “conflict, contradiction, and difference.”¹⁴ I would add that we should also notice what seems obvious, uncomplicated, and similar. In the diagrams I have studied, it would be easy to miss the significance of simplifying symbolic notation as a way to rationalize an image. In Rosenberg’s essay, he argues for an approach to data visualization that reveals the graphic techniques beneath a diagram, and “induce[s] the viewer to think about the substance, methodology, design, technology, and aspects of production” that the diagram uses to present a particular view.¹⁵ The factors I have focused on have included simplification, standardization, juxtaposition of elements, and precision. In my consideration of dance diagrams, I have noticed what has been left out in an effort to identify how the authors of these diagrams decided what constituted noble movement. Opening the black box of diagram construction, as Rosenberg counsels, leads to a more nuanced, complicated way of thinking with diagrams. Tufte’s set of principles

¹³ Starting with his 1983 self-published volume, *The Visual Display of Quantitative Information*, Tufte has developed his approach and educated thousands of designers in his many presentations and subsequent publications.

¹⁴ Daniel Rosenberg, “Against Infographics,” *Art Journal* 74, no. 4 (2015): 38–57.

¹⁵ *Ibid.*

produces what he calls “graphical elegance.” These other principles might be called “graphical critique,” revealing, as they do, “epistemological differences produced by changes of scale, clarify[ing] the purposes and implications of data representations, and show[ing] how verbal and graphic devices interact in data representation.”¹⁶ As I have studied eighteenth-century diagrams for dance and drill, I have kept these principles of analysis in mind.

In my research, I have drawn on the work of visual theorists, historians of science, and other scholars to extend the historiography of non-art images, specifically diagrams. Most of these studies have focused on scientific visualizations. These scholars include art historian James Elkins, who identifies the neoclassicism of the eighteenth century as a move “away from haphazard naturalism toward geometric notation.”¹⁷ Elkins uses this description to discuss diagrams in crystallography, but his insights are applicable to other diagrammatic images of the period, as I will demonstrate in the dance and drill diagrams that follow. In eighteenth-century dance, one finds elaborate court dance notations in the early eighteenth century and the rise of a simplified contredanse notation after 1760. This turn can be characterized as a move toward the Neoclassical aesthetic Elkins describes. This turn toward geometric notation, and ever finer, more precise measurements, can also be found in drill diagrams of the eighteenth century.

In these diagrams for dance and dance, the connection between science and the social practices depicted does not depend on the realistic visual techniques but rather on systems of notation that refer to bodily movement through visual signs. Unlike Svetlana Alpers, whose study of painting in the Dutch Republic reveals a close connection

¹⁶ Rosenberg, “Against Infographics,” 38–57.

¹⁷ Elkins, *Domain of Images*, 17.

between realism in art and foundational principles of early modern science: direct observation, empiricism, and objective knowledge, my study exposes a tension between what was notated and what was seen.¹⁸ In Barbara Maria Stafford's *Artful Science: Enlightenment, Entertainment, and the Eclipse of Visual Education*, she notes a sophisticated level of visual literacy in eighteenth century Europe.¹⁹ Viewers were used to visual games and slights of hand on paper. My research establishes a connection between the ephemeral nature of noble movement – what Stafford might call a “fashionable illusion” – and challenges of notating instructions for that movement on a page.²⁰

Culture of Diagram and the Encyclopédie

I am building on the work of Michael Marrinan and John Bender who have persuasively argued for a “Culture of Diagram” that developed out of eighteenth-century visualizations.²¹ Marrinan and Bender describe a culture of diagram reflected in theatrical productions and in paintings which, they argue, the viewer completed, partly through the bodily knowledge of the spectator who were familiar with the gestures depicted.²² The gestural language acquired through the practice of courtly dance and the courtly mannerisms of the French military are the subject of the dissertation. This “culture of

¹⁸ Svetlana Alpers, *The Art of Describing: Dutch Art in the Seventeenth Century* (Chicago: University of Chicago Press, 1983).

¹⁹ According to Stafford, “Mid-eighteenth-century northern Europe (especially France, Germany, the Low Countries, and Great Britain) was in the throes of changing from an oral, visual, and aristocratic culture to a market-oriented, democratic, print culture.” This “oral/visual” culture prized reading out loud. Stafford argues that solitary reading and an emphasis on abstract texts over images countered superstitious, icon-rich “Romanish traditions.” She draws on games and diversions as central to eighteenth-century culture, arguing that “rational recreation was visual education.” Barbara Maria Stafford, *Artful Science: Enlightenment, Entertainment, and the Eclipse of Visual Education* (Cambridge, MA.: MIT Press, 1994), 1-5, 73.

²⁰ Stafford, *Artful Science*, 79.

²¹ John Bender and Michael Marrinan, *The Culture of Diagram* (Stanford, CA: Stanford University Press, 2010), title page.

²² Bender and Marrinan, *The Culture of Diagram*, 34-35.

diagram,” as Marrinan and Bender have argued (and I concur), has shaped the way we interact with the material world by the way diagrams enable more detached, abstract conception of objects and processes. In the eighteenth century, diagrams were applied not to the material world, but to the social world of polite company, both the aristocracy and those aspiring to elite status. I have focused on these diagrams to show how science was applied to social phenomena as well as to forward the idea that how people moved their bodies influenced – in a visceral, perhaps unconscious way – approached scientific inquiry.

I have taken as my starting point, diagrams found in the *Encyclopédie; ou Dictionnaire raisonné des sciences, des arts et des métiers par une société de gens de lettres* [Encyclopedia or rational Dictionary of sciences, arts, and manufactures, by a Society of Men of letters] edited by Denis Diderot (1713-1784) and Jean le Rond d’Alembert (1717-1783), particularly those entries for “*Chorégraphie, ou l’art d’écrire la danse*” [Dance notation, or the art of writing dance] and those under the heading “*Art Militaire*” [Military tactics].²³ Marrinan and Bender argue that the copperplate illustrations for the workshops portrayed in the *Encyclopédie* plates urge a curious, emotionally disengaged study of the processes and tools depicted (see Figure 1.1). In these images, artisanal processes are analyzed, taken apart, and put on display to facilitate a new way of thinking about them. Diagrams also take apart processes and put them on display – using an abstract visual language – to facilitate a new way of thinking about them.

²³ *Encyclopédie*, s.v. “Chorégraphie,” “Art Militaire.”

One of the ways the *Encyclopédie* provides cohesion for over 77,000 articles on diverse topics is the way articles are referenced to other articles. While individual entries represent the views of individual authors, each entry is then related to a series of related topics. Thus *Danse* refers the reader to *Geste* which refers the reader to *Déclamation*, and so on. This endless web of associations is second nature to someone in our own age browsing the internet—getting closer or, at least as often, further from the topic with which one started. In the *Encyclopédie*, this convention was both startling and even revolutionary.²⁴ These “rapports” as they were called by contemporaries, form the connections that knit the *Encyclopédie* project into a coherent whole. Thus Diderot’s *rapports* reconnect knowledge on a different plane, revealing a newly analytical view of the world.²⁵ This analytical approach – taking information apart and putting it back together – is a key feature of diagrams, albeit in visual form.

My work is also informed by the approach to the *Encyclopédie* suggested by Stephen Werner’s *Blueprint: a Study of Diderot and the Encyclopédie Prints*, in which he advances the idea that the plates in the *Encyclopédie* “present” knowledge as one might present a play.²⁶ The *Encyclopédie* has been celebrated for disseminating Enlightenment principles, stirring the ferment of ideas that sparked the French Revolution, and depicting in meticulous detail the inner workings of artisanal studios that made everything from

²⁴ For some ingenious early modern ways of correlating information, see Ann Blair, *Too Much to Know : Managing Scholarly Information Before the Modern Age* (New Haven: Yale University Press, 2010).

²⁵ The classic historiography on the *Encyclopédie* include John. Lough, *The Encyclopédie*. (New York: D. McKay Co., 1971); Robert Darnton, *The Business of Enlightenment: A Publishing History of the Encyclopédie, 1775-1800* (Cambridge: Belknap Press, 1979); and Frank Arthur Kafker and Serena Kafker, *The Encyclopedists as Individuals: A Biographical Dictionary of the Authors of the Encyclopédie* (Oxford UK: Voltaire Foundation, 1988).

²⁶ Stephen Werner, *Blueprint: A Study of Diderot and the Encyclopédie Plates* (Birmingham, AL: Summa Publications, 1993).

pins to pâté.²⁷ Werner focuses on the *Encyclopédie* engravings – volumes 18 to 28, published in the last decade of the project (1762-1772) – to argue that the way knowledge is presented by these images is a form of knowledge that should be taken seriously.²⁸ The illustrations that Werner discusses are largely the iconic portrayals of artisan studios that feature a vignette on the upper half of the page and the tools used in the studio neatly laid out on the page at the bottom (as seen in Figure 1.1). Werner argues that the plates in the *Encyclopédie* put trade secrets on display.

My work, in contrast, centers on the movement notations that Werner barely notices in his survey of engraved plates.²⁹ The secrets that were revealed in the *Encyclopédie* were not only those of the powerful guilds of artisans, as Werner relates, but also of aristocrats. This dissertation focuses on the numerous discussions of elite practices – dance, military arts, and equitation – found in the *Encyclopédie*. Many entries that I will be discussing revealed aristocratic secrets: how to behave in polite company, how to dance gracefully and in a convincingly noble way in dance, how to organize and command one's troops. Furthermore, the plates include diagrams for ingenious systems of notation that had been devised for these practices: dance choreography, military drill schematics, and even steps for horse ballets. These directions in graphic form, like much

²⁷ *Encyclopédie*, op. cite. See fn 1; Philipp Blom, *Enlightening the World: Encyclopédie, the Book That Changed the Course of History* (New York: Palgrave Macmillan, 2005).

²⁸ There is a robust literature on visual epistemology. Salient examples include Lorraine Daston and Peter Galison, *Objectivity* (New York; Cambridge, Mass.: Zone Books ; Distributed by the MIT Press, 2007); Edward R Tufte, *Visual Explanations: Images and Quantities, Evidence and Narrative* (Cheshire, Conn.: Graphics Press, 1997); E.R Tufte, *Envisioning Information* (Connecticut: Graphics Press, 1992); Johanna Drucker, *Graphesis: Visual Forms of Knowledge Production* (Cambridge, MA: Harvard University Press, 2014).

²⁹ He mentions engravings for the French navy, music, and equestrian arts (see p. 28), however, as Werner points out, “by far the most significant – and numerous – engravings of Diderot’s text were devoted to illustrations of machines, tools, industrial manoeuvres, and eighteenth century *metiers* [crafts].” Werner, *Blueprint*, 24.

in the *Encyclopédie*, implied that these elite practices could be understood and learned, even learned from a book. This confident attitude is displayed on the title page of Louis Pecour's *Recueil de Dances* (1704) in which the author has "given to the public the means to easily learn by oneself all sorts of dances with the help of 'intelligible characters.'" ³⁰ Likewise, in Gabriel Pictet's *Essai sur la Tactique de l'Infanterie* (1761), he asserts that infantry officers can learn – from his book – how to conduct war using reason. ³¹ This is a marked difference from the earlier view that aristocrats and military leaders were *born*, not made.

A Scientific Approach to Civility

The noble body displayed not only physical grace, but also embodied noble virtues. As the entry on "Noblesse," in the *Encyclopédie* proclaimed,

With regard to the nobility in private persons, one has a kind of respect for an old castle or for a building which has withstood the weather, or even for a beautiful and big tree which is fresh and whole despite its old age. How much more must one have for a noble and ancient family which has stood against the storms of time? The new nobility is the work of the prince's power, but the old is the work of time alone: if one inspires more talent; the other, more greatness of soul. ³²

Diagramming these movements then was a way of understanding virtues – the "greatness of soul" – displayed in the noble body including poise, confidence, politesse, and freedom from affectation. According to Jacques Revel, polite behavior came to be increasingly regulated and universalized. Revel traces this phenomenon to a fifteenth century manual by the humanist Desiderius Erasmus (1466-1546), *De civilitate morum*

³⁰ "donné au public des moyens faciles pour apprendre d'eux mêmes toutes sortes de dances par des caractères intelligibles." Louis Pecour, *Recueil de Dances Contenant Un Tres Grand Nombre, Des Meillieres Entrées de Ballet* (Paris: Feuillet, 1704). All translations, unless otherwise noted, are my own.

³¹ Gabriel Pictet, *Essai Sur La Tactique de L'infanterie* (Geneva: Emmanuel Etienne du Villard, 1761), title page.

³² Chevalier de Jaucourt, *Encyclopédie*, s.v. "Noblesse."

puerilium [Manners for Children], which was reprinted, republished, translated, and disseminated widely well into the eighteenth century. Erasmus' main tenet was that the body expressed the inner state of the soul, thus, if one could properly train the body, it would have an ameliorating effect. Physical signs therefore were not only windows to the state of the soul but could also be regulated in an effort to affect the soul in a positive way. Revel claims that by the end of the seventeenth century, the rules of civility had extended to a wide spectrum of the population, albeit in different ways depending on one's station in life. He points to the publication of Jean-Baptiste de la Salle's 1703 *Les Règles de la bienséance et de la civilité chrétienne* [Rules of Propriety and Christian Civility] as cementing the expectations for behavior even amongst the lower classes.

During the eighteenth century the codification of civility was at its height; however, in contrast to Erasmus' hope that civil behavior would unite an ever larger population as education was extended to all classes, late seventeenth century etiquette manuals such as those by F. de Callières and by the abbé de Bellegarde sought to reify class distinctions. The most renowned of early courtesy manuals, *Il Libro del Cortegiano* [The Book of the Courtier], by Baldassare Castiglione (1428-1529), first published in Venice in 1528, remained influential through the eighteenth century. Castiglione stressed how differently from his or her subordinates the courtier should behave.³³ Castiglione, a nobleman himself, aimed in his treatise to expound on the qualities that defined the nobility and set members of the noble class apart from the rest of society.

Enlightenment Optimism

³³ Baldassare Castiglione, *The Book of the Courtier* (1528), trans. Leonard Eckstein Opdycke (New York: Charles Scribner, 1903), 36.

In the dance manuals that I examined, the authors appealed to a larger segment of society. They claimed that one could learn by oneself –*soi meme* – thus marketing their publications to aspiring elites and would-be dancing masters.³⁴ These books with their accompanying diagrams reflected the optimism of the Enlightenment, that philosophical movement that promoted the application of reason to all manner of social, intellectual, and physical problems.³⁵ Rather than rely on the authority and legitimacy of church or political leaders, eighteenth-century *philosophes* called for intellectual maturity and reliance on one's own insights gained through reflection and empirical observation. Emmanuel Kant in his oft-cited 1784 essay, "What is Enlightenment?" urged readers to "*Sapere Aude!*" [Dare to Know!]. The Enlightenment has been characterized as a movement uniquely focused on the mind, but there are some things known only through the body.³⁶ This current project is focused on two corporeal practices of the

³⁴ Authors of all twelve of the major dance treatises I examined published before 1760, and two published after, claim that one can learn to dance from their book. Many explicitly state one does not need a dancing master. See also Elisabeth H. Rebman, "Chorégraphie : An Annotated Bibliography of Eighteenth Century Printed Instruction Books" (MA, Stanford University, 1981).

³⁵ The Enlightenment was and is also known in French as the *siècle des lumières* [century of the enlightened ones], a nomenclature that puts the *philosophes*, i.e. intellectual leaders of the movement, at the center. This highlights the sociability of the period which seems to me to be essential. I am dating the Enlightenment as spanning the long eighteenth century – about 1685 to 1815, however in different times and places during this period, there are cultural, social, philosophical, and political movements that would be better characterized as Baroque, or Romantic, or something else, thus Enlightenment is not synonymous with the eighteenth century. Classic texts on the Enlightenment include Peter Gay, *The Enlightenment: An Interpretation* (New York: Knopf, 1966), and Daniel Roche, *France in the Enlightenment*. (Cambridge, Mass.: Harvard University Press, 2001). Specific to science and visual culture in the Enlightenment, see Barbara Maria Stafford, *Artful Science: Enlightenment, Entertainment, and the Eclipse of Visual Education* (Cambridge, MA: MIT Press, 1994) and William Clark, Jan Golinski, and Simon Schaffer, "Introduction," 3-31, in William Clark, Jan. Golinski, and Simon Schaffer, eds., *The Sciences in Enlightened Europe* (Chicago: University of Chicago Press, 1999). Some recent scholarship argues for the recognition of many "enlightenments": for example, Gertrude Himmelfarb, *The Roads to Modernity: The British, French, and American Enlightenments* (Knopf Doubleday Publishing Group, 2007); Ian Hunter, *Rival Enlightenments: Civil and Metaphysical Philosophy in Early Modern Germany* (Cambridge University Press, 2001); Caroline Winterer, *American Enlightenments: Pursuing Happiness in the Age of Reason* (Yale University Press, 2016). To say the literature on Enlightenment is vast is an understatement.

³⁶ Dorinda Outram, *Panorama of the Enlightenment* (London: Thames and Hudson, 2006), 14.

Enlightenment, specifically dance and military drill, as they were rationalized, written down, and published using diagrammatic notation systems.

This aspect of my research has been inspired by scholars of embodied aspects of Enlightenment including Emma Spary, Roy Porter, and George Vigarello.³⁷ Like Emma Spary who, in her book *Eating the Enlightenment*, notices the increased consumption of luxuries such as coffee and sugar even among the lower classes, I am arguing that the bearing and movement considered exclusive to noble bodies came to be regarded as something that could be acquired by commoners. Even court dance was not limited to the upper echelon of society. Military commissions likewise became more open to capable members of non-noble classes over the course of the eighteenth century.³⁸

Ancien Régime France under Louis XV

France in the eighteenth century was one of the most populous, powerful, and prosperous countries in Europe. During the reign of Louis XV (1715-1774), France's population grew from 21.5 million to nearly 30 million.³⁹ Until the 1770s, France was the "world's leading industrial economy," according to Michel Delon, but wealth was increasingly concentrated in the upper classes.⁴⁰ French society had been organized into

³⁷ E. C Spary, *Eating the Enlightenment: Food and the Sciences in Paris* (Chicago: The University of Chicago Press, 2012); Roy Porter, *Flesh in the Age of Reason: The Modern Foundations of Body and Soul* (New York: W.W. Norton & Co., 2004), Alain Corbin, Jean-Jacques Courtine, and Georges Vigarello, *Histoire du corps* (Paris: Seuil, 2005). See also Georges Vigarello, "The Upward Training of the Body from the Age of Chivalry to Courtly Civility," in *Fragments for a History of the Human Body*, ed. Michel Feher, Ramona Naddaff, and Nadia Tazi (New York: Zone Books, 1989), 149–99; and Carol Houlihan Flynn, "Running Out of Matter: The Body and Exercise in Eighteenth-Century Fiction," in *The Language of Psyche: Mind and Body in the Enlightenment* (Los Angeles, CA: Clark Library, 1990), 147–85.

³⁸ This development so angered the traditional "nobles of the sword" that they lobbied successfully for the Ségur law of 1781 which limited military leadership to men with four generations of documented nobility.

³⁹ Gwynne Lewis, *France, 1715-1804: Power and the People* (New York: Pearson Longman, 2004), 147.

⁴⁰ Michel Delon, *Encyclopedia of the Enlightenment*, trans. Gwen Wells (New York: Routledge, 2013), 698. Although France's industrial infrastructure was not on par with that of Britain, its economy was larger overall.

three estates since the Middle Ages.⁴¹ The first estate consisted of the clergy (the higher positions entirely filled by members of the aristocracy). The second estate consisted of nobles divided by function into the military and civil branches of government: “nobles of the sword” and “nobles of the robe” respectively. The third estate included everyone else. Members of this lowest estate varied widely in terms of economic status, education, and political influence. The clergy and nobles (members of the first and second estates) were exempt from paying most taxes including the *corvée royale* (forced labor on roads), the salt tax (*gabelle*), and the *taille* (a direct tax on land). Meanwhile, in varying degrees, the third estate paid these taxes as well as tithes and seigniorial dues.

In *ancien régime* [old regime] France, as Norbert Elias has convincingly argued, social status and connections were more important than money.⁴² In an absolutist monarchical system such as that of eighteenth-century France, the king had considerable influence on the lives of his subjects. He had far-reaching authority to grant or sell government positions, issue monopolies on trade and manufacture, impose taxes (and award tax-farmer status), and approve publications and performances. Wealthier members of lower classes could and did purchase titles and government positions; however, these new nobles were often regarded with skepticism. The king even revoked these titles on occasion; the desire for a noble title was so great that those who had lost their titles often repurchased them if they were later reoffered for sale.⁴³ Noble status, and

⁴¹ The king was considered to be in a class outside the estates.

⁴² Norbert Elias, *The Court Society*, trans. Edmund Jephcott (New York: Pantheon Books, 1983), 81, 165, 168.

⁴³ Selling titles was an important source of revenue for the crown. Franklin Lewis Ford, *Robe and Sword: The Regrouping of the French Aristocracy after Louis XIV* (Cambridge, MA: Harvard University Press, 1962), 12-15.

the trappings of nobility – clothing, carriage, houses, and a physically fit graceful body – were highly valued.

Even though only the top 2% of the population could claim a place in the first or second estate, members of this small group were also strictly divided into various levels. In the French Catholic church, the upper clergy – bishops, archbishops, and directors of abbeys and convents – controlled much larger resources than those in provincial or lower positions; nobles at court commanded much more respect than those from the provinces. Louis XV reigned during a period many historians consider the pinnacle of French culture and influence.⁴⁴ The visual arts, fashion, and architecture flourished during this period. The craftsmanship of Louis XV furniture remains unparalleled. The performing arts and, indeed, the performance of science, flourished.⁴⁵ Courtiers constantly jockeyed for position, seeking the favor of the king. To be invited to go hunting with Louis XV at his retreat in Marly reflected the king's utmost trust and honor.⁴⁶ To enjoy this privilege, an aspiring courtier had first to be presented to the king in a formal ceremony. This required months of study and practice. It was such an important event, that Louis XV attended to requests for presentations even when he was on the battlefield.⁴⁷

⁴⁴ For example, Olivier Bernier, *Louis the Beloved: The Life of Louis XV* (Garden City, NY: Doubleday, 1984) and Guy Chaussinand-Nogaret, *The French Nobility in the Eighteenth Century: From Feudalism to Enlightenment* (Cambridge: Cambridge University Press, 1985).

⁴⁵ The historiography on arts during this period are justly vast. For the theatrical demonstrations of scientific experiment including electricity, anatomy, and astronomy see Geoffrey V. Sutton, *Science for a Polite Society: Gender, Culture, and the Demonstration of Enlightenment* (Boulder, CO: Westview Press, 1995); Anita Guerrini, *The Courtiers' Anatomists: Animals and Humans in Louis XIV's Paris* (University of Chicago Press, 2015); Robin E. Rider, *The Show of Science*, Series of Keepsakes Issued by the Friends of the Bancroft Library for Its Members, No. 31 (Berkeley: The Friends of the Bancroft Library, University of California, 1983), among others.

⁴⁶ John Adamson, *The Princely Courts of Europe: Ritual, Politics and Culture under the Ancien Régime, 1500-1750* (London: Weidenfeld & Nicolson, 1999), 76.

⁴⁷ Charles-Philippe d'Albert duc de Luynes, *Mémoires du duc de Luynes sur la Cour de Louis XV*, ed. L. Dussieux et Eud. Soulié, vol. 6 (Paris: Firmin-Didot frères, 1860), 13. Quoted in Bernier, *Louis the Beloved*, 125-26.

Rationalizing Nobility

While birth was the primary identifying marker of a noble person, the noble bearing, courtesy, and valor – skills and postures displayed in dance and at war – confirmed the *noblesse* of the person displaying them. These physical virtues had earlier been considered natural and divinely-ordained attributes of members of the noble class. Being able to bow, walk, and dance gracefully; projecting a commanding bearing; having a relaxed, confident and elegant seat on a horse – all of these seemingly innate qualities marked the person of noble blood.⁴⁸ To publish instructions for these practices, then, implied a radically different way of thinking about how one became a member of the noble class. One could buy a title, but to present oneself convincingly as noble, one also needed to physically play the part. Membership in the noble class required spending whatever was necessary to uphold the appearance of that rank, whether through acquiring the latest fashions in clothing, through the rental of housing in the best neighborhood, through the breeding of one's horses and decoration of one's carriage, or via regular attendance at the most exclusive social gatherings. One's rank was displayed on one's person and in all arenas of activity: this included one's posture and movement above all.

Applying reason to practices which had been associated exclusively with noble birth had unanticipated do-it-yourself implications for a growing class of elites who aspired to join the noble ranks during the eighteenth century. There was considerable social mobility during the eighteenth century, largely due to wealth from the West Indies

⁴⁸ Many fairy tales of the period played on this theme. In some versions of the classic *Beauty and the Beast*, for example, the beast cannot hide his nobility in spite of his grotesque physical appearance.

and other French colonies.⁴⁹ The development of movement notation systems paralleled the rise of an aspiring elite class that sought to attain the physical skills, posture, and poise that hitherto had been reserved for the aristocracy. Movement—as people danced with each other or moved together in military formations or rode horses in stylized patterns—informed relationships between people and their sense of social order. Regal dance and stylish riding had served to separate those of elite status from those below them. In the military, drill functioned to reinforce hierarchies. The military bearing of officers made distinctions in rank visible. Drill manuals and diagrams educated newly installed aristocratic officers and performed the existing social order as officers put their subordinates through their paces.⁵⁰

Embrace of French culture

During the Enlightenment, social elites throughout Europe and much of the rest of the world spoke a lingua franca, i.e. French, and emulated French culture, which included performing court dances. Likewise, French officers were admired for their sense of style and respected for their gallantry on the battlefield.⁵¹ Displays of wealth and power—processions, architecture, dress—that had served to separate the noble class from the rest of society became more available to a rising elite who sought not only the trappings of

⁴⁹ According to James E. McClellan, one in eight people in France derived wealth from the colonies, particularly Saint-Domingue, during the eighteenth century. James McClellan, *Colonialism and Science: Saint Domingue in the Old Regime* (Baltimore: Johns Hopkins University Press, 1992), 63.

⁵⁰ Boucher d'Argis, s.v. "Noblesse Militaire," *Encyclopédie*.

⁵¹ "The nobles of France never failed under Louis XIV to display, and lavishly, the reckless, wasteful courage which their whole tradition called forth." Franklin Lewis Ford, *Robe and Sword: The Regrouping of the French Aristocracy after Louis XIV* (Cambridge, MA: Harvard University Press, 1962), 17-18. However, as Julia Osman, points out, during the Seven Years War, "Pride, Prejudice and Prestige: French Officers in North America During the Seven Years' War, this proved detrimental to the French cause in the New World as French officers were not concerned with saving the colonies for France as much as they were concerned with behaving honorably in the face of defeat. Julia Osman, "Pride, Prejudice and Prestige: French Officers in North America During the Seven Years' War," in *The Seven Years' War: Global Views, History of Warfare* (Leiden: Brill, 2012), 192.

nobility but who also worked to present themselves as noble in body and person as well. Physical skills and posture of one's body served as proof of one's superior breeding. Indeed, so many people presented themselves as noble, the Chevalier de Jaucourt wrote an entry on "Noblesse, usurpateur de la" [Usurper of Nobility] for the *Encyclopédie*. He writes, that the government attempted to identify and fine these "usurpers," however, it proved to be impossible to punish false "nobles" without inconveniencing those of true noble blood.⁵²

Appearance served not only as a sign of one's place in society but as a link to the privileges and resources tied to that position. Since the king, with vast wealth and power, was able to bestow titles or rescue a failing noble family through an appointment or pension, it made sense to pay attention to one's appearance and to be noticed in a favorable manner. The maintenance of one's privilege and status depended on proving through one's pleasing manners and convincing look of opulence, even if that opulence was based on over-expenditure, was therefore of paramount importance. As Norbert Elias explains in *The Court Society*,

If one grows up in a society in which the possession of a title is rated higher than that of earned wealth, and in which membership of the royal court or even the privilege of access to the king's person . . . ranks exceptionally high on the scale of social values, it is difficult to escape the compulsion to base one's personal goals on these social values and norms and to join in the competition for such opportunities.⁵³

⁵² Chevalier de Jaucourt, "Noblesse," *Encyclopédie*, vol. 11, 181. There are over forty subentries under *noblesse* by various authors including "*Noblesse militaire*" [military nobility], "*Noblesse nouvelle*," [new nobility], "*Noblesse protégée*," [protected nobility which is doubtful], "*Noblesse de sang*," [nobility of the blood], and "*Noblesse spirituelle ou littéraire*," [spiritual or literary nobility, granted to men of letters].

⁵³ Norbert Elias, *The Court Society*, trans. Edmund Japhcott (New York: Pantheon Books, 1983), 75.

Studying the physical movements associated with noble behavior were one way to “join the competition,” as Elias remarked. Diagrams presented a key to some of the salient arenas of noble activity in the eighteenth century: dance and drill.

Understanding how movement diagrams worked reveals aspects of Enlightenment life that have been less well studied and suggests new ways of appreciating other kinds of diagrammatic representations and knowledge production.⁵⁴ Diagrams do not merely represent reality (although they may aim at this ideal); they can be deeply implicated in the knowledge-producing process itself. As Daston and Galison have argued, images as “working objects” have been key tools in analyzing and communicating scientific findings.⁵⁵ In the early modern period, these images were carefully shaped to reflect nature with aesthetic as well as ontological considerations in mind. Before the advent of mechanically “objective” representations, knowledge of the natural world was mediated not by the camera but by the artist’s hand carefully trained to standardize subjects and eliminate idiosyncrasies. My project examines how diagrammatic notations helped codify and standardize the movement of elite human bodies, whether these movements were those of the cultured dancer or the commander of a trained elite corps of soldiers marching in unison.

Visual notations have been a potent intermediary in the manipulation of spatial relationships, the correlation of unlike parts, and the juxtaposition of disparate and similar elements, leading to new ways of thinking. As Simon and Larkin argue in their seminal

⁵⁴ The Enlightenment has traditionally been a “great men” narrative. Dorinda Outram’s work has exposed numerous underappreciated sides to our picture of life in the Enlightenment, whether on the plight of slaves, the consequences of globalization, or coffee shops as sites of social gatherings. See Dorinda Outram, *The Enlightenment* (Cambridge: Cambridge University Press, 2005).

⁵⁵ Lorraine Daston and Peter Galison, “The Image of Objectivity,” *Representations*, no. 40 (1992): 81–128.

article, “Why a Diagram Is (Sometimes) Worth Ten Thousand Words,” diagrams present information in a way that makes possible connections and ideas that might not otherwise be perceived.⁵⁶ In notating moving bodies on the page, choreographers and drill masters combined both mental visualization and motor memory to communicate French courtly ideals beyond national and class boundaries. This project takes a closer look at this process and these practices to bring underappreciated aspects of the Enlightenment into sharper focus.

Outline of Chapters

The following chapters examine specific examples of diagrams as they existed in the eighteenth century. These diagrams, I argue, are key sources for the history of science. These images did not just supplement, illustrate, or bolster textual knowledge: I argue that they provided an alternative avenue to knowledge, specifically knowledge of the body and what bodies meant in an eighteenth-century context. Prompting insights that cannot be discerned through texts alone, this study of movement diagrams aims to offer insights into some of the unspoken assumptions of the period.⁵⁷

Chapter Two introduces diagrams as working objects. I argue that diagramming was a key activity of participants in what we call the Scientific Revolution and they called the “new sciences.” My work situates the development of analysis and abstraction – strategies key to the practice of science – in the kinds of diagrams produced in the seventeenth and eighteenth centuries. These developments occurred in uneven stages.

⁵⁶ Jill H. Larkin and Herbert A. Simon, “Why a Diagram Is (Sometimes) Worth Ten Thousand Words,” *COGSCI Cognitive Science* 11, no. 1 (1987): 98–99.

⁵⁷ James Elkins, *Visual Literacy* (Hoboken: Taylor and Francis, 2010); Barbara Maria Stafford, *Artful Science: Enlightenment, Entertainment, and the Eclipse of Visual Education* (Cambridge, Mass.: MIT Press, 1994); Drucker, *Graphesis*; Lester C. Olson, Cara A. Finnegan, and Diane S. Hope, eds. *Visual Rhetoric: A Reader in Communication and American Culture* (Los Angeles: Sage, 2008); Nicholas Mirzoeff, *The Visual Culture Reader* (London; New York: Routledge, 2002).

This chapter looks at images that exemplify moments when elements of diagramming emerged: in the distortion of visual perspective in the service of emphasizing certain ideas (as in Tycho Brahe's observatory), in the smoothing of details to facilitate classification (as in Reaumur's wood-boring bee), or in the jumble of details placed side-by-side to create new understandings (as in Jean Rou's charts of history). Diagrams universalize knowledge through the omission of details. The next two chapters consider how that move toward universalizing affected practices intimately associated with nobility: dance and drill. How did diagrams inscribe bodies on the page?

In Chapter Three, I discuss the difficulty of capturing movement on a static page. Early dance notations indicated steps or spatial movement but not both. The genius of what dance scholars call Beauchamp/Feuillet notation was the way it reduced nuanced and intricate steps and postures of court dance to clear, simple lines and dots and juxtaposed them with spatial patterns matched to musical notation. The new contredanses for groups of four couples, and the notation that mapped their spatial patterns, indicated changes in position but not steps. This contredanse notation was much more similar to military drill diagrams than the Beauchamp/Feuillet system. Like drill diagrams, contredanse notations mapped movement from a bird's eye view. They focused on groups moving together in complex patterns rather than emphasizing the stylized footwork of court dance.

Chapter Four looks first at humanist attempts to recreate ancient Greek and Roman military practice by depicting them in diagrams on the page. Even before the chaos of the Thirty Years' War (1618-1648), the northern Netherlands became a hotbed of innovation, including the application of geometry to fortress design and drill. This

chapter looks at two kinds of drill: pictures in a series taught the handling of weapons and maps with symbols depicted group formations on the field. These latter diagrams became ever more precise as movements were mapped geometrically. Translating action on the ground into images on the page or vice versa was never straightforward. This chapter also considers the ubiquity of drill in culture in an effort to understand some of the connections between dance and drill as movement practices.

To conclude in Chapter Five, I revisit the Enlightenment as an embodied as well as intellectual movement. In our current ever more digital experience of the world, what can we learn from Enlightenment ways of knowing? Further, how might embodied epistemologies – reconstruction of scientific experiments, dances, or drills – inform our understanding of the Enlightenment past? In this dissertation, I have examined some of the connections between modern science and the cultural contexts in which it developed. For many people, the philosophical tenets of the Enlightenment as they were articulated in the eighteenth century continue to inform intellectual inquiry. Taking a closer look at the cultural – and graphic – interfaces that informed the Enlightenment project will give us a more critical and multidimensional view of that historical period.

CHAPTER TWO

DIAGRAM: BODIES ON THE PAGE

Diagram, an illustrative figure which, without representing the exact appearance of an object, gives an outline or general scheme of it, so as to exhibit the shape and relations of its various parts.

“Diagram,” Oxford English Dictionary, 2018⁵⁸

It is said of the Socratic philosopher, Aristippus, so Vitruvius wrote in the preface to the sixth book of his De architectura, that being shipwrecked and cast on the shore of Rhodes and seeing there geometrical figures on the sand, he cried out to his companions, “Let us be of good hope, for indeed I see the traces of men.”

Clarence J. Glacken, *Traces on the Rhodian Shore*, 1967⁵⁹

Introduction: Diagrams and the New Sciences

Diagrams in the form of geometrical figures sketched on a beach signaled human civilization to shipwrecked Greek philosophers in Clarence Glacken’s classic account of nature and culture in Western thought.⁶⁰ There was something distinctly human about the creation of diagrams that delighted Aristippus (c. 435-356 BC) of Cyrene. It filled him with “good hope” that the island on which they were shipwrecked was civilized and that they would find food and shelter (see Figure 2.1).⁶¹ The traces in the sand that Aristippus discovered mapped problems in geometry, one of the earliest and most common uses of diagrams. Graphs and diagrams in mathematics, astronomy, and cartography can be

⁵⁸ “Diagram,” OED Online. June 2017. Oxford University Press. Accessed July 05, 2017.

⁵⁹ Vitruvius, *De Architectura*, vi, 1, quoted in Clarence J. Glacken, *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century* (Berkeley: University of California Press, 1967). Front matter. The image accompanying Glacken’s quote is from Euclid, edited by David Gregory, ed. *Opera* (Oxford, 1703).

⁶⁰ Clarence J. Glacken, *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century* (Berkeley: University of California Press, 1967).

⁶¹ This account is in Vitruvius Pollio, *Vitruvius: The Ten Books on Architecture*, trans. M. H. Morris Hicky Morgan (New York: Dover Publications, Dover, 1960), 167.

found at least as far back as ancient Greece and Rome.⁶² Diagrams and diagrammatic features formed important aspects of Renaissance images, particularly in mathematical, astrological, and alchemical contexts. By the eighteenth century, diagrams not only informed scientific developments in myriad areas of investigation, including taxonomy and natural history, geology, astronomy, chemistry, electricity, anatomy, and mechanics, but were also applied to social and cultural systems.

One finds the story of Aristippus discovering a diagram in the sand in a key text in Renaissance humanism: *De architectura* by Vitruvius, the first-century Roman architect and engineer. *De architectura* had been rediscovered by the indefatigable scholar Poggio Bracciolini (1380-1459) in 1414.⁶³ As Pamela Long has pointed out in *Artisan/practitioners and the rise of the new sciences, 1400-1600*, the interactions between scholars and artisans in the Renaissance fostered new approaches to the study of the natural world. For these investigators, pictures and diagrams were a way of communicating that did not require the long years of study in Latin that distinguished the scholar.⁶⁴ Drawing on the work of Edgar Zilsel, an early twentieth century socialist philosopher, Long points to a dynamic “trading zone” between artisan and scholar as a fertile ground that spawned what came to be known as the Scientific Revolution. While the notion of a sudden “revolution” in science has been contested, I find the term useful

⁶² For a discussion of diagrams in a Byzantine manuscript of Aristotle’s *Mechanics*, see Joyce van Leeuwen, “Thinking and Learning from Diagrams in the Aristotelian Mechanics,” *Nuncius: Journal of the History of Science* 29, no. 1 (June 2014): 53–87. For diagrams in ancient Greek mathematics, see Revell Netz, *The Shaping of Deduction in Greek Mathematics: a Study in Cognitive History* (Cambridge: Cambridge University Press, 1999) and Ken Saito, “A Preliminary Study in the Critical Assessment of Diagrams in Greek Mathematical Works,” *Sciamus*, 2006, 7: 81-144.

⁶³ However, for evidence that Vitruvius’ work was well known in Europe before Bracciolini’s discovery, see Carol Herselle Krinsky, “Seventy-Eight Vitruvius Manuscripts,” *Journal of the Warburg and Courtauld Institutes* 30 (1967): 36–70.

⁶⁴ Pamela O Long, *Artisan/Practitioners and the Rise of the New Sciences, 1400-1600* (Corvallis, OR: Oregon State University Press, 2011), 65.

to describe the “new sciences,” as they were called at the time.⁶⁵ These new sciences emerged as the deep veneration for books and ancient learning that had marked earlier modes of inquiry came to be regarded as insufficient for understanding a rapidly changing world in an age of global travel. Long describes the new sciences as encompassing

a variety of empirical approaches...an appreciation for the knowledge acquired by hands-on manipulation and the use of instruments; the practices of direct observation and experimentation; methods of precise measurement and other forms of quantification; and a positive valuation of individual experience.⁶⁶

The Scientific Revolution can also be viewed as a movement not only towards an increased interest in empirically-verified knowledge, but also as a movement to visualize that knowledge. As Bruno Latour has argued, the birth of modern science was due *not* to a change in human intellectual capacity but rather to “simple modifications in the way in which groups of people argue(d) with one another using paper, signs, prints and diagrams.”⁶⁷ With the advent of the printing press at the end of the fifteenth century, printed images of all kinds proliferated as a mode of knowledge-making and representation in early modern Europe.

⁶⁵ For the debate around the use of the term “revolution,” see Steven Shapin, *The Scientific Revolution* (Chicago: University of Chicago Press, 1996), Thomas S Kuhn, *The Structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1962), and I. Bernard Cohen, “The Eighteenth-Century Origins of the Concept of Scientific Revolution,” *Journal of the History of Ideas* 37, no. 2 (1976): 257–88. See also H. Floris Cohen, *The Scientific Revolution: A Historiographical Inquiry* (Chicago: University of Chicago Press, 1994), Margaret C. Jacob, *The Scientific Revolution: A Brief History with Documents* (Boston: Bedford/St. Martin’s, 2009), David Wootton, *The Invention of Science: A New History of the Scientific Revolution* (New York: Harper, 2015), and Lisa Jardine, *Ingenious Pursuits: Building the Scientific Revolution* (London: Abacus, 2000).

⁶⁶ Pamela O Long, *Artisan/Practitioners and the Rise of the New Sciences, 1400-1600* (Corvallis, OR: Oregon State University Press, 2011), 3.

⁶⁷ Bruno Latour, “Visualization and Cognition: Drawing Things Together,” in *Knowledge and Society Studies in the Sociology of Culture Past and Present*, ed. H. Kuklick, vol. 6 (New York: Jai Press, 1985), 3. Indeed, as will be discussed further, many historians have placed the beginnings of modern science in the seventeenth century with a “scientific revolution” extending into the eighteenth century.

Diagrams, for the purposes of this project, are abstract visual representations of data. I am using the term *text* to refer to words, letters, and sentences on a page. I am defining *pictures* as visual representations that aim to mimic what one sees in a realistic, rather than idealistic, way. Diagrams, in contrast, are abstract representations. They use lines, points, and geometric shapes to simplify and organize information on the page. One might include pictorial elements along with a diagram, which might not be as easily “read” as a picture. These hybrid images, incorporating both pictorial and diagrammatic elements, are especially interesting in what they reveal about the development of diagrammatic ways of visualizing and thinking. These ways of thinking were characteristic of the new sciences.

The *Vitruvian Man* by Leonardo da Vinci (1452-1519) (see Figure 2.2) serves as a point of departure for this chapter. His iconic depiction of the human body “diagrammed,” a hybrid image incorporating both picture and diagram, was inspired by a passage in Vitruvius’s *De architectura* which described the body according to principles of geometry:

For the human body is so designed by nature that the face, from the chin to the top of the forehead and the lowest roots of the hair, is a tenth part of the whole height; the open hand from the wrist to the tip of the middle finger is just the same; the head from the chin to the crown is an eighth, and with the neck and shoulder from the top of the breast to the to the lowest roots of the hair is a sixth; from the middle of the breast to the summit of the crown is a fourth....Similarly, in the members of a temple there ought to be the greatest harmony in the symmetrical relations of the different parts to the general magnitude of the whole.⁶⁸

⁶⁸ Vitruvius, trans. M. H. Morgan, *Vitruvius: The Ten Books on Architecture* (New York: Dover Publications, 1960), 72-3.

This description of the idealized human body is found in Vitruvius' discussion of building temples.⁶⁹ Temples are earthly spaces linking humans to the realm of the gods. Similarly, Renaissance humanists such as Leonardo viewed noble bodies as intermediaries between heaven and earth. Dance historian Catherine Turocy discusses Pythagorean cosmology and theory as a model for the noble body: "a circle represents the spiritual realm and a square represents material existence. Thus, in Leonardo's image, the human body represented the perfect marriage of spirit and matter."⁷⁰

Diagrams communicate this sort of conceptual message well. They do not mimic normal vision: one does not normally *see* a circle and square surrounding a noble body.⁷¹ Nevertheless, the message of nobility can be clearly read in the body whose well-formed dimensions are confirmed by the surrounding diagram. Diagrams may direct attention to the most important elements of the concept, object, or action being contemplated, while omitting elements the designer of a diagram considers extraneous. In the case of the "Vitruvian Man," the most important elements are the signposting of cosmic embodiment represented by the circle and square.⁷² Setting the "Vitruvian Man" within an abstract geometric context expressed this heaven/earth connection as a scientific, mathematical concept rather than an astrological or religious one.

⁶⁹ Leonardo depicts the ideal noble body here as male; however, Renaissance descriptions of embodied nobility encompassed both male and female.

⁷⁰ Catherine Turocy, "Vitruvian Man, Baroque Dance, and Fractals," *Early Music America* 18, no. 4 (Winter 2012): 26–31, 60.

⁷¹ The nobility of Leonardo's Vitruvian Man was a product of perfect mathematical proportions which were a mark of virtue rather than of noble birth. Inscribed on the back of an early painting by Leonardo (of Ginevra de' Benci) is the saying, "form adorns virtue." It was believed that appearance reflected one's inner character. In the neoplatonic world view, dance "unites the beauty of the soul and that of the body." Günter Berghaus, "Neoplatonic and Pythagorean Notions of World Harmony and Unity and Their Influence on Renaissance Dance Theory," *Dance Research* 10, no. 2 (1992): 62. See also Nesca A. Robb, *Neoplatonism of the Italian Renaissance* (New York: Octagon Books, 1968).

⁷² Jennifer Nevile, *The Eloquent Body: Dance and Humanist Culture in Fifteenth-Century Italy* (Bloomington, IN: Indiana University Press, 2004), 129.

Based on his own experience and observations, Leonardo had, in one of his notebooks, rewritten Vitruvius' passage on the human body to reflect his own findings.⁷³ In place of Vitruvius' notes that "the length of the foot is one sixth of the height of the body," Leonardo wrote that "the foot, from where it is attached to the leg to the tip of the great toe, is as long as the space between the upper part of the chin and the roots of the hair *ab*, and equal to five sixths of the face."⁷⁴ Leonardo came to this conclusion after careful study of the body both at rest and in motion. In another passage, he noted, "Man is a model of the world."⁷⁵ Thus, his study of the human body and its ideal proportions had ramifications beyond an exercise in representation and justified his careful attention to precise measurements. Portrayals of the human body were potent images in which could be read the entire cosmos, according to the architect and artist Francesco di Giorgio Martini (1439–1501). In his manuscript, *Trattato di architettura, ingegneria e arte militare*, Martini proclaimed, "All the arts and all rules are derived from a well-composed and proportioned human body."⁷⁶ In his treatise, Martini included diagrammatic plans for churches overlaid with a human figure, images that may also have inspired Leonardo, who had met Martini in 1490.⁷⁷

Two years after Leonardo's death, an Italian translation of Vitruvius' *De architectura* was published by Cesare Cesariano (1475-1543). Unlike the earlier manuscript recovered by Bracciolini, this edition was lavishly illustrated with pictures

⁷³ Toby Lester, *Da Vinci's Ghost: Genius, Obsession, and How Leonardo Created the World in His Own Image* (New York: Simon and Schuster, 2012), 190-193.

⁷⁴ Lester, *Da Vinci's Ghost*, 192. See also discussion in Kenneth D. Keele, *Leonardo Da Vinci's Elements of the Science of Man* (Cambridge MA: Academic Press, 2014), 251-52.

⁷⁵ Lester, *Da Vinci's Ghost*, frontispiece.

⁷⁶ Lester, *Da Vinci's Ghost*, 7-10.

⁷⁷ Lester, *Da Vinci's Ghost*, 199.

and/or diagrams on nearly every page.⁷⁸ In this 1521 edition, one finds two more examples of a “Vitruvian man.” These are not as well-proportioned as the one by Leonardo, but they do speak to a continued interest in the diagrammed body. Cesariano’s visual realizations of Vitruvius’ writings marked the rise of a visual culture facilitated by the invention of the printing press in the preceding century.

Diagrams come in myriad manifestations. I have defined diagrams as a subcategory under “image,” which I am defining as any visualization, whether in material or nonmaterial form, i.e. an idea in one’s head.⁷⁹ In the next section, I will discuss the role of images in the Scientific Revolution writ large. I then compare diagrams to other kinds of inscriptions such as pictures and texts to further define how diagrams differ from other kinds of images, as well as how different visual elements (such as pictures and textual material) may be combined or presented in a diagrammatic manner. All of these graphic visualizations fall under the overarching category of images. In my analysis, I have identified a number of things diagrams *do*: simplify, juxtapose, and standardize. They lend precision to the study of objects and, in my research, to the movement of people.

The development of one-point perspective, along with the *camera obscura*, had revolutionized possibilities for realistic pictorial representation in the fifteenth century.⁸⁰

In place of flattened representations of people, animals, and places, characteristic of the

⁷⁸ Marcus Vitruvius Pollio, *De architectura* (1521), trans. Cesare Cesariano, Facsimile edition, London: B. Blom, 1968.

⁷⁹ In this, I differ from W. J. T. Mitchell, who defines a picture as a material object and an image as the visualisation on which it is based. I am defining picture more narrowly. See W. J. T. Mitchell, “Four Fundamental Concepts of Image Science,” in *Visual Literacy* (New York: Routledge, 2010), 16.

⁸⁰ For overviews on the development of perspective, see Samuel Y. Edgerton’s classic, *The Renaissance Rediscovery of Linear Perspective* (Oxford: Oxford University Press, 1975). See also Kirsti Andersen, *The Geometry of an Art: The History of the Mathematical Theory of Perspective from Alberti to Monge* (New York: Springer, 2007).

Middle Ages (c. 800-1200), Renaissance artists applied rules of one-point perspective to draw and paint scenes on flat surfaces that mimicked the depth of a three-dimensional world. In one-point perspective, a picture is created as it would be viewed by the eyes of one person. Often, a diagram, in the form of lines drawn between the subject and object(s) viewed, would make perspective explicit for the viewer of a drawing demonstrating perspective (see Figure 2.3). Manuals on how to draw often included such diagrams as heuristic aids, and indeed, still do. By the seventeenth century, close attention to realistic representations of objects mirrored a heightened interest in empirical investigations. Svetlana Alpers has argued that this was particularly true in the Netherlands where Dutch painting of the seventeenth century diverged radically from Italian Renaissance painting.⁸¹ The Italian school drew heavily on textual references, allegories, and biblical stories in their pursuit of art. Italians used realistic perspective in the service of painting moral lessons in the most convincing way possible.⁸² Dutch painting, in contrast, aimed for realistic representations of the material world, to celebrate the colors and textures of everyday objects, portrayed as they appeared to the human eye. These paintings featured scenes from everyday life rather than imagined scenes from the Bible. In short, Dutch painting reflected the principle of empiricism – knowledge derived from the senses – so key to the Scientific Revolution.

However, it was not only the production of more realistic images made possible by the use of one-point perspective that characterized the Scientific Revolution. The “new sciences,” according to David Wootton, employed “a fresh language: discovery,

⁸¹ Svetlana Alpers, *The Art of Describing: Dutch Art in the Seventeenth Century* (Chicago: University of Chicago Press, 1983).

⁸² Samuel Y. Edgerton, *The Renaissance Rediscovery of Linear Perspective* (New York: Basic Books, 1975), 164.

progress, fact, experiment, hypothesis, theory, laws of nature.” These terms and the concepts they represented “became tools to think scientifically.”⁸³ A scientific approach, on the Baconian model, was analytical, based on empirical evidence rather than revelation, and was communicated in such a way that the results of one’s analysis could be replicated and verified. Historian Francesco Panese notes that Francis Bacon (1561-1626) sought first to assemble an “archive of nature” to collect and organize nature’s laws, which Bacon called “forms.”⁸⁴ These forms were then to be translated into images. This was a project other naturalists tackled with varying success. Images were notoriously untrustworthy: Pliny had advised not trusting images at all. However, naturalists, including Ulisse Aldrovandi (1522-1605) and Conrad Gesner (1516-1565), recognized the value of images and advocated a collective enterprise for comparing and correcting images.⁸⁵ In his essay, Panese continues, “one way of considering the invention of modern science is as a transformation of our way of looking.”⁸⁶ Bruno Latour further develops the importance of perspective, noting that “in a linear perspective, no matter from what distance and angle an object is seen, it is always possible to transfer it – to translate it – and to obtain the same object at a different size as seen from another position.”⁸⁷ From this observation, Latour developed his notion of “immutable mobiles,” those universal objects and ideas that form the foundation of

⁸³ David Wootton, *The Invention of Science: A New History of the Scientific Revolution* (New York: Harper, 2015), back cover.

⁸⁴ Francesco Panese, “The Accursed Part of Scientific Iconography,” in *Visual Cultures of Science: Rethinking Representational Practices in Knowledge Building and Science Communication*, ed. Luc Pauwels (Hanover, NH: Dartmouth College Press, University Press of New England, 2006), 63–89, see 63.

⁸⁵ Paula Findlen, “Natural History,” in *Early Modern Science*, ed. Lorraine Daston and Katharine Park, vol. 3, *The Cambridge History of Science* (Cambridge: Cambridge University Press, 2006), 435–68, see 458.

⁸⁶ Panese, “The Accursed Part of Scientific Iconography,” 64.

⁸⁷ Bruno Latour, “Visualization and Cognition: Drawing Things Together,” in *Knowledge and Society Studies in the Sociology of Culture Past and Present*, ed. H. Kuklick, vol. 6 (Jai Press, 1985), 7.

Western science. He concludes, “The rationalization that took place during the so-called ‘scientific revolution’ is not of the mind, of the eye, of philosophy, but of the *sight*.”⁸⁸

Nevertheless, the world that science now helps us visualize is a multi-perspectival, diagrammatic correlation of often disparate parts, not necessarily dependent on human senses. Empiricism fostered the visual languages of the Scientific Revolution, but the abstraction possible in a diagram also lent itself to the scientific imagination.

René Descartes (1596-1650) spoke to the value of diagrammatic images as cognitive tools when he wrote, “thus it often happens that in order to be more perfect as an image and to represent an object better, an engraving ought not to resemble it.”⁸⁹ According to Descartes, the point of an image is not to depict an object exactly the way it *looks* to the human eye, but rather to represent it more effectively.⁹⁰ For example, in Descartes’ illustration of a woman moving her finger to point to an arrow, he situates a diagram of her sight-lines inside a pictorial outline of her body (see Figure 2.4). This is not a realistic view – even her eyes are placed sideways to show how each sees the arrow from a slightly different angle – but it illuminates how the image of the arrow reaches the gland inside her brain. Descartes continues,

It is enough that the image resembles its object in a few respects... You can see this in the case of engravings: consisting only of a little ink placed here and there on a piece of paper, they represent to us forests, town, people, and even battles and storms; and although they make us think of countless different qualities in these objects, it is only in respect of shape that there is any real resemblance.⁹¹

⁸⁸ Latour, “Visualization and Cognition: Drawing Things Together,” 7.

⁸⁹ René Descartes, “Discourse Four,” Chapter 7, “Optics” (1637) in Nicholas Mirzoeff, *The Visual Culture Reader*, 2nd ed. (London ; New York: Routledge, 2002), 120.

⁹⁰ Ibid.

⁹¹ Ibid.

Descartes' point is relevant to the diagrams I have researched as well as to the many distinctive hybrid images he included in his publications.⁹² The diagram is not the dancer nor the marching soldier, but it conveys information to evoke an image of these figures and their movement for the viewer who understands the diagrammatic language being used.

An engraving from the end of the seventeenth century illustrates an increased fascination with diagrams as uniquely suited to the study of the sciences and fine arts. "L'Academie des Sciences et des Beaux Arts," by Sébastien Leclerc (1637-1714) imagines a French Academy for the sciences and the fine arts including disciplines such as Mathematics, Music, Astronomy, Architecture, Cartography, Natural History, and Literature (see Figure 2.5).⁹³ The scene is reminiscent of Raphael's c. 1510 "School of Athens" with its many toga-clad philosophers and the stately columned forum. Leclerc's version, however, reveals a shift in intellectual inquiry: his one hundred and sixty or so philosophers, still toga-clad, are not poised for disputations but rather are poring over diagrams.⁹⁴ There are diagrams everywhere: Leclerc's scene is crowded with geometric figures, sketches of eclipses, and charts. An enormous rendition of a star fort is laid out over a table, huge easels propped against a wall display diagrams of pendulums. Another

⁹² See Melissa Lo, "The Picture Multiple: Figuring, Thinking, and Knowing in Descartes's *Essais* (1637)," *Journal of the History of Ideas* 78, no. 3 July (2017): 369–399.

⁹³ Maxime Préaud calls this one of Leclerc's chefs-d'oeuvre, a "sumptuous and complex" masterpiece completed towards the end of Leclerc's life. Maxime Préaud, "L'Académie Des Sciences et Des Beaux-Arts: Le Testament Graphique de Sébastien Leclerc," *Canadian Art Review* 10, no. 1 (1983): 73–81. Although it measured a mere 10 x 15 inches, it pictured approximately one hundred and sixty distinct people.

⁹⁴ Maxime Préaud notes other differences between Raphael's version and Leclerc's rendition. For example, Préaud observes that in Leclerc's version, the some one hundred and sixty figures are anonymous, whereas in Raphael's school the figures are identifiable as philosophers including Plato and Aristotle. Préaud argues that Leclerc's engraving is a reflection of Leclerc's deep interest in the sciences and arts, a sort of "autoportrait allégorique." I do not necessarily disagree, however, it is the graphic depiction of diagrams, as well as the instruments which Préaud also notes, that most interest me. Préaud, "L'Académie Des Sciences et Des Beaux-Arts," 73–81..

easel in an alcove exhibits a diagram of Aristotle's spiral. Several globes – three-dimensional diagrams – are also pictured while tools for all sorts of measuring and drawing are being employed or simply piled in a big heap in the foreground. The plethora of instruments and diagrams declare the coming eighteenth century to be one of quantification – and diagrams.⁹⁵

Hybrid Images: Text, Picture, Diagram

Early modern exploration prompted the proliferation of maps, a form of diagram essential to military operations and also instrumental in European court spectacle and dance. Innovations in cartography and other forms of visual representation addressed systems of measuring and calculating space, whether of land, sea, or the heavens.⁹⁶ In fields as diverse as surveying, astronomy, navigation, and map-making, new theories of measurement revolutionized European approaches to the physical world. Rosenberg and Grafton emphasize the importance of this increased interest in cartography stating, “by the seventeenth century, the map had become a key symbol not only of the power of monarchs but of the power of knowledge itself.”⁹⁷ A map is a graphic abstraction and simplification of a natural or built landscape (or seascape or the cosmos). Depending on the map, it may include geological features, political boundaries, roads, cities, and landmarks. Early maps included areas marked “terra incognita” or decorated with pictures of monsters or mermaids to designate parts of the world that were yet unknown.

By the eighteenth century, much of the physical earth had been mapped to scale. Maps

⁹⁵ Tore Frängsmyr, J. L. Heilbron, and Robin E. Rider, eds., *The Quantifying Spirit in the 18th Century*, Uppsala Studies in History of Science (Berkeley: University of California Press, 1990), is a prime example.

⁹⁶ David Buisseret, *The Mapmaker's Quest: Depicting New Worlds in Renaissance Europe* (Oxford: Oxford University Press, 2003), 1. Buisseret points out that there were few maps in Europe in 1400, but by 1650, maps were numerous and varied.

⁹⁷ Daniel Rosenberg and Anthony Grafton, *Cartographies of Time: A History of the Timeline* (New York: Princeton Architectural Press, 2010), 17.

could also be used to visualize unseen forces. Benjamin Franklin's mapping of the Atlantic current, for example, visually clarified why it was much faster to sail from America to Britain rather than the other way around (see Figure 2.6). Franklin's map included pictorial elements to make clear the preferred direction of travel – pictures of small sailing ships pointed the way. Such pictorial elements illuminated many early modern diagrams.

Pictures themselves could also be arranged in a diagrammatic way, drawing on the underlying principles and aesthetics of diagrams but comprised entirely of somewhat realistic pictorial elements. For example, in an undated engraving of the observatory belonging to the Danish astronomer Tycho Brahe (1546-1601), Brahe's instruments are depicted larger than life to emphasize the importance of precise measurements to his work (see Figure 2.7). The curve of his mural quadrant, described by Brahe as just under 2 meters long, sweeps across the entire page.⁹⁸ Tycho seated in the center of the image pointing to the sky while assistants around the edges of the image (left to right) take notes, watch clocks, or peer through a slit in the quadrant to make observations. This is a diagrammatic picture. The various elements are labeled alphabetically to identify people and objects geometrically on the page (for example the assistant on the right is under the "F" while the quadrant is said to be attached to the wall at "MPO"). There is a picture of a picture on the far wall: in this mural, one can see other assistants using other instruments belonging to Tycho or recording observations. This image works iconographically as each object or person portrayed stands for an idea. It conveys

⁹⁸ Tycho Brahe, *Astronomiæ instauratæ Mechanica*, Section 5: Quadrans Muralis Sive Tichonicus [The Mural, or Tychonian, Quadrant], Description and Use of the instrument (Wandsbek, 1598). Published online by the Royal Danish Library http://www.kb.dk/en/nb/tema/webudstillinger/brahe_mechanica/brahe_fsi.html?page=20 Accessed February 28, 2018.

information about Tycho's observatory without adhering to a one-point perspective; this is not the view of a person passing by the observatory buildings but rather an abstracted view of the work conducted within them.⁹⁹ The elements are realistic pictorial depictions but they are arranged in an unrealistic diagrammatic way: Tycho's favorite dog lying on the floor is included even though he was deceased, because he is "a symbol not only of his noble race but also of sagacity and fidelity."¹⁰⁰ The lower half of assistant F is missing in this image because it is not important for the viewer to see what he is standing on. The juxtaposition of instruments and people, in a room smaller than actual size, again works to draw attention to the accuracy of the astronomer's empirical observations and the work that has gone in to the making of them.¹⁰¹

Diagrams and diagrammatic pictures are iconic. In contrast, text is a symbolic visualization.¹⁰² An icon represents an object, person, or idea without mimicking its appearance. In symbolic forms of communication like text, the relationship between the shapes on the page that form letters is arbitrary. There is nothing about the letter "A" that

⁹⁹ Joan Blaeu, *Geographia*, vol. 1 (Amsterdam, 1662). See also Grafton, op cite, 246.

¹⁰⁰ This Tycho explains in the accompanying text. Brahe, *Astronomiæ instauratæ Mechanica*, op cite.

¹⁰¹ Tycho Brahe, like many early modern natural philosophers, often included diagrams in his notes. The alert reader will notice a plethora of such marginalia in various stages of development in the notebooks of figures such as Galileo Galilei (1564-1642), Giovanni Alfonso Borelli (1609-1679), René Descartes (1596-1650), and Isaac Newton (1642-1727). These quick sketches litter the pages of journals, letters, and personal papers of sixteenth and seventeenth century luminaries in the "new sciences," as they were called. These graphic visualizations were often considered important enough by their authors to have been included in their published treatises, but in nineteenth century editions of their works, the diagrams often were deleted. For example, Melissa Lo has studied the nineteenth century editions of Descartes' work, noting the absence of the diagrams that figure prominently in Descartes publications. Paper presented at "Tools of Reason," conference, Stanford University, February 2017. A survey of these diagrammatic sketches is beyond the scope of this current work but their utility in the turn towards empiricism that marked the Scientific Revolution deserves further study.

¹⁰² However, see Scott McCloud, *Understanding Comics: The Invisible Art* (New York: William Morrow/HarperCollins, 1993), 46–49. McCloud argues that picture and text can be conceptualized on a continuum, text being an extreme case of abstraction. See also discussion of icons pp. 26-28. Furthermore, some theorists refer to a third category of the indexical, in which there's a causal/pointer relationship between the signifier and the signified (e.g. smoke signifying fire). I have not used this concept in my analysis.

indicates the sounds it represents, or gives a clue to its role as a vowel in languages based on the Latin alphabet, nor its place at the beginning of the string of letters that make up that alphabet. The lines that make up the legs and point of an “A” are not intrinsic to its making of meaning. An “A” can be written as “a” without a loss of its function in communication. In a diagram, the placing of lines and other iconographic shapes indicate movement, space, or details that have been omitted depending on the diagram.¹⁰³ In a diagram, a line can stand for a path of motion, shorthand for a foot, or a length of time. While the arrangement of letters in a text refers only to the ideas conveyed by the words formed, the diagrammatic placement of text on the page can have implications for how that text is read.

In sixteenth-century Paris, Petrus Ramus (1515-1572), a Huguenot humanist, philosopher, and educator, promoted innovations in the layout of text on the page as a way to facilitate instruction. These graphic innovations in the form of “Ramist brackets” reflected a radical philosophical approach to knowledge against the entrenched scholasticism of medieval universities (see Figure 2.8).¹⁰⁴ In contrast to the oral dialectical teaching model of Aristotle that had been traditional in European universities throughout the Middle Ages, Ramus argued for the value of print as a way of organizing knowledge and as a heuristic tool.¹⁰⁵ Organizing text on the page using brackets to contain and correlate information in tabular form made it easier to read. The result was

¹⁰³ Letter shapes may also appear in a diagram but their function is usually to label elements of the diagram.

¹⁰⁴ See discussion of branching diagrams in Ann Blair, *Too Much to Know : Managing Scholarly Information Before the Modern Age* (New Haven: Yale University Press, 2010), 144–52.

¹⁰⁵ Walter Ong has argued for the significance of this development in *Ramus, Method, and the Decay of Dialogue: From the Art of Discourse to the Art of Reason* (Cambridge: Harvard University Press, 1958), 79, 203.

more than a heuristic device; this way of displaying information also changed how philosophers thought about knowledge itself. Ramus' innovation was to take what had been an aural tradition – Aristotelian discourse – and transform it into chunks of information on a page. This approach shifted knowledge production from a linear back and forth dialogue in speech to visual idea-units which could then be connected and combined in any number of ways. Walter Ong explains the implications of this change in pedagogy:

The Ramist arts of discourse are monologue arts. [In the end, they] tend finally even to lose the sense of monologue in pure diagrammatics. This orientation is very profound and of a piece with the orientation of Ramism toward an object world (associated with visual perception) rather than toward a person world (associated with voice and auditory perception).¹⁰⁶

Ramus, in effect, lays a foundation for the new sciences by reinforcing the value of individual empiricist observations which could be inscribed, distributed, and checked repeatedly. Units of information, such as those found in encyclopedia entries, could be cross-referenced, creating a web of knowledge, an argument made in spatial form. The layout of the *Encyclopédie*, particularly D'Alembert's tree of knowledge in his "Prospectus" (see Figure 2.9), owed much of its organizing logic to this earlier work of Ramus.

Elizabeth Tebeaux traces instruction manuals and technical writing to Ramist conventions. She claims that the simplified, diagrammatic presentation of text on the page was made necessary by the semi-literacy of an expanded reading public. As Michael Moran explains in his preface to Tebeaux's study, early books presented information in

¹⁰⁶ Walter J. Ong, *Ramus, Method, and the Decay of Dialogue: From the Art of Discourse to the Art of Reason* (Cambridge: Harvard University Press, 1958), 287.

“undifferentiated, dense prose that was difficult to read quickly.”¹⁰⁷ Therefore, even early on, printers and authors tried to make how-to books easier to read by arranging text on the page in order to present information in a visually appealing way. They looked to Ramist brackets as a model. This print style also tended to make the information reported seem more objective. Rather than being associated with a person speaking, information came packaged on a page. These diagrammed texts were strategically placed on the page for ease of reading.

Simplification: Toward Making Science Universal

One of the more obvious ways that diagrams shape information about the world is that, like many other visual images, a diagram is a translation from a three dimensional world onto a two-dimensional page. While a 1570 edition of Euclid’s *The Elements of Geometrie* included glued-in paper shapes to make pop-up tetrahedrons and other three-dimensional figures, most diagrams, certainly in the eighteenth century and earlier, were written or printed on two-dimensional paper.¹⁰⁸ Edward Tufte, the noted author of numerous volumes on graphic design, sums up the difficulty of translating three dimensions into two when he exclaims, “The world is complex, dynamic, multidimensional; the paper is static, flat. How are we to represent the rich visual world of experience and measurement on mere flatland?”¹⁰⁹ This question cuts to the heart of the history of science. Scientific representations of the world are not the world itself, yet science aims to reflect that world as objectively as possible. Diagrams are often used in

¹⁰⁷ Michael G. Moran, Preface to Elizabeth Tebeaux, *The Emergence of a Tradition: Technical Writing in the English Renaissance, 1475-1640* (Amityville, NY: Baywood Publishing Company, 1997), iv.

¹⁰⁸ E. R. Tufte, *Envisioning Information* (Cheshire, CT: Graphics Press, 1992), 16.

¹⁰⁹ Ibid., 9.

science to anchor the objective, rational, abstract thought that characterizes scientific practice.

According to Lorraine Daston and Peter Galison, eighteenth-century naturalists favored visual images manipulated to depict the salient features of the most perfect specimen representative of all other specimens of that kind.¹¹⁰ This simplification necessitated value judgments – or the eye of “genius” as many of these naturalists would proclaim – to figure out which details should be omitted or smoothed over. The prominent French naturalist Georges Louis Leclerc de Buffon (1707-1788), for example, wrote

a single character happily discovered, is more decisive, and conveys more knowledge of the subject, than a thousand minute and trifling features; for in proportion to their number, they necessarily become equivocal and common, and, of course, superfluous, if not hurtful to the real knowledge of Nature, who sports with the rules we prescribe to her, soars above all methodical distributions, and can only be perceived by the penetrating eye of genius.¹¹¹

Naturalists understood these decisions to be a critical aspect of their work as Daston and Galison explain:

Collectively, eighteenth-century atlas makers created a way of seeing, one that saw past the surfaces of plants, bones, or crystals to underlying forms. The choice of images that best represented “what truly is” engaged scientific atlas makers in ontological and aesthetic judgments that mechanical objectivity later forbade.¹¹²

¹¹⁰ I suggest the term “True-to-Type” (rather than “Truth-to-Nature” as used by Daston and Galison) as a way to describe this eighteenth-century diagrammatic proclivity for standardizing images to better portray the essence of an object. See Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007), 58, 88. Daston and Galison have been criticized for over-simplifying stages in visual scientific cognition and for their heavy reliance on images in atlases to the exclusion of other sources. See Nick Jardine, Review of *Objectivity*, *The British Journal for the Philosophy of Science* 63, no. 4 (2012): 885–93; John V. Pickstone, “The Disunities of Representation,” *The British Journal for the History of Science* 42, no. 4 (2009): 595–600; and Theodore M. Porter, “The Objective Self,” *Victorian Studies* 50, no. 4 (2008): 641–47, for a sample of the many reviews of this work.

¹¹¹ Georges Louis Leclerc de Buffon, *Histoire Naturelle, Générale et Particulière, Avec La Description Du Cabinet Du Roy* (Paris: L’Imprimerie royale, 1749), 7:122.

¹¹² *Ibid.*, 60.

While such images often included elements that were pictorial, i.e. that appeared realistic, looking more closely, one can see that the emphasis is on the underlying structure. Such an image is more diagrammatic than pictorial. What is represented is a particular approach to an object rather than the realistic appearance of that object. Determining which underlying feature or form to use as the determining feature was a matter of debate and negotiation.

The visualizations of the taxonomist Carl Linnaeus (1707-1778) in his 1737 publication *Hortus Cliffortianus* demonstrate the advantages of displaying only the most important features of a plant to better identify a natural object (see Figure 2.10). Linnaeus includes a page of sixty-two different leaf shapes, with most of them depicted only in outline.¹¹³ The leaf shapes are lined up in seven and a half rows with five to nine leaf shapes in each row. These leaves would have grown in widely differing sizes, both within a particular tree and among different species, but for the sake of uniformity, they are presented graphically as if they were all approximately the same size. This makes comparison easier but it is a simplification that did not pictorially reflect the appearance of these leaves in nature. The argument Linnaeus makes through the visual medium of this chart was that morphology, specifically leaf shape, was useful in the identification of plants. In his view, traits such as the size, color, smell, or texture of a leaf were not the important features for identification. Similarly, in Linnaeus' classification system, he chose sexual organs of plants as the key to placing them in his taxonomy. These too could be diagrammed. In her biography of the Swedish naturalist, *Linnaeus: Nature and Nation*, Lisbet Koerner traces the increasing influence throughout Europe (and

¹¹³ A few leaves are depicted with shading to indicate depth but this shading is only included for those leaves which could not be distinguished from other leaves without this additional visual information.

eventually, the world) of Linnaeus' taxonomic system.¹¹⁴ This simplified, standardized system made it possible for numerous "apostles" to join his quest to catalog all of nature.¹¹⁵

The "Geometrized Bee," as Daston and Galison call it, is another example of a diagrammatic image (see Figure 2.11), this time of a standardized bee specimen. This bee appears among other drawings of wood-boring bees in plate 5 in the *Mémoires pour servir à l'histoire des insectes* by René-Antoine Ferchault de Réaumur (1683-1757). In this image, one finds a close up of a head and proboscis somewhat dissected. The parts of this bee are abstracted from its body and each part is labeled with letters. In keeping with the epistemic virtue of what Daston and Galison call "Truth-to-Nature," Réaumur here presents a specimen part more perfect than that of a bee found in nature.¹¹⁶ Mary Terrall notes that the inclusion of only useful knowledge in images like the "Geometrized Bee," distinguished them from the "'frivolous' or 'amusing' pastimes of the effeminate and unproductive rich." The stripping away of superfluous details in the diagrammatic engravings in Réaumur's study stood in stark contrast to the "pleasing ornaments" of salon culture and art of the period.¹¹⁷ Terrall notes that the rationalization inherent in the diagrammatic image was associated with masculinity. Nevertheless, many illustrators were women. Hélène Dumoustier de Marsilly (fl. 1750), for example, who executed this

¹¹⁴ Lisbet Koerner, *Linnaeus: Nature and Nation* (Cambridge, MA: Harvard University Press, 2001), 16. Koerner underlines the importance of this development to the continued practical needs of science by enumerating a list of "modern codes of nomenclature" that she claims began with Linnaeus' species labels starting with the first edition of *Species plantarum* in 1753.

¹¹⁵ Details of the voyages undertaken by Linnaeus' students and "apostles," as they were called, can be found in the eight volume set (eleven books) edited by Lars Hansen: *The Linnaeus Apostles* (London: IK Foundation, 2007).

¹¹⁶ Daston and Galison, *Objectivity*, 85.

¹¹⁷ Mary Terrall, "Masculine Knowledge, the Public Good, and the Scientific Household of Réaumur," *Osiris* 30, no. 1 (January 2015): 186.

drawing of a bee, was praised by Réaumur not for her own acumen in identifying the salient features of the insect but for her work in translating Réaumur's rational thought into visual form. She worked as Réaumur's graphic amanuensis, following his lead to know "how to recognize that which is most remarkable in an insect and the position in which it should be represented."¹¹⁸ Marsilly was able to see and portray the underlying salient aspects of an insect in the rational way Réaumur envisioned them.¹¹⁹ Her images are diagrammatic in the way they are idealized, shorn of extraneous pictorial details, and flattened and labeled to draw attention to the parts.

In an unusual and provocative study of comics, Scott McCloud theorizes the value of images abstracted from a more realistic appearance. Building on the work of philosopher Marshall McLuhan, McCloud argues that an abstracted image – such as a cartoon version of a face – can be more effective in communicating with a reader than a more realistic image, even a photograph. McCloud forwards a reason for this counter-intuitive finding: the abstracted image can represent many different manifestations of the person or object represented. He uses the example of a cartoon face to demonstrate the universality of an abstracted, simplified image.¹²⁰ A viewer, McCloud argues, identifies more readily with a cartoon face because the nonspecificity of such a face (or object or setting) invites self-identification (see Figure 2.12). The realistic image, in contrast, looks like a particular person, in this case, the author. Furthermore, an abstracted image of an object, and the knowledge of that object the image represents, can stand for many similar objects anywhere. I have visualized a similar progression for feet in second position in

¹¹⁸ Réaumur's will as quoted in Daston and Galison, *Objectivity*, 84.

¹¹⁹ Réaumur chose Mme. Marsilly as his heiress, citing the value of her role in his research as the visual interpreter of his ideas. Terrall, "Masculine Knowledge," 186-87.

¹²⁰ McCloud, *Understanding Comics: The Invisible Art*, 31.

increasing levels of abstraction: at the top is a photograph of the feet of Baroque dance specialist Paige Whitney-Baugess, next is a cartoon drawing from a historic graphic novel, third down is a pictorial image of feet standing over notation in Kellom Tomlinson's *The Art of Dancing* (1735), and finally, at the bottom, is a diagram of the feet in second position shown in notation from a 1701 dance manual (see Figure 2.12). I suggest that this last diagrammatic image is universalized in much the same way that modern science universalizes knowledge.¹²¹

Diagrams developed in the context of a turn toward universal, objective science in the eighteenth century. In Lorraine Daston's search for the roots of what has come to be deemed scientific objectivity, she locates a change in what was considered a scientific fact:

the prototypical scientific fact mutated between circa 1660 and 1730, from a singular and striking event that could be replicated only with great difficulty, if at all, to a large and uniform class of events that could be produced at will. The texture of description of nature changed accordingly, from long accounts bristling with particulars to concise reports made deliberately bland by summary, repetition, and omission of details.¹²²

To arrive at this assertion, Daston compares two approaches to scientific inquiry in the seventeenth and early eighteenth centuries respectively.

¹²¹ The concept of science as universal knowledge has been discussed at length in work such as Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, MA: Harvard University Press, 1987); Brian W. Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (Chicago: University of Chicago Press, 2006), especially 206-208; Jan. Golinski, *Making Natural Knowledge: Constructivism and the History of Science* (Chicago: University of Chicago Press, 2005), see chapter 6, 162-185; and Lorraine Daston and Katharine Park, *Wonders and the Order of Nature, 1150-1750* (New York: Zone Books, 1998), see chapter 9 "The Enlightenment and the Anti-Marvelous," 329-64.

¹²² Lorraine Daston, "Description by Omission: Nature Enlightened and Obscured," in *Regimes of Description: In the Archive of the Eighteenth Century*, ed. John B Bender and Michael Marrinan (Stanford, Calif: Stanford University Press, 2005), 13.

In her chapter, “Description by Omission,” Daston sets the meticulously empirical and richly detailed studies of Robert Boyle (1627-1691) against the stanchly pared-down descriptions of Charles François de Cisternay du Fay (1698-1739). Boyle’s pictorial engravings packed with particulars invited the viewer to be a “virtual” witness to his experiments; DuFay’s schematic instructions invited readers to conduct their own experiments.¹²³ Boyle noted every unusual anomaly in his research, fearing that any missed minutiae might be the most revealing while Dufay “tamed singularities into regularities.”¹²⁴ This taming involved smoothing over inconvenient observations and aberrations in favor of generalizations that could be applied to phenomena anywhere. In their studies of phosphorescence for example, Boyle recorded “which side of the diamond he rubbed, and with what color cloth” in an effort to ascertain exactly what was needed to make a substance luminous.¹²⁵ Dufay, in contrast, claimed that almost anything could be made to glow in the dark, despite his own difficulties in producing the effect in many of the substances he listed.¹²⁶ Dufay openly shared his methods for producing luminescence, striving to make his techniques “as simple and as insensitive to local variations as possible.”¹²⁷ His scientific method universalized knowledge by making it accessible, replicable, and abstract. Omitting the colorful details and peculiarities of

¹²³ Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, N.J.: Princeton University Press, 1985), 62. Shapin and Schaffer convincingly argue that the “density” of Boyle’s engravings created a vivid impression of the experimental scene, convincing readers of the veracity of his experiments.

¹²⁴ Lorraine Daston, “Description by Omission: Nature Enlightened and Obscured,” in *Regimes of Description: In the Archive of the Eighteenth Century*, ed. John B Bender and Michael Marrinan (Menlo Park, CA: Stanford University Press, 2005), 21.

¹²⁵ Daston, “Description by Omission,” 16.

¹²⁶ For example, in his 1730 “Mémoire sur un grand nombre de phosphores nouveaux,” Dufay claimed “ivory, animal bones, oyster shells, egg shells, and other similar materials” could be made luminescent. M. du Fay, “Mémoire Sur Un Grand Nombre de Phosphores Nouveaux,” *Académie Royale Des Sciences* (Paris, 1730), 534.

¹²⁷ *Ibid.*, 20.

Boyle's experiments, Dufay's approach to phosphorescence epitomized Daston's contention that science in the eighteenth century aimed for description by omission. The forward-looking practitioner of science "not only eschewed all forms of secrecy and obscurity in publishing his techniques, he also strove to make them as simple and as insensitive to local variations as possible."¹²⁸ Simplification, then, was a key component of a more modern approach to scientific inquiry. Diagramming is a visual counterpart to this impulse to remove the distracting, elaborate details that characterized earlier modes of scientific research.

Juxtapositions: the Art of Putting Things Together

Another way to trace the turn toward description by omission is by considering natural history collections. One might think, for example, of the sumptuous cabinet of curiosities that belonged to Ferrante Imperato (c.1525-c.1615), an apothecary in Naples. His 1599 publication, *Dell' historia naturale*, detailed his enormous collection of natural specimens and foreign objects.¹²⁹ This wildly disparate group of rare and marvelous things was typical of the Renaissance "wonder cabinets" that were the pride of collectors throughout Europe from the fifteenth through seventeenth centuries. Gentlemen naturalists valued all that was rare and spectacular; their collections were meant to impress their visitors and to display their wealth and connections. Objects were not ordered according to taxonomic or alphabetic principles, but rather set together with

¹²⁸ Daston, "Description by Omission," 20.

¹²⁹ Ferrante Imperato, *Dell' historia Natvrle Di Ferrante Imperato Napoletano Libri XXVIII : Nella Qvale Ordinatamente Si Tratta Della Diuversa Condition Di Miniere e Pietre : Con Alcune Historie Di Piante & Animalì, Sin'hora Non Date in Luce*. (Naples: Nella stamparia à Porta Reale per Costantino Vitale, 1599).

unlike items to highlight the unique and curious characteristics that made them valuable (see Figure 2.13).¹³⁰

In the eighteenth century, one more often finds collections like the anonymous cabinet of natural objects depicted in Figure 2.14. This Enlightenment cabinet contains only coral, though of many different varieties. Each different variety is made regular by housing each specimen in its own cubbyhole, separated by wooden dividers. The appearance is tidy and contained. The “curiosities” displayed here, like those of Imperato’s cabinet, are displayed out of context – one is not viewing them in the ocean – however, these objects are presented in a very different way: this is a disciplined collection. The scale and presentation invite a different kind of scrutiny. Because only one kind of specimen is showcased in this collection, one has the sense that one could master the knowledge it represents. In its simplification of both the design of the cabinet and the specimens stored there, this natural history collection exemplifies the diagrammatic language that emerged in the eighteenth century. Imperato’s cabinet and publication was meant to awe and astonish; Enlightenment science aimed toward the rational parsing of objects into manageable taxonomies and catalogs.

This was an ideal, rather than a reality. Naturalists of the period struggled to find a place between the interests and activities of *les curieux* and *les savants* [amateurs and scientists].¹³¹ Antoine Joseph Dezallier d’Argenville (1680-1765), in his 1757 *La Conchyliologie, ou Traité sur la nature des coquillages* [Conchology, or Treatise on the

¹³⁰ Katie Whitaker, “The Culture of Curiosity,” in Nicholas Jardine, James A. Secord, and E. C. Spary, eds., *Cultures of Natural History* (Cambridge: Cambridge University Press, 1996), 87.

¹³¹ Nathalie Vuillemin, *Les beautés de la nature à l’épreuve de l’analyse: programmes scientifiques et tentations esthétiques dans l’histoire naturelle du XVIIIe siècle, 1744-1805* (Paris: Presses Sorbonne nouvelle, 2009), 320-324.

nature of shells], included a section on how to arrange a natural history cabinet. He described the mid-eighteenth century situation thus:

The laymen put together their cabinets & beautiful collections. The simply curious are sensitive to the pleasure of seeing, seeking only the quick glance. Those who are knowledgeable find there the means of examining [specimens] by comparison, and of inventing several methods of dividing them, and arranging them into types. These different combinations open a sure path for reaching the perfect knowledge of these beautiful things, so little known to the ancients.¹³²

In his effort to find a middle ground between the layman's love of variety and the researcher's desire for order, Dezallier d'Argenville offers names for specific collections, indicating a move towards collections of a single type of specimen. For example, a *Lithophylacium* is a *Cabinet où l'on range des Pierres* [where one orders Rocks], a *Metallophylacium*, or *Metallototeca*, *Cabinet de Métaux* [a Cabinet of Metals], or *Minerallothea*, *Cabinet de Minéraux* [Cabinet of Minerals].¹³³

These were to be kept separate from the *Technophylacium*, *Cabinet de divers Ouvrages de l'Art* [Cabinet of diverse Objects of Art], or the *Pinacotheca*, *Cabinet où l'on serre des choses curieuses* [Cabinet where one puts curious things].¹³⁴ In advocating for keeping scientific collections separate, Dezallier d'Argenville compared the natural history collections he had described in an essay for the *Mercure François* in 1727 with natural history collections fifty years later:

¹³² "Les parties curieuses forment les cabinets & les belles collections. Les simples curieux sensibles au plaisir de la vuë, n'y recherchent que le coup d'oeil. Les Sçavans y trouvent les moyens de les examiner par comparaisons, & d'inventer plusieurs méthodes pour les diviser, & ranger dans leurs genres. Ces différentes combinaisons ouvrent un chemin sûr pour parvenir à la connoissance parfaite de ces belles choses, si peu connue des anciens." I have translated *savant* here as "knowledgeable person" to gesture toward the emerging notion of scientist, a term not invented until the 1830s. Antoine Joseph Dezallier d'Argenville, *L'histoire Naturelle Éclaircie Dans Une de Ses Parties Principales, La Conchyliologie, Qui Traite Des Coquillages de Mer, de Rivière et de Terre* (Paris: De Bure, l'aine, 1757), 105.

¹³³ D'Argenville, *L'histoire Naturelle*, liij, lvij, lvij.

¹³⁴ D'Argenville, *L'histoire Naturelle*, xij, lxxij.

We have formerly given in the *Mercure François* a dissertation on the choice and arrangement of a curious Cabinet: everything is displayed there, and everything contributes to embellishing it; books, medals, pieces of antiquity, those of sculpture, paintings, drawings of the great masters, prints, foreign clothing, up to the works of the lathe & mechanics: the assortment of a laboratory is not even forgotten. Here, there is a new display in which only the works of nature are presented; infinitely beyond art, they must erase all others: this display gives an idea of the order that could be followed in the great collections.¹³⁵

In his 1780 edition of *La Conchyliologie*, d'Argenville is unequivocal in his insistence on rationalizing collections of shells:

The arrangement of these shells requires some detail here. Naturalists arrange them in classes and by families; it is unquestionably the best and most methodical way. They mix, according to this principle, the ugly shells with the beautiful, the large with the small, so that the eye is sometimes tired; but this methodical order, which always presents a scholarly layout to the mind, must be preferred over a symmetrical order. Nothing must be arbitrary in its principles...the form, unequal sizes, symmetry, location, [nothing] must stop the spirit of order.¹³⁶

Many other natural history collections – and the prints that represented them – exemplified this Enlightenment aesthetic. In a 1706 print of Vincent Levin's cabinet, one finds rows and rows of bottled specimens neatly arranged side by side on shelves (see

¹³⁵ “Nous avons donné autrefois dans le *Mercure François*, une dissertation sur le choix & l'arrangement d'un Cabinet curieux: tout y est employé, & tout contribue à l'embellir; les livres, les médailles, les morceaux d'antiquité, ceux de sculpture, les tableaux, les dessins des grands maîtres, les estampes, les habillemens étrangers, jusqu'aux ouvrages de tour & de mécanique: l'assortiment d'un laboratoire n'y est pas même oublié. C'est ici une nouvelle scene qui ne présente que les ouvrages de la nature; infiniment au-dessus de l'art, ils doivent effacer tous les autres: cette scene donne l'idée de l'ordre qu'on pourroit suivre dans les grandes collections.” Antoine Joseph Dezallier d'Argenville, *L'histoire Naturelle Éclaircie Dans Une de Ses Parties Principales, La Conchyliologie, Qui Traite Des Coquillages de Mer, de Rivière et de Terre*, second edition (Paris: De Bure, l'aine, 1780), 105.

¹³⁶ “L'arrangement de ces coquilles demande ici quelque détail. Les naturalistes les disposent par classes & par familles; c'est sans contredit la meilleure manière & la plus méthodique. Ils mêlent, suivant ce principe, les coquilles brutes avec les belles, les grandes avec les petites, de sorte que l'oeil en est quelquefois fatigué; mais cette ordre méthodique qui présent toujours à esprit une savante distribution, doit être préféré à l'ordre symétrique. Rien ne doit être arbitraire dans les principes: il ne peut y en avoir que dans l'usage que l'on en fait; ainsi le coup d'oeil ne fait rien: la forme, l'inégalité des grandeurs, la symétrie, les place, ne doivent point arrêter l'esprit d'ordre.” D'Argenville, *L'histoire Naturelle Éclaircie Dans Une de Ses Parties Principales, La Conchyliologie*, 191.

Figure 2.15).¹³⁷ In another engraving, a collection of insects belonging to Jacob Christian Schäffer (1718-1790) was stored in tidy drawers (see Figure 2.16).¹³⁸

Bertrand Daugeron's research on the relationship between natural history and empire demonstrates how "the knowledge of a naturalist was thought on and with scientific collections."¹³⁹ The organization of objects, as well as the process of collecting them, played a critical role in the development of natural history as a field. When Georges Cuvier (1769-1832) lauded the utility of the Linnaean system of taxonomy for arranging the immense quantity of objects that had been collected, he was not only referring to names. The arrangement of Linnaeus' Latin terminology arranged on the page in Ramist columns informed the way natural objects were stored in France's national collection of natural history.¹⁴⁰

Diagrams thus can be considered *working objects*. They do not just depict information but make possible, even encourage, new ways of thinking about the material world. With regard to spatial history, Richard White claims that diagramming "is not just about producing illustrations or maps to communicate things that you have already discovered by other means. It is a means of doing research; it generates questions that might otherwise go unasked, it reveals historical relations that might otherwise go

¹³⁷ Vincent Levin, *Wondertooneel der nature, geopent in eene korte beschryvinge der hoofddeelen van de byzondere zeldzaamheden daar in begrepen* (Amsterdam: François Halma, 1706), Tableau 4; in Bertrand Daugeron, *Collections naturalistes entre science et empires, 1763-1804* (Paris: Muséum national d'histoire naturelle, 2009), 69.

¹³⁸ See Smithsonian exhibit catalogue: <http://www.sil.si.edu/exhibitions/wonderbound/gallery.htm> Accessed May 19, 2018.

¹³⁹ Bertrand Daugeron, *Collections Naturalistes Entre Science et Empires, 1763-1804*, Archives (Paris: Muséum national d'histoire naturelle, 2009), 260-262.

¹⁴⁰ Georges Cuvier, *Histoire des progrès des sciences naturelle depuis 1789 jusqu'à ce jour* (Paris: librairie encyclopédique de Roret, 1834), 1:284. Cited in Daugeron, *Collections naturalistes*, 36-37. See E. C. Spary, *Utopia's Garden: French Natural History from Old Regime to Revolution* (Chicago: University of Chicago Press, 2000) for the story of how the king's cabinet was transformed into a publically-celebrated museum.

unnoticed, and it undermines, or substantiates, stories upon which we build our own versions of the past.”¹⁴¹ Jacques Bertin, however, cautions against confusing the purposes of a working diagram with one meant to communicate findings. Using diagrams as “tools of reason” invites, or may even require, the inclusion of as much data as possible.¹⁴² Diagrams in the eighteenth century often became dense with information, largely due to the fine details that were made possible by new techniques in copperplate engraving. As James Elkins notes “Nothing approaching the complexity and versatility of modern notations existed before the Enlightenment...Now it is common in science and technology to find images that are entirely opaque to untrained eyes, not only because they depend on specialized concepts but because they are organized according to specialized notational structures.”¹⁴³ In other words, in the eighteenth century, sophisticated graphic methods began to be used not only to represent information, but to think about specific problems.

Isaac Newton is a prime example of an important figure in late seventeenth-century science who thought with diagrams. He jotted numerous diagrams in the margins of his letters and notes indicating the vital role of visualizations in his thought process. In one of his early notebooks, Newton wrote extensively on the subject of drawing and included recipes for making ink, demonstrating his commitment to drawing as a foundational skill for empirical observation.¹⁴⁴ Newton’s search for universal truths was

¹⁴¹ Richard White, “What Is Spatial History?,” *Spatial History Project: Working Paper*. Stanford University. Accessed March 13, 2017, <https://web.stanford.edu/group/spatialhistory/cgi-bin/site/pub.php?id=29>.

¹⁴² Jacques Bertin, *Graphics and Graphic Information-Processing* (Berlin ; New York: De Gruyter, 1981), 22. I am borrowing the phrase “tools of reason” from the organizers of a conference by that name on the practice of scientific diagramming. The conference took place at Stanford University in 2017.

¹⁴³ James Elkins, *The Domain of Images* (Ithaca, N.Y.; London: Cornell Univ. Press, 1999), 234.

¹⁴⁴ See The Pierpont Morgan Notebook, Catalogue Entry: NATP00001. <http://www.newtonproject.ox.ac.uk>

predicated on diagrams. Émilie du Châtelet (1706-1749), philosopher and translator of Newton's *Principia*, summed up the quintessentially optimistic Enlightenment view of science when she wrote, "this world is the best of the possible worlds, the one where the greatest variety exists with the greatest order, and where the largest number of the facts is produced by the 'simplest laws' (quotes mine)."¹⁴⁵ Newton's quest for over-arching principles and Châtelet's confidence in scientific progress lay in the discovery of *universal* laws. I argue that the finding of these laws was intertwined with the concurrent development of diagrams without which Western science would have developed very differently.

Another example of what it might mean for a diagram to be a working object can be found in a timeline designed by the Huguenot attorney, Jean Rou (1638-1711). Rou's ambitious visual compilation of "universal" history, compared major civilizations starting with the ancient world – the very fine small print was made possible by engraving on copper. This history was in the form of a chart: text was arranged diagrammatically rather than pictures or symbols. The juxtapositions and arrangement of space, i.e. the columns and rows in which text appears, guided the viewer to make conclusions based on where the text appears on the page. In this chart, liaison lines, scattered through and over the text, indicate countries connected by alliance agreements or royal marriages. Rou's first publication in 1672 was well received, however, in his second volume of seven timelines, Rou included material that suggested a more controversial interpretation of history. In the middle of the last chart in his 1675 *Tables historiques, chronologiques, & généalogiques*, Rou placed France in a central column with a number of other western European

¹⁴⁵ Émilie Du Châtelet, *Selected Philosophical and Scientific Writings*, trans. Judith P Zinsser (University of Chicago Press, 2009), 144.

countries to the right including England, Scotland, Poland, Sweden, Denmark, and Naples/Sicily (see Figure 2.17). At the far right, there are two columns that list battles and “illustrious men.” The columns to the left of the France column include Spain (and its minor regions Portugal, Castile, Leon, Aragon, and Navarre), the *Occident* [the West] which here encompasses the Holy Roman Empire, Hungary, and Bohemia, the *Orient* [the East] which appears to focus on Greece, with columns continuing to the left listing together (surprisingly) the Turks, Persia, and the Papal states. To the far left is a column of dates with the earliest at the top. Rou’s elaborate diagrams went beyond the representation of information to invite the reader to contemplate history in different places simultaneously and to link relations between geographically disparate entities. Unfortunately, the censors who studied Rou’s chart took offense at his inclusion of Protestant figures (and perhaps with his placement of the Papal states with the Turks) and Rou spent time in the Bastille before he fled to England.¹⁴⁶

It was not until a century later that Joseph Priestley (1733-1804), inspired by Rou’s work, created two ground-breaking timelines: one of biography and one of history.¹⁴⁷ These two charts were meant to be viewed together. They exemplify the concept of diagrams as working objects: Priestley drew up these two charts using the same scale for each so that they could be compared directly (see Figure 2.18 and 2.19). He argued that thinking historically – the kind of thinking that his charts made possible – was key to human progress. The notion of *progress* which so defined the eighteenth-century *mentalité* was born from a new linear concept of history as opposed to the

¹⁴⁶ Rosenberg and Grafton, *Cartographies of Time: A History of the Timeline*, 97.

¹⁴⁷ These were first published in 1764 and 1765 with many subsequent editions.

cyclical notion of history that had prevailed up until then.¹⁴⁸ This development, as Anthony Grafton and Daniel Rosenberg have demonstrated, is exemplified by the development of timelines.¹⁴⁹ By the end of the eighteenth century, the mapping of economic and political data in graphic form by Joseph Priestley furthered the idea that such claims could be made visually.

Standardization: Making Sense in an Age of Enlightenment

The *Encyclopédie* of Diderot and D'Alembert also asserted a philosophy of knowledge through the cross-referencing of images and text. Many of the *Encyclopédie* images picture a workshop on the top of the page and display the standard tools of the trade laid out separately on the bottom half of the page. These have garnered a lot of attention because they brought artisans and their work into public view as never before. The images are diagrammatic in the way the pictures on the top half of the page often eschew perspective and, on the bottom half of the page, in the spatial arrangement of the tools, systematically laid out one-by-one, each with its own identifying letter.

An examination of the plates on their own reveals an illuminating play between diagram and picture. In one of the plates under the heading “Astronomie,” at least three kinds of images share the space on the page. First, in the upper right corner, there is a pictorial representation of the moon, magnified so that one can see the craters, plains, and mountains (see Figure 2.20). This magnified vision of the moon, labeled “Fig. 20,” is “derived from the knowledge of the times,” according to the author of the caption. The

¹⁴⁸ Jürgen Mittelstrass, Peter McLaughlin, and Arnold Burgen, *The Idea of Progress* (Berlin: Walter de Gruyter, 1997), ix-xi; David Bebbington, *Patterns in History: A Christian Perspective on Historical Thought* (Vancouver, BC: Regent College Publishing, 1990), 21; Gary B. Miles, *Livy: Reconstructing Early Rome* (Ithaca, NY: Cornell University Press, 1997), 75-76; Silvia Sebastiani, *The Scottish Enlightenment: Race, Gender, and the Limits of Progress* (New York: Springer, 2013), 44-48.

¹⁴⁹ Rosenberg and Grafton, *Cartographies of Time: A History of the Timeline*, 104.

image showcases various shadows and topography.¹⁵⁰ Along the left side of the page, labeled “Fig. 19,” is a different kind of image: geometric diagrams of bare lines and letters indicating the angle of the moon as seen from earth and the measuring of lunar mountains. Finally, in the lower right corner, a mechanical drawing of a *sphere armillaire de Ptolomée* [Armillary sphere of Ptolemy] offers yet another kind of image. This one is part pictorial and part diagram: the ornately carved stand contrasts with the simple lines tracing the orbit of the sun around the earth. Why did the engraver of this plate include Ptolemy’s model of the universe in a post-Copernican publication? The elaborate Rococo decoration of the stand for the armillary sphere, a style which would have been contemporary to the time of publication, suggests that this plate is a juxtaposition of new and ancient knowledge. By including these many different kinds of images, the *Encyclopédie* positioned knowledge as something that was not static but rather progressed.

On another page in the series of plates on astronomy (plate IV), the systems of Ptolemy, Copernicus, and Tycho Brahe are lined up to illustrate the progression from one to the next (see Figure 2.21). However, the majority of the twenty-six plates in the entry on Astronomy are diagrams of instruments of measurement: from a *Quart de Cercle Mobile* [a portable Quadrant], labeled “Plate XIV,” (see Figure 2.22) to an *Instrument du secteur de M. de Fouchi &c.* [Sector Instrument designed by M. (Jean) de Fouchi etc.], “Plate XXVI,” (see Figure 2.23).¹⁵¹ In the picture of M. de Fouchi’s sector, a disembodied eye indicates where one should look through it. Three geometrical line

¹⁵⁰ The abbreviated Fig. references are for the numbered drawings in the *Encyclopédie* plate.

¹⁵¹ *Secteur* [Sector] in this case, is a precisely calibrated movable telescope (however it had less mobility than a quadrant). Le Roy, *Encyclopédie*, s.v. “Secteur astronomique.”

diagrams, “Fig. 4, 5, and 6,” explain how the sector works mathematically. At the bottom of the page, cross-section drawings show the differences between three different reflecting systems for telescopes: fig. 7 shows Laurent Cassegrain’s 1672 version; fig. 8 features one designed by James Gregory in 1663 but not built until 1673 by Robert Hooke; and fig. 9 depicts Newton’s 1668 telescope, considered the first reflecting telescope. A sense of progress permeates the engraving and the different kinds of visualizations used epitomize the juxtaposition of the many different approaches to knowledge that appear throughout the *Encyclopédie*.

In this chapter, I am connecting this drive toward finding the “simplest laws” with a key trait of diagrams – visualizing data in the least complicated way in an effort to make such data easier to understand and/or analyze. To simplify is to reduce something “to a clearer or more intelligible form.”¹⁵² Diagrams may indeed simplify information to convey it more clearly, but in so doing, they also endorse a particular viewpoint. The simplicity of a diagram may offer “computational efficiency” as Simon and Larkin propose, but it also presents a view of the world shorn of details, a “description by omission.”¹⁵³

Diagrams are always visual arguments, as numerous theorists have pointed out. Communications theorist Johanna Drucker, for example, cautions,

Most information visualizations are acts of interpretation masquerading as presentation. In other words, they are images that act as if they are just showing

¹⁵² “Simplify, V.,” *OED Online* (Oxford University Press). It also specifically references the use of a diagram as a conduit toward simplifying information: “Thus the diagram will simplify to the following [etc.].” K. G. Lockyer, *An introduction to critical path analysis*, (London: Pitman, 1964), ii. 21.

¹⁵³ Jill H Larkin and Herbert A Simon, “Why a Diagram Is (Sometimes) Worth Ten Thousand Words,” *COGSCI Cognitive Science* 11, no. 1 (1987): 65.

us *what is*, but in actuality, they are *arguments made in graphical form*” (italics in original).¹⁵⁴

Diagrammatic visual languages developed concurrently with the development of the new sciences and alongside the methodologies and epistemic values that defined them. The medium of the diagram as intrinsic to scientific thinking has garnered increased interest been more rigorously addressed by historians of science and by scholars in the burgeoning fields of visual culture and visual studies.¹⁵⁵ James Elkins writes, “Visual studies has the potential to contribute a voice significantly different from the text-based practices that are preeminent in the humanities and it has the capacity to uncover connections between parts of the university that are now largely disjointed.”¹⁵⁶ I suggest that the study of diagrams in particular can be a productive area of inquiry for humanists and scientists interested in finding commonalities in the historic record.¹⁵⁷

This chapter has described diagrams as they developed over the long Scientific Revolution. Building on Latour’s insight that visualization was key in the development of Western science, I am looking at how diagrams were applied to the movement of noble bodies in an effort to understand how science came to inform ideas about social class. Thomas Broman has commented on the application of science to understanding – and reforming – society in the eighteenth century. As he writes, “In the Enlightenment, the

¹⁵⁴ Johanna Drucker, *Graphesis: Visual Forms of Knowledge Production* (Cambridge, MA: Harvard University Press, 2014), Introduction, unpaginated.

¹⁵⁵ For a sample of the increasingly robust literature on visual arguments, see Drucker, *Graphesis*; Orit Halpern, *Beautiful Data : A History of Vision and Reason since 1945* (Durham: Duke University Press, 2014); James Elkins, *The Domain of Images* (Ithaca, N.Y.; London: Cornell Univ. Press, 1999); Edward R. Tufte, *Visual Explanations: Images and Quantities, Evidence and Narrative* (Cheshire, Conn.: Graphics Press, 1997). In addition, a recent conference focused on the theme of diagrams as tools for thinking: “Tools of Reason: The Practice of Scientific Diagramming From Antiquity to the Present” conference at Stanford University, February 10-11, 2017.

¹⁵⁶ James Elkins, *Visual Studies: A Skeptical Introduction* (New York: Routledge, 2009), vii.

¹⁵⁷ Nicholas Mirzoeff also argues for visual culture as “an increasingly important meeting place for critics, historians, and practitioners in all visual media who are impatient with the tired nostrums of their ‘home’ discipline or medium. Mirzoeff, *The Visual Culture Reader*, 2nd ed. (New York: Routledge, 2002), 6.

value of theoretical knowledge began to be measured against its ability to guide action, and scientific knowledge acquired a public role as the ideological justification for the reform of society.”¹⁵⁸ Diagrams, then, served as one of the tools in the application of science to social reform.

The scientific analysis of human bodily movement, conceptualized and recorded in diagrams, promised improvement in the social standing of individuals who turned to diagrammatic notations to learn noble comportment through dance and other forms of choreographed movement. Diagrammatic notations had also long been used in the “science of war” as aids in the study of fortifications, to visualize battle strategies, and to map out drill exercises to guide the efficient movement of large groups of soldiers. I am not the first to note the connection between training in court dance and the education of officers; however the close relationship between dance and drill has not been pursued through a comparison of shared diagrammatic languages.¹⁵⁹ I claim that these diagrammatic languages signaled a newly scientific approach to these practices. By the eighteenth century, the close relationship between dance and the military was revealed not only through the noble bearing of leaders at court and in the military but also in the notational practices common to each.

¹⁵⁸ Thomas Broman, “The Semblance of Transparency: Expertise as a Social Good and an Ideology in Enlightened Societies,” *Osiris*, 2012, 188.

¹⁵⁹ See, for example, Matthew McCormack, “Dance and Drill: Polite Accomplishments and Military Masculinities in Georgian Britain,” *Cultural & Social History* 8, no. 3 (2011): 315–30; and William Hardy McNeill, *Keeping Together in Time: Dance and Drill in Human History* (Cambridge, MA: Harvard University Press, 1995).

CHAPTER THREE

DANCE: BODIES IN MOTION

All the misfortunes of men, all the deadly disasters that history is full of, the blunders of politicians, the mistakes of great captains – all these have come just from not knowing how to dance.

Molière, *Le Bourgeois Gentilhomme*, 1670¹⁶⁰

*My fretted Sides, I laugh and drop my Pen,
To think 'mongst the Worlds distracted Crew
There's Mathematicks ev'n in dancing too.*

Aphra Behn, *A Satyr Against Dancing*, 1702¹⁶¹

We are obliged to the French for the precision which dancing shows today. They have refined it on the lathe of good taste.

Magri, *Theoretical and Practical Treatise on Dancing*, 1779¹⁶²

Introduction: M. Jourdain Aims to Improve Himself

Let me introduce Monsieur Jourdain. He is the bumbling protagonist of Molière's comedy, *The Bourgeois Gentilhomme* [The Would-Be Gentleman]. In this popular seventeenth-century play, this upstart merchant tries to make himself into a person of quality by hiring a host of teachers. His instructors – a dancing master, two musicians, a fencing master, and a philosopher – are all convinced that it will be impossible to instill in M. Jourdain the proper physical and philosophical skills he needs to fulfill his dreams of “nobility and gallantry.”¹⁶³ The dancing master and the musician argue about whether it is better to work for a gentleman of quality who can appreciate their skill or whether it is sufficient to be paid well. They end up agreeing that while the appreciation of a person

¹⁶⁰ Molière, *The Misanthrope and Other Plays*, trans. Donald M. Frame (New York: New American Library, 1968), 221.

¹⁶¹ Aphra Behn, *A Satyr Against Dancing. By a Person of Honour* (London: A. Baldwin near the Oxford-Arms in Warwick-Lane, 1702), 9.

¹⁶² Gennaro Magri, *Theoretical and Practical Treatise on Dancing*, 1779, translated and edited by Irmgard E Berry and Annalisa Fox (London: Dance Books), 10.

¹⁶³ Molière, *The Misanthrope and Other Plays*, 221.

of exquisite taste is satisfying, money *does* matter. Nevertheless, they both hope that they can at least teach their new employer a modicum of good taste. As the play continues, however, Monsieur Jourdain proves to be completely and hilariously unteachable, much to the delight of the aristocratic audience who first viewed this *comédie ballet* in 1670 (see Figure 3.1).¹⁶⁴

Just thirty years after the premiere of Molière's farce, a new wave of publications provided instructions so that one could learn – from a book – how to dance like a member of the noble class. What made these how-to manuals different from earlier dance treatises was their claim that one could learn to dance by oneself *from a book*. These manuals included an innovative system of diagrammatic notation that analyzed and visually described the movements involved in imitating the grace and posture of an aristocrat.

In this chapter, I first consider the importance of physical grace and knowledge of dance as a marker of nobility. I then turn to a survey of early European dance notations, which highlights the innovative character of the dance notation systems that will be the focus of this chapter. There were a number of dance notation systems introduced in the eighteenth century; however only two systems were widely published and disseminated: *chorégraphie*, invented for court dance under Louis XIV, and *contredanse* diagrams, a shorthand system for less formal group dances. An analysis of notation for a typical court dance, the popular *L'Aimable Vainqueur*, reveals some of the design elements it shared with scientific visualizations of the period.¹⁶⁵ Turning to contredanse notations published later in the eighteenth century, one finds more evidence of diagrammatic simplification,

¹⁶⁴ The *comédie ballet* genre was invented by Molière, the stage name for Jean-Baptiste Poquelin (1622-1673). The playwright mixed theater with music and dance, incorporating the talents of Jean-Baptiste Lully and Pierre Beauchamp respectively.

¹⁶⁵ i.e. simplification, juxtapositions, and the mapping of movement through scaling down component parts.

standardization, and juxtaposition of visual and textual elements: an analysis of a contredanse published in honor of the Chevalier de Saint-George reveals these elements in play. The last section of this chapter looks at dance notation as it was discussed in the *Encyclopédie*.

There had been an increasing concern during the seventeenth century, especially among the court nobility, with self-imposed control of demeanor and movement as a new *marque de noblesse*.¹⁶⁶ A lot was at stake in insisting that nobles were naturally more physically fit and agile. This is made plain by the large crowd that traditionally assembled to watch the heir to the throne take his first riding lesson. Everyone was eager to see how quickly and easily the young royal learned to control his horse – a sign of his future ability to take hold of the reins of government. The young royal would, in fact, have already been studying riding in private, but it was important to maintain the fiction that noble birth conveyed “natural” grace and power. It was commonly agreed that aristocrats had a superior bodily bearing and manner that distinguished them from the rest of the population.¹⁶⁷ As one eighteenth century author, Willem Anthonie Ockerse, observed,

People of standing have a certain *savoir faire*, which distinguishes them from the multitude and which is so to the manner born that it even reveals their birth, when dressed as peasants...there is even distinction in their features, in the shape of their bodies: something delicate, something uncommon, or how shall I name it?¹⁶⁸

¹⁶⁶ Arditi, *Genealogy of Manners*, 77; Motley, *Becoming a French Aristocrat*, 7-8, 10, 13, 123-124, 139-141, 211; Georges Vigarello, “The Upward Training of the Body from the Age of Chivalry to Courtly Civility,” in *Fragments for a History of the Human Body*, pt. 2, ed. Michel Feher, Ramona Naddaf, and Nadia Tazi (New York: Zone, 1989). See also Muchembled, “L’Ordre des corps,” chap. 4 in *L’Invention de l’homme moderne*.

¹⁶⁷ Herman Roodenburg, *The Eloquence of the Body: Perspectives on Gesture in the Dutch Republic* (Zwolle, Netherlands: Waanders Publishers, 2004), 1.

¹⁶⁸ Quoted in Roodenburg, *The Eloquence of the Body*, 9.

This is illustrated by the story of *Cendrillon* [Cinderella]. In this French fairy tale, the foot as well as the bearing of the young heroine is a distinguishing characteristic that enables the Prince to recognize her as of the noble class.¹⁶⁹ As we will see, Beauchamp/Feuillet notation emphasized the skillful foot. Literary scholar Timothy C. Murray argues that the textual prominence of the heroine's delicate foot and glass slipper in Charles Perrault's 1697 version of *Cendrillon Ou La Petite Pantoufle de Verre* [Cinderella and the Little Slipper of Glass] is a significant clue to the story's meaning.¹⁷⁰ Like the dances of this period, fairy tales conveyed meanings for their readers that are not apparent to the twenty-first century viewer. Marc Soriano suggests fairy tales from this period served as a medium for early moderns to grapple with the contradiction between new rational, scientific ways of approaching the world and lingering superstitions of the past.

In my reading, the skilled dancing of the disguised Cinderella at the ball is what earns her recognition as noble and worthy of a prince. This physical beauty is also reflected in her morality: she is "sweet and good" beyond all others.¹⁷¹ Even dressed in rags at home, Cinderella's beauty shines through: she is described as *plus belle* – more beautiful than her step-sisters, even though they are dressed *très-magnifiquement*. It is Cinderella who has given her step-sisters sartorial advice, and her good taste is noted as another mark of her nobility.¹⁷²

¹⁶⁹ Charles Perrault, *Histoires, ou Contes du tems passé : avec des moralités* (La Haye: s.n, 1742).

¹⁷⁰ Timothy C. Murray, "A Marvelous Guide to Anamorphosis: *Cendrillon Ou La Petite Pantoufle de Verre*," *MLN* 91, no. 6 (1976): 1276–95.

¹⁷¹ Une jeune fille... "d'une douceur & d'une bonté sans exemple." Charles Perrault, "Cendrillon, ou la Petite Pantoufle de Verre," in *Histoires, ou Contes du tems passé : avec des moralités* (La Haye: s.n, 1742), 43.

¹⁷² Perrault, "Cendrillon," 50.

In the story, Cendrillon appears at the ball, splendidly dressed and riding in a gold coach with six grey horses, a coachman with a beautiful moustache, and six lackeys, thanks to her fairy godmother's magic. Once at the palace, the Prince leads her into the company and places her at the head of the ranks of female aristocrats and then invites her to dance. Formal court balls in the *ancien régime* proceeded one couple at a time, strictly in order of rank with the king dancing first with the queen, and then the queen dancing with the next man, and so on.¹⁷³ If this fairy tale references this tradition, then Cendrillon would have been observed by everyone at the ball, dancing a complex series of steps and patterns, having never rehearsed with the Prince, something that would have only been possible if she already knew the dance – dances in which the man “leads” his partner did not develop until the nineteenth century. Cinderella's dance with the prince was part of the court spectacle.¹⁷⁴ As the tale continues, Cinderella “dances with so much grace, that she was admired still more.”¹⁷⁵ As the clock struck 11:45, she makes a *grande révérence* [formal curtsy] to the company to leave before her midnight deadline. The readers of this tale, Perrault's fellow salonnières, would have been familiar with the protocol of court dances. The *merveilleux*, or wonder, of Cinderella's transformation included her apparently “natural” knowledge of the proper *révérence* and court dances.

While nobles were expected to be naturally graceful, there were numerous manuals published throughout the early modern period giving instructions for gaining just such a “natural” manner. If this manner were indeed “inbred,” why the need for a

¹⁷³ Hilton, *Dance of Court & Theater*, 11.

¹⁷⁴ Rebecca Harris-Warrick, “Ballroom Dancing at the Court of Louis XIV,” *Early Music* 14, no. 1 (1986): 41–49.

¹⁷⁵ “Elle dansa avec tant de grace, qu'on l'admira encore davantage.” Perrault, “Cendrillon, ou la Petite Pantoufle de Verre,” 54.

manual? Herman Roodenburg calls this “Castiglione’s Paradox,” after Baldassare Castiglione’s 1528 *The Courtier*, the most widely read of these manuals.¹⁷⁶ Roodenburg argues that elites had a “corporeal” bodily memory learned from early childhood that gave them an advantage. Aristocratic children traditionally began their education at home. This included instruction in dance. First, the proper movements for the *révérence* or bow was mastered.¹⁷⁷ The depth of one’s bow or curtsy was carefully calculated to acknowledge social rank. The *révérence* consisted of a complicated set pattern of steps for men with a bend at the waist and a subtle bend and rise with the back erect for women with the eyes lowered and raised.¹⁷⁸ These bow movements are detailed in many dance treatises of the period. Aristocratic parents particularly valued this aspect of the dancing master’s curriculum: knowing how to make a proper *révérence* and the accompanying respectful behavior served to situate a child in the household hierarchy as well as providing lessons for participation in extended aristocratic social circles.¹⁷⁹

Early Dance Notations

The tradition of aristocratic dance had deep roots in the development of court culture. One of the earliest collections of dance notations in Europe is a sumptuous c.1460 manuscript originally belonging to Marie de Bourgogne and then to her daughter

¹⁷⁶ Herman Roodenburg, *The Eloquence of the Body: Perspectives on Gesture in the Dutch Republic* (Zwolle, Netherlands: Waanders Publishers, 2004), 1.

¹⁷⁷ Even if they did not learn figured dances, they learned to walk well, do a bow, and carry the body well. Mark Edward Motley, *Becoming a French Aristocrat: The Education of the Court Nobility, 1580-1715* (Princeton, NJ: Princeton University Press, 1990), 58.

¹⁷⁸ Women were instructed to maintain an upright posture while bending their knees and lowering their eyes – the movement is extremely subtle (and not at all like the affected bending curtsies one invariably sees in even the most historically-informed movies depicting the period).

¹⁷⁹ Motley stresses the importance of extensive family networks in training aristocratic children in noble manners and values. In this, he disagrees with Philippe Ariès who viewed the extended aristocratic family as backward in comparison with closer relationships between parents and children in other classes. Motley, *Becoming a French Aristocrat*, 23-24.

Margaret of Austria (see Figure 3.2). The collection contains single lines of unmeasured music beautifully written on black paper decorated with swirling arabesques and ornate initials. The dance steps are indicated by gold letters written directly above or below the music. Each letter stands for a step or movement. At the beginning of each dance, for example, a capital “R” stood for *révérence* (an opening bow). Steps included the double, indicated by a “d” (three steps forward and a step to close), the single, indicated by an “s” (two steps forward to a close), the branle, indicated by a “b” (steps to the side), and the *ripresa*, a sideways swaying step indicated by a “z.” The steps were written in order from left to right, underneath musical pitches written on a staff but with little indication of timing or rhythm for either the music or the dance steps, and few directions for floor patterns.¹⁸⁰ Dancers would have memorized these dance steps. Musicians during this period likewise did not follow along with the score when performing any more than dancers did.¹⁸¹

For humanists in Renaissance Italy, the mapping of the cosmos and the natural beauty of geometry and linear perspective had shaped ideas of social and moral order. Early Italian dance treatises mirrored these concerns.¹⁸² The noble body, with its upright posture and the bend and rise of noble dance steps, metaphorically positioned the noble

¹⁸⁰ Some of the dances in Margaret of Austria’s dance collection are in mensural notation but without indications of the steps directly underneath, the dance being described in accompanying text. The striking scrollwork and lettering in gold and silver on black paper indicates the importance of dance at court.

¹⁸¹ Lieven Baert and Veerle Fack, “‘Les Basses Danses de Marguerite d’Autriche’ from the Ms. 9085, Bibliothèque Royale Albert I, Brussels,” 1995, <http://virtuabis.free.fr/Les%20Basses%20Danses%20de%20Marguerite.pdf>.

¹⁸² These ideas were exported to France along with Castiglione’s *The Book of the Courtier* and the dances that Catherine de Médicis (1519-1589) brought with her when she married the King Henri II (1519-1559) in 1533. For a description of the role of dance in the Italian court society that Catherine brought to France, see Jennifer Nevile, *The Eloquent Body: Dance and Humanist Culture in Fifteenth-Century Italy* (Bloomington, IN: Indiana University Press, 2004), 44-45. For dance as a reflection of the cosmos, see Nevile, *The Eloquent Body*, 122-131.

as an embodied intermediary between earth and the heavens, as we saw with the Vitruvian man in the previous chapter.¹⁸³ The first dance treatise published in France drew on humanist ideals. This author, the canon of Langres, Jehan Tabourot (1519-1595), who published under the anagrammatic pen name of Thoniot Arbeau, also published on astronomy.¹⁸⁴ Arbeau's *Orchesography*, first published in 1588, was a widely read and reprinted dance and etiquette manual popular throughout Europe. It consisted of a Socratic dialogue between a student named "Capriol" and his dancing master.¹⁸⁵ Several illustrations of a male student executing various steps complement the text. These convey the student's enthusiasm as well as the master's measured instructions and praise. Arbeau's original contribution to the notation of dance was to turn his mensural music notation sideways so that dance step notation could be printed alongside the corresponding music (see Figure 3.3).¹⁸⁶

Paths of movement were not indicated in either Arbeau's manual or the Burgundian manuscript of a century earlier. Other early dance sources focused on dance patterns but did not include steps or rhythm. Arbeau's descriptions emphasized the execution of steps. In contrast, Claude-François Ménéstrier's 1682 *Des ballets anciens et modernes selon les regles du theatre* includes several diagrams showing the positions of

¹⁸³ Catherine Turocy, "Beyond La Danse Noble : Conventions in Choreography and Dance Performance at the Time of Rameau's *Hippolyte et Aricie*," in *Moving History / Dancing Cultures : A Dance History Reader*, ed. Ann Dils and Ann Cooper Albright (Middletown, Conn: Wesleyan University Press, 2001), 95. See also Catherine Turocy, "Vitruvian Man, Baroque Dance, and Fractals," *Early Music America* 18, no. 4 (Winter 2012): 26–31, 60.

¹⁸⁴ Jehan Tabourot, *Compot et Manuel Kalendrier, par lequel toutes personnes peuvent facilement apprendre et sçavoir le cours du Soleil et de la Lune et semblablement les festes fixes et mobiles que l'on doit célébrer en l'Eglise, suyvant la correction ordonné par notre Saint Père Grégoire XIII* (Langres, n.d). Cited in *Mémoires de l'Académie des sciences, arts et belles-lettres de Dijon*, I (Dijon: Académie de Dijon, 1924), 107.

¹⁸⁵ A "capriol" is also the name of a virtuosic jumping step in which the legs beat together while in the air.

¹⁸⁶ Mensural music notation refers to the European system developed for Renaissance polyphony between 1400 and 1600. Rhythm was indicated by note durations (roughly equivalent to modern whole, half, quarter notes, etc.) but was not organized in barred measures.

dancers on the floor although he too does not indicate steps. In one section of Ménestrier's book, he describes five ballets in the Italian style presented by students at the *Collegio dei Nobili* in Parma to celebrate the marriage of the Duke of Parma to the Princess of Modena, Maria D'Este. Ménestrier included diagrams to show the positions of the dancers in different parts of each ballet, for example, at the end, five dancers line up in a diagram to form the name of the princess (see Figure 3.4).¹⁸⁷ Ménestrier dedicated his book to the Duke of Aumont, the first gentleman of the king's chamber. The duke, as we learn in Ménestrier's dedicatory preface, was responsible for "regulating spectacles and divertissements of the court."¹⁸⁸ Diagrams such as these may have been those sketched by the organizers of such spectacles or, in published form, have served as reminders of that auspicious event. In his dedicatory remarks, Ménestrier praises the valor and fidelity of the duke. Such virtues were closely aligned with nobility and thus enacted and embodied in court dances.¹⁸⁹

It would be difficult to over-emphasize the role of horses and horsemanship in early modern courts. Larger courts organized ballets for riders and their horses called *carousels*.¹⁹⁰ These equine spectacles evolved from medieval tournaments as part of the transition in the identity of noble from warrior knights to the "early modern courtier-

¹⁸⁷ Claude-François Menestrier, *Des ballets anciens et modernes selon les règles du theatre* (Paris: Guignard, 1682), 240–46.

¹⁸⁸ Menestrier, *Des ballets anciens et modernes*, ii.

¹⁸⁹ Treva J. Tucker, "From Destrier to Danseur: The Role of the Horse in Early Modern French Noble Identity" (Ph.D., University of Southern California, 2007), ii. See also Franklin Lewis Ford, *Robe and Sword: The Regrouping of the French Aristocracy after Louis XIV* (New York: Harper & Row, 1971); and Constance Brittain Bouchard, "Strong of Body, Brave and Noble": *Chivalry and Society in Medieval France* (Ithaca NY: Cornell University Press, 2017).

¹⁹⁰ See, for example, Marc Vanscheeuwijck, "The Baroque Equestrian Ballet: A Rediscovered Torneo by Bolognese Composer Giovanni Paolo Colonna (1676)," in *La Figura e l'Opera Di Antonio Cesti Nel Seicento Europeo*, ed. Maria Teresa Dellaborra (Florence: Leo S. Olschki, 2003).

aristocrat.”¹⁹¹ In a print commemorating one such “horse ballet,” in honor of Giovanni de Bardi, Conte di Vernio (1534-1612), a large picture in the center illustrates the spectacle of riders in an arena (see Figure 3.5). In the foreground, two elaborately costumed riders, one on each side of the scene, pose in front of drawn curtains further emphasizing the theatrical quality of the scene. Fifteen diagrams of riders in various patterns – as if viewed from above – form a border around the central pictorial image. A smaller picture at the top shows another arena with riders performing, perhaps the same figures in another location. The diagrams around the edge are static; one cannot tell how the riders were to progress from one pattern to the next, as the paths of motion are not indicated. Nevertheless, the series of patterns displayed in diagrams strongly suggest movement from one to the next.¹⁹²

Another print commemorating danced patterns is found in the 1610 *Ballet de Monseigneur le duc de Vendôme, dansé lui douzième en la ville de Paris dans la grande salle de la maison royale du Louvre* [Ballet of Monsieur the Duke of Vendôme, danced by him the twelfth in the city of Paris in the great hall in the royal house of the Louvre]. It celebrates a performance of dances in text descriptions and diagrams of twelve dancers in different configurations that stand for courtly characteristics such as “Great Courage,” “Agreeable Pain,” “Proven Constance,” and “Deliberate Virtue” (see Figure 3.6).¹⁹³ Again, these are static sequential patterns; the diagrams do not indicate *how* these dancers

¹⁹¹ Treva J. Tucker, *From Destrier to Danseur*, 39-40. Norbert Elias makes a similar argument. See Elias, *The Court Society*, trans. Edmund Jephcott (New York: Pantheon Books, 1983), 253.

¹⁹² Later images of carousels in France, such as for those celebrated at the court of Louis XIV, are pictorial rather than diagrammatic. These include images of large crowds viewing a spectacle or individual portraits of riders in elegant costumes on their horses. These do not display the series of diagrammatic patterns included in this print from Bologna.

¹⁹³ *Ballet de Monseigneur le duc de Vendôme, dansé lui douzième en la ville de Paris dans la grande salle de la maison royale du Louvre* (Paris: J. de Heuqueville, 1610), 36.

were meant to move from one pattern to another. Instead, they indicate beginning and/or ending configurations.

The physical display of virtues in the bodies of highly ranked persons dancing at court made nobility visible. These spectacles maintained or negotiated social hierarchies over the course of the event and then afterwards in commemorative prints. They functioned like the ubiquitous processions through towns in early modern Europe that Robert Darnton describes so colorfully, revealing “the *dignités, qualités, corps*, and *états* of which the social order was thought to be composed.”¹⁹⁴ That these dances and processions were printed and disseminated, I argue, spread the influence of these spectacles – and the social and political hierarchies they reified – beyond the population of onlookers at an event.

Beauchamp/Feuillet Notation

In the 1670s, Louis XIV commissioned Pierre Beauchamp (1631-1705) to invent a system of notation for dance to parallel that of music.¹⁹⁵ Throughout his reign, Louis XIV had employed spectacle – theater, dance, and horse ballets – to promote the visibility and importance of the crown.¹⁹⁶ One of his first acts of his personal rule of France was to establish the *Académie Royale de Danse* [Royal Academy of Dance] in 1662.¹⁹⁷ The

¹⁹⁴ Robert Darnton, *The Great Cat Massacre and Other Episodes in French Cultural History* (New York: Basic Books, 1984), 116.

¹⁹⁵ Ivor Guest, in *The Paris Opéra Ballet*, 9, writes that Louis XIV commissioned Beauchamp while in Chambord in 1674 but does not cite a source for this information.

¹⁹⁶ Control of nobles through their required participation in time-consuming, expensive state functions was an important piece of government policy under Louis XIV; however, as Jean-Marie Apostolides and other scholars have pointed out, Louis XIV’s state machinery eventually took on a life of its own. See Jean-Marie Apostolides, *Le roi-machine: spectacle et politique au temps de Louis XIV*, Arguments; (Paris: Editions de Minuit, 1981). See also Peter Burke, *The Fabrication of Louis XIV* (New Haven: Yale University Press, 1994).

¹⁹⁷ Louis XIV, *Lettres patentes du roy, pour l’établissement de l’Académie royale de danse en la ville de Paris . Vérifiées en Parlement le 30 mars 1662* (Paris: P. Le Petit, 1663), 14. Of the premiere French

thirteen members of the academy were charged with meeting once a month “to confer, advise, and deliberate on the perfection of the art of dance and to correct excesses that may have been introduced.”¹⁹⁸ In his preamble to the letters patent establishing the academy, Louis XIV counted the “Art of Dance” as “one of the most honorable & most necessary for the formation of the body.” Dance, being “the best and most natural” preparation for all sorts of exercises, was found to be particularly suitable for the exercise of arms. Thus it was especially useful for the second estate: the role of the nobility in society was traditionally linked to the military. This class was singled out in the letters of patent by Louis XIV as “our Nobility and others who have the honor to approach us.” Dance was thus explicitly paired with Louis’ militarization of France. However, the preamble goes on to note that dance was useful “not only in times of war but also in times of peace for performance in the king’s ballets.” Louis XIV skillfully employed dance as a political tool by requiring the presence of powerful aristocrats at court where their energy was devoted to participating in court rituals that included dancing at a high level.¹⁹⁹ Louis XIV employed this strategy throughout his long reign to prevent rivals from fomenting revolts such as he had experienced as a child during the *Fronde* uprisings.²⁰⁰ With the founding of the *Académie Royale de Danse* and the subsequent commissioning of a notation system for dance to parallel that of music, Louis XIV raised standards of performance for both nobility and professionals.

academies, it was preceeded only by the *Académie française*, established in 1635, and the *Académie royale de peinture et de sculpture*, founded in 1648.

¹⁹⁸ Louis XIV, *Lettres patentes du roy*, 14.

¹⁹⁹ See, for example, Wendy Hilton, *Dance of Court and Theater: The French Noble Style, 1690-1725* (Princeton, NJ: Princeton Book Company, 1981); Georgia Cowart, *The Triumph of Pleasure: Louis XIV & the Politics of Spectacle* (Chicago: University of Chicago Press, 2008); and Mark Edward Motley, *Becoming a French Aristocrat: The Education of the Court Nobility, 1580-1715* (Princeton, NJ: Princeton University Press, 1990), 57.

²⁰⁰ Hilton, *Dance of Court & Theater*, 8–9.

Beauchamp had been appointed director of the *Académie Royale de Danse* in 1671. He had danced at the side of Louis XIV since the king made his royal debut at age 15 as Apollo, the Sun King, in the 1653 *Ballet de la Nuit*. After his morning ride, Louis XIV took daily dance lessons from Beauchamp, signaling to courtiers that dancing was “as essential an accomplishment for a gentleman as fencing.”²⁰¹ Beauchamp’s father, Louis Beauchamp, played violin in the King’s *grande bande* – the elite group of twenty-four violins that played during the king’s evening meal and for the daily ritual of the King’s “Levée,” as well as on special occasions such as royal balls, banquets, and birthdays. Thus, the younger Beauchamp learned to play the violin from his father alongside developing his skill in dance.²⁰² Most dance teachers played the violin. They usually accompanied dance lessons on a tiny violin (an instrument sometimes referred to as a “pocket” violin or even simply as a “dancing master”). Beauchamp’s training in music, especially during a time when musical notation was becoming standardized, proved pivotal in his invention of an exceptionally well-conceived dance notation system. Beauchamp did not benefit materially however from the publication of his work.²⁰³ Instead, another dancing master, Raoul Auger Feuillet (c. 1660-1710), published a

²⁰¹ Guest, *The Paris Opéra Ballet*, 6.

²⁰² See Régine Astier, “Pierre Beauchamp: The Illustrious Unknown Choreographer, Part 1,” *Dance Scope* 8, no. 2 (1974): 30–42; Régine Astier, “Pierre Beauchamp: The Illustrious Unknown Choreographer, Part 2,” *Dance Scope* 9, no. 1 (1974): 30–45.

²⁰³ Indeed, the notation was called Feuillet notation until recently. Only two choreographies attributed to Pierre Beauchamp still exist, a Sarabande and Rigadoun, both in manuscript. They are catalogued in Meredith Little and Carol Marsh, *La Danse Noble: An Inventory of Dances and Sources* (Williamstown MA: Broude Brothers, 1992), MS-10 and MS-30.

detailed account of the system under his own name in 1700.²⁰⁴ Although Beauchamp took Feuillet to court, the judge did not rule in his favor.²⁰⁵

Another dancing master named in Beauchamp's suit, André Lorin (fl. 1698), had also attempted to curry favor with Louis XIV by inventing a system of dance notation.²⁰⁶ Lorin's *Livre de Contredanses* (1698) consists primarily of a series of different sequential patterns (see Figure 3.7). Rather than using symbols to represent dancers, Lorin includes tiny pictures of dancers, four couples to a page arrayed in lines of men and women, each in a slightly different outfit. Four bars of music are included at the top of the page and small diagrams under each measure indicate the movement to be performed: a two hand turn between lady 2 and gentleman 1. A dotted line shows the "line of dance," i.e. the pattern lady 2 and gentleman 1 follow as they take two hands and turn once around, then return to their places. That Lorin devoted an entire page to illustrating what is a very simple move reveals just how difficult it is to notate movement of the body. The Beauchamp/Feuillet system analyzed the mechanisms of movement to create a system that could convey complicated movements with extremely simplified symbols. As musicologist Jean Guilcher observes, Lorin's system was inferior because he attempted to associate the abstract with the senses while Beauchamp's system addressed movement in a purely intellectual way.²⁰⁷

²⁰⁴ Raoul Auger Feuillet, *Chorégraphie Ou L'Art De Décrire La Dance* (Paris: Auteur, 1700).

²⁰⁵ While the judge acknowledged Beauchamp as the originator of the system, Beauchamp had not pursued publication, therefore, the judge did not penalize Feuillet for publishing it. Two other dancing masters, André Lorin and DeHaise, were named in the suit but their systems were not judged to be pirated versions of Beauchamp's dance notation. Régine Astier, "Pierre Beauchamp: The Illustrious Unknown Choreographer, Part 1," *Dance Scope* 8, no. 2 (1974): 30–42.

²⁰⁶ J.-M. Guilcher, "André Lorin et l'invention de l'écriture Chorégraphique," *Revue d'histoire Du Théâtre* (1969): 256–59.

²⁰⁷ Guilcher, "André Lorin," 264.

The process of printing and disseminating dances in the Beauchamp/Feuillet notation helped codify and standardize the noble style as aristocrats and their emulators rehearsed and performed in courts throughout Europe and the colonies using the notation as a shared inscription device. By focusing on particular parts of the body, the notation signaled what counted in the presentation of the noble body: smooth movement across the floor, a graceful, curved carriage of the arms, and, especially important, the gestures and beautiful inclinations of the foot.

As we have seen, acquiring a noble bearing, along with “natural” skill in dance, had been a matter of emulation and private lessons in the home, far from the scrutiny of outsiders. This changed with Feuillet’s 1700 publication of *Chorégraphie* and the rush of subsequent translations, treatises and choreographies published during the first quarter of the eighteenth century. The first edition of Feuillet’s *Chorégraphie* quickly sold out. The *Mercure galant* included an animated review:

To respond to your questions concerning the opinion that one makes about the book of Choregraphy, written by Mr. Feuillet, which is the first to find the secret of describing Dance for us with so much artistry, I will tell you that the Public uses it, and that all the Dancing Masters dispersed throughout Europe, make good use of what he has invented. They buy this Choregraphy and the demand is so great that we will have to make a new edition of it soon. This tells you in a few words how much it is esteemed. It must be admitted that what is useful becomes in some way necessary, and that which is convenient, easy, and enjoyable all at the same time, cannot fail to attract universal approbation. All these advantages are found in the book we are discussing.²⁰⁸

As the review continues, one learns that each dance will cost only ten sols, a modest sum which will appeal to both “dancing masters and the *Curieux*.”²⁰⁹

²⁰⁸ *Mercure galant* (Paris: Michel Brunet, May 1700), 197-99.

²⁰⁹ The term *Curieux* here could refer simply to interested persons; in the eighteenth century, this term could also, more specifically, refer to the person of taste whose interests encompassed both science and aesthetics. Bettina Dietz and Thomas Nutz, “Collections Curieuses: The Aesthetics of Curiosity and Elite

Feuillet anticipated a widespread demand for notations of the latest dances and his publications were indeed successful. In the preface to his *Chorégraphie*, he promised another collection of dances to be published soon. Since Feuillet's privilege to print and distribute his dances was only for six years, he quickly released a collection of sixteen dances (these are often found bound with his *Chorégraphie* treatise). In 1701, Feuillet published a collection of another fourteen dances composed by Beauchamp's successor under Louis XIV, Louis Pécour (1653-1729). Dance notation was invented in France, but it did not stay there. Very soon after, other dancing masters translated Feuillet's treatise and/or circulated their own dance choreographies using the system. Most were published in inexpensive octavo editions although Feuillet's 1709 edition was published in quarto.²¹⁰ Over the course of the eighteenth century, over three hundred and fifty dances were published.²¹¹ Twenty-five years ago, there were four hundred and forty-five extant copies of published notation and sixteen manuscript collections (containing two hundred and twenty eight dances in manuscript alone). These publications can be found in nearly sixty libraries all over the world.²¹²

Perhaps in an effort to boost sales, the authors of treatises on the Beauchamp/Feuillet system went to great lengths to claim that one could learn to dance solely with the purchase of their books. The title page of Raoul Feuillet's seminal 1700 *Chorégraphie*, for example, states "with this [manual], one easily learns by oneself all

Lifestyle in Eighteenth-Century Paris," *Eighteenth-Century Life* 29, no. 3 (2005): 44–75. See especially pp. 46–47, and 50.

²¹⁰ Each page of an octavo edition was printed on an eighth of a large sheet of paper; a quarto edition (quarter of a sheet) would be double that size. Feuillet's 1700 edition of *Chorégraphie* did not indicate a price, but the single dance, Aimable Vainqueur, sold for six sols or about \$3 (see fn 265).

²¹¹ Many more have been found, but they have not been systematically catalogued.

²¹² Meredith Little and Carol Marsh, *La Danse Noble: An Inventory of Dances and Sources* (Williamstown MA: Broude Brothers, 1992), xv-xvi, 91-139.

sorts of Dances.” It is advertised as a “Work very useful for the Dancing Master & for all those persons who apply themselves to the Dance.” John Essex (1680-1744), introducing his treatise on the Beauchamp/Feuillet notation, writes that it is “adapted to the Meanest Capacity” – even the least intelligent reader could understand it. The dancing master John Weaver (1673-1760), explaining the French dance notation to an English audience, promised to teach “The whole Art [of dancing]...with compleat Tables of all Steps us’d in Dancing, and Rules for the Motions of the Arms, &c. Whereby Any Person (who understands Dancing) may of himself learn all manner of Dances.” In Germany, dancing master Gottfried Taubert (1670-1746) likewise qualifies his promise that by means of his treatise, “each one ...can learn from it himself all kinds of dance without much effort,” adding in parentheses that the reader should be “prepared in the fundamentals.”²¹³

As Weaver and Taubert caution, learning the fundamentals of court dance – how to carry oneself and how to move – was a prerequisite.²¹⁴ One dancing master, a M. Dupré (n.d.) of Mans, was reluctant to publish his knowledge, fearing a student would become a competitor. He finally published his *Méthode Pour Apprendre de Soi-Mesme La Chorégraphie* in 1757 out of “the love I have for the Arts I teach, for the public, and especially for my students,” who had apparently requested something in writing to supplement their lessons.²¹⁵ It explains completely in text how to perform the most popular dances of the time. It seems that readers would have already had the engraved notations for these popular dances in hand but were not able to decipher all of the steps.

²¹³ Gottfried Taubert, *The Compleat Dancing Master: A Translation of Gottfried Taubert’s Rechtschaffener Tantzmeister (1717)*, trans. Tilden A Russell, 2 vols. (New York: Peter Lang, 2012), title page.

²¹⁴ In this discussion, I have used sources from throughout Europe. Court dance and the notations that described them were considered French regardless of where they were taught or danced.

²¹⁵ “L’amour que j’ai pour les Arts que j’enseigne, pour le Public, & en particulier pour mes Eleves” M. Dupré, *Méthode Pour Apprendre de Soi-Mesme La Choregraphie Ou l’art de Decrire et Déchiffrer Les Danses Par Caractères, Figures & Signes Démonstratifs* (Mans, France: Charles Monnoyer, 1757), 5.

Most dances in chorégraphie were published separately from the treatises. Dupré offers to send the dances in *Chorégraphie* if the reader sent him a stamp for postage. A copy of Dupré's *Méthode* held by the British Library included a manuscript copy of the last dance described tucked in the back of the book. This was a dance composed by Dupré, unlike the rest of the dances described in the book which were by Pécour and other more well-known dancing masters.

The Beauchamp/Feuillet notation contributed significantly to establishing a growing cadre of dancing masters. While Feuillet's first publication in 1700 seems optimistic that the public will be interested in buying his book to learn how to dance on their own, other authors geared their manuals to dancing masters and aspiring dancing masters. In 1725, P. Siris advertised a dance he had composed, *The Diana*, "written in characters for the use of the Masters." He offered it *gratis* "to all the Dancing Masters in England," if they would only send their names and come to his house.²¹⁶ Of the one hundred and sixty-nine subscribers to the 1735 *Art of Dancing Explained by Reading and Figures* by Kellom Tomlinson (c.1690-after 1753), twenty-three were dancing masters.²¹⁷ Describing the audience for his book, he writes that he has written "for the amusement of the curious, the farther Illustration of this Work, and the Instruction of such as are desirous to understand the Characters of Dancing."²¹⁸ Tomlinson strongly encouraged the use of the notation, writing, "in his humble Opinion teaching to *play by ear* and to *Dance*

²¹⁶ P. Siris, "This Day Was Publish'd," *Evening Post*, May 6, 1725, no. 2463.

²¹⁷ Kellom Tomlinson, *The Art of Dancing Explained by Reading and Figures Whereby the Manner of Performing the Steps in Made Easy by a New and Familiar Method: Being the Original Work First Design'd in the Year 1724, and Now Published by Kellom Tomlinson, Dancing-Master. In Two Books.* (London: Printed for the author and are to be had of him, at the Red and Gold Flower Pot next door to Edwards's Coffee-House, over against the Bull and Gate, in High-Holbourn, 1735).

²¹⁸ Tomlinson, *Art of Dancing*, after title page.

without Book are equally wrong & ought to be discontinued.”²¹⁹ In his Preface, Tomlinson explicitly directs his treatise to amateurs. He writes that the works of Beauchamp and Feuillet “both relate only to the Characters of Dancing: which, like the Notes of Music, can be only useful to Masters, and cannot be understood by any other without their particular Instructions.”²²⁰ In contrast, Tomlinson says,

the Piece which I here offer to the World will be of general Use to all, who either have learned, or are learning to dance: the Words describing the Manner in which the Steps are to be taken; and the Figures representing Persons as actually taking them; both which together will make the Learning more pleasant to the one, and serve as a continual Remembrancer (sic) to the other.²²¹

A clue to how dance notations were used by amateurs is offered by P. Siris when he writes that he has included in his treatise a Rigaudon which is “Short, Gentile, and Easy.” He continues to explain that since this particular dance was well-known to everyone, this facilitated the study of the written notation.²²² He suggests learning this dance (from a dance master or another dancer) and then comparing the steps one has learned to the notation to make the connection between the diagram and the dance. The publication of treatises and notations thus provided a new source of income for dancing masters.

That the composition, notation, and publication of dances was, for the first time, an important aspect of the dancing master as is evidenced by the notation proudly displayed in the portrait of Pécour (see Figure 3.8). He is not shown dancing but rather holding a piece of notation that is apparently of his own composition. Representing

²¹⁹ Tomlinson, *Art of Dancing*, Preface.

²²⁰ Ibid.

²²¹ Ibid.

²²² P. Siris, *The Art of Dancing, Demonstrated by Characters and Figures; Whereby One May Learn Easily, and of One's Self, All Sorts of Dances, Being a Work Very Useful to All Such as Practise Dancing, Especially Masters. Done from the French of Monsieur Feuillet, with Many Alterations in the Characters, and an Addition of the English Rigaudon, and French Bretagne* (London: printed for the author, and may be had of him, at his house in Newport Street, 1706), Preface.

himself as not only a dancer but as a *composer* of dances – what we would call a choreographer – Pécour marks a transition in the practice of dance similar to that occurring in music. In the seventeenth century and earlier, professional instrumentalists had relied heavily on improvisation in their performances. They often worked from scores in which some of the notes were indicated (i.e. in a “figured bass” line) but others were left to be filled in by a well-versed professional. During the eighteenth century, the rise of accomplished amateur musicians was accompanied by a rise in music published specifically for dilettante of this period.²²³ These scores were paradoxically *more* complex as they were meant to be played as written.²²⁴ Likewise, the invention of Beauchamp/Feuillet dance notation provided instructions for accomplished elite students of dance and their dancing masters rather than for professional dancers on stage whose repertoire included a much larger vocabulary of steps that could be improvised and as well as more extravagant gestures.²²⁵

The Beauchamp/Feuillet system, unlike the earlier notations discussed above, includes a plethora of different kinds of information juxtaposed on the same page. Similar to many of the early examples – the *carousel* print, the diagrams of Ménéstrier or the figures for the *Ballet de Monseigneur le duc de Vendôme* – the view is from above, as if the choreographer were looking down, suspended in the air. A dance notated in the

²²³ See Roger Chartier, “Afterword: Music in Print,” in Kate Van Orden, ed., *Music and the Cultures of Print*, (New York: Garland Publishing, 2000), 325-41.

²²⁴ Kimary Fick, “Aesthetics and the Amateur Keyboardist: Historical Approaches to Character and Expression in the Music of C.P.E. Bach” (Musicking, University of Oregon, April 12, 2018); Cameron Steuart, “The Division of Taste: Diminution in the Treatises of Leopold Mozart and Giuseppe Tartini” (Musicking, University of Oregon, April 12, 2018). Steuart argues that Leopold Mozart’s choice to treat diminution (improvised embellishments and variations) only superficially “was rooted more in an anticipation of the needs and abilities of his intended readership than it was in any aesthetic shift.” Because Mozart was writing for amateurs, he expected them to be reading from more fully notated scores.

²²⁵ See Edmund Fairfax, *The Styles of Eighteenth-Century Ballet* (Lanham, MD: Scarecrow Press, 2003).

Beauchamp/Feuillet system consists of several pages, each page printed from an engraved plate.²²⁶ A “line of dance” or path [*le chemin*] for each dancer marks the pattern of movement. These lines run in a pleasing symmetry, with axial and mirror patterning. Starting positions on each page are designated by a half circle for a man and a half circle with a dot in the middle (or sometimes a double half circle) for a woman.²²⁷ Small symbols located alongside the lines for steps indicate whether the dancer is to bend or rise, spring or slide, or complete any number of other movements. For example, a *glissade* [sliding step] is indicated by a “T” on the side (see Figure 3.9). Feuillet included numerous charts. Jumps could be performed in a number of ways (see Figure 3.10). The *coupé*, comprised of a bend and rise, also could be performed with numerous variations but always finished with the entire body poised in an erect, active position – a noble pose (see Figure 3.11). The foot is of central importance as it is the main body part indicated by the notation. The step symbol represents itself is a representation of a foot with a small dot standing for the heel [*Le Talon*] and the rest of the foot indicated by a line connected to the dot (see Figure 3.12). The placement of the music at the top of the page corresponded to measures marked in the dance and served as a constant reminder of the centrality of the monarch in court dance: the notation was always held with the top of the page oriented toward the throne regardless of which way the dancer is facing (see Figure 3.13).²²⁸ After bowing, the beginning of every court dance moves respectfully towards the king (*la présence*). The omnipresent monarch was always acknowledged in court

²²⁶ There are also a number of extant dances in manuscript. Meredith Little and Carol Marsh, *La Danse Noble: An Inventory of Dances and Sources* (Williamstown MA: Broude Brothers, 1992); Francine Lancelot, *La belle dance: catalogue raisonné fait en l'an 1995* (Paris: Van Dieren, 1996).

²²⁷ The straight line across the half circle indicates the front of the dancer; the rounded part is the back of the dancer.

²²⁸ The number of measures in the music at the top of each page corresponds to the number of measures marked in the dance notation with a small line across the line of dance.

dances – even when the king was not physically present – through the orientation of the choreography. This was an important aspect of dance in the noble style reinforced by the diagrammatic notation that made this clear similar to the way early modern European maps made north the top of the world.

L’Aimable Vainqueur

L’Aimable Vainqueur [*Amiable Conqueror*] (see Figure 3.14) was one of the most famous dances in the eighteenth-century canon.²²⁹ The six pages of notation were first published in 1701 and advertised as a *Dance Nouvelle Dancée devant le Roy a Marly* [New Dance Danced in front of the King at Marly].²³⁰ Marly was Louis XIV’s hunting lodge southwest of Paris. Monsieur Pécour is listed as the composer of the dance and Mr. Feuillet as the “Author of the *Chorégraphie*.” The composition of the dance and the notation of dances were separate tasks requiring specialized knowledge and skill. Not until the 1835 edition of the *Dictionnaire de l’Académie française*, 6th Edition (1835) did definitions of *chorégraphie* include the composition of dances.²³¹ The 1701 version of *L’Aimable Vainqueur* is for a couple and was danced first by Mr. le Comte de Brionne and Mademoiselle de Bernonville, then, as was the custom at a formal ball, it was danced

²²⁹ The dance was sometimes known as the *Louvre*, and appears as “amable vencedor” in several Spanish colonial manuscripts. With thanks for James Middleton for this and for pointing out the music in the painting in Mexico City cited below.

²³⁰ Attesting to its popularity, there are numerous extant copies of different versions (for a couple or for a man) of *Aimable Vainqueur* choreography in manuscript and print, as well as music.²³⁰ A virtuosic solo choreography for a man is subtitled, “*non dancé a l’opera*” [not danced at the opera], which suggests it was especially appropriate for court.

²³¹ In the fourth and fifth editions of *Dictionnaire de l’Académie française* in 1762 and 1798 respectively, and in Jean-François Féraud’s *Dictionnaire critique de la langue française* (1787-88), “*Chorégraphie*” initially referred only to the process of inscribing dances, the “*Art de noter les pas et les figures d’une danse*” [Art of writing the steps and figures of a dance], not to the process of creating a dance. *Chorégraphie* is the correct spelling in eighteenth century France to refer to the writing of dance notation, not “*choréographie*.” However, when referring in English to dance notation or composition, I am using the spelling “choreography.”

by other courtiers, one couple at a time, over and over, which reportedly “made his majesty [Louis XIV] very satisfied.”²³²

As one of the most widely danced choreographies notated in Beauchamp/Feuillet system, references to *L’Aimable Vainqueur* are found in numerous places and unexpected contexts. On a painted screen in c. 1760 Mexico City, for example, a fashionable couple stands poised to dance in the center panel while a young woman among the musicians on the left holds the music for *L’Aimable Vainqueur* so that the gamba player can read the tune (see Figure 3.15).²³³ The tune also appears in J. Lebas’ 1738 book of recipes, *Festin joyeux* [Joyous Feast] which presents instructions for making dishes such as mussel soup through poetry set to popular songs (such as *L’Aimable Vainqueur*).²³⁴

L’Aimable Vainqueur was only one of the hundreds of dances published in the Beauchamp/Feuillet system.²³⁵ Starting in 1700, Feuillet published collections of new dances nearly every year in Paris, the center of *La Belle Danse* between 1700 and 1725. Although Louis XIV had less interest in dance and more in religion at the end of his life, the dance tradition he established continued to be widespread well after he had stopped dancing himself. Translations, editions, and new collections appeared in England,

²³² Guillaume-Louis Pécour, “Au. Lecteur” [To the Reader], *Aimable Vainqueur, Dance Nouvelle Dancée Devant Le roy à Marly, de La Composition de M. Pécour et Mise Au Jour Par M. Feuillet* (Paris: M. Brunet: 1701).

²³³ See exhibit catalogue: Ilona Katzew, editor, *Painted in Mexico, 1700-1790: Pinxit Mexici*, (Los Angeles: Prestel, 2017).

²³⁴ J. Lebas, *Festin joyeux, ou, La cuisine en musique, en vers libres ...* (Paris: Lesclapart pere, etc., 1738), 131-133 (vue 249-251), music on p. 24 (vue 334). As in printed ballads, often a number of different poems (or, in this case, recipes) were matched to the same tune. *Festin joyeux* included twenty-three pages of music notation and two tables of contents: one for the recipes, the other for the tunes.

²³⁵ As new choreographies have continued to be identified in the archives, the number of extant dances has increased to about four hundred and fifty, from the over three hundred catalogued in Meredith Little and Carol Marsh, *La Danse Noble: An Inventory of Dances and Sources* (Williamstown MA: Broude Brothers, 1992). See Karin Modigh, “Music forms & Feuillet notation,” Programme (Löftadalen, Sweden: Nordic Baroque Dancers & Löftadalen Conservatory International Summer Academy of Baroque Dance brochure, 2018), 23.

throughout continental Europe, and in Cuba and Brazil during the long eighteenth century.

Where One Danced

There were numerous occasions on which a courtier might dance. At a formal *grand ball*, the king sat at the top of the room and, as we have seen above, one couple at a time presented a prepared dance (see Figure 3.16). Spectators were as much on display as dancers and elegant dress marked rank, as well as one's place in the hall. Depending on the event, a court ball might consist of an opening *branle*, a processional dance dating back to the age of chivalry. Court balls were spectacles. Hundreds of people came to dances expecting to watch rather than perform. So similar did this aspect of dance at court and theater remain that, according to Wendy Hilton, "in the early eighteenth century a couple dance might be performed first by professionals in the theater, and then adopted as a ballroom dance; this did not mean that theatrical dance was simple, but that social dance was complex."²³⁶ At the beginning of the eighteenth century, professional dancers of a high caliber in the theater were rare. Therefore, members of the nobility, who had trained in dance since they were young, were allowed to appear in public performances in opera ballets through privileges specifically granting them the right to perform "without prejudice to their rank."²³⁷

Court spectacles often included dances organized around a theme. On February 17, 1700, the King and Queen of England arrived at Marly. An hour and a half later, a ball began with *Monseigneur* ("Le Grand Dauphin," the eldest son of Louis XIV) arriving

²³⁶ Hilton, *Dance of Court & Theater*, 9.

²³⁷ Guest, *The Paris Opéra Ballet*, 8. It is not clear how many, if any, aristocrats actually performed in theatrical productions.

on a Palanquin carried by slaves and preceded by a large number of courtiers dressed as wild animals from the king's menagerie including Ostriches, Demoiselle Cranes, Monkeys, Bears, Parrots, and Butterflies. They were followed by Officers, Turkish Slaves, and Sultans, who danced an entrée together with those costumed as animals. These sorts of court entertainments took a great deal of planning and preparation on the part of courtiers and their servants.²³⁸ Pictures of these court spectacles celebrated these performances, but as they were not meant to be duplicated, they were not set down in notation.

While large ceremonial balls required a great deal of preparation and practice, presumably with the assistance of professional dancing masters and musicians, an aristocrat also needed to be prepared for impromptu dances. Notations were useful for learning standard dances ahead of time. In March 1707, for example, a “bal de hasard” [ball of happenstance] took place after dinner, prompted by the Duc de Berry who invited one of the guests to dance a minuet.²³⁹ Unlike most court dances, the *menuet ordinaire* [usual minuet] followed a set pattern: after the introduction and bows, the couple danced to the side and then on the diagonal to pass in an “S” curve typical of the Baroque arabesque design. This was modified to a “Z” pattern which was thought to be more flattering later in the eighteenth century. After several repetitions, the man would signal a right hand turn, and then a left hand turn, another “S” or “Z” pattern and then a two hand turn to complete the dance. This geometric patterning was so ingrained in the trained,

²³⁸ *Mercure galant* (Paris: Michel Brunet, February 1700), 222-24.

²³⁹ As reported in the *Mercure galant* on March 20, 1707. Richard Templar Semmens, *The Bals Publics at the Paris Opéra in the Eighteenth Century* (Hillsdale, NY: Pendragon Press, 2004), 2. The Duc de Luynes also described a *bal de hasard* that occurred on Feb. 19, 1744 in his *Mémoires* of life at the court of Louis XV.

noble body that the subtle difference between an “S” and a “Z” would have been quite striking. In orienting the dancer to the notation as it related to the space of the ballroom, Pierre Rameau noted the underlying math: “These different figures are formed with the help of geometric lines, which guide [the dancer] from one place to another, and in consequence, trace a sure path, making the dance conform to the rules.”²⁴⁰

A number of dance notations in the Beauchamp/Feuillet system were published with the subtitle, “as danced at the opera.” Dance notations with annotations such as the “Saraband of Issee, ‘performed by Mr. Düpré & Mrs. Büllock’ or a “Saraband, ‘danc’d by Monsr. Marcell and Madle. Menais at Paris 1720’” or the “Loure pour deux hommes, ‘Dancée par Mr. Blondy et Mr. Philbois à l’Opera de Scilla’” or the “Gigue pour une femme, ‘Seul nom dancé a Lopera’” or simply “as danced by Mr. Blondy at the opera,” were common features of dances notated, engraved, and sold by Feuillet and (later) by other publishers of dances notated in the Beauchamp/Feuillet system.

The *bals publics* were inaugurated almost immediately after the death of Louis XIV.²⁴¹ These took place in the Opera house in Paris close to the residence of the Regent, the Duc d’Orléans, which was, significantly, away from the confines of the court at Versailles. These balls were theoretically open to the public, however the entry fee was substantial, suggesting that this was an arena for the movers and shakers of society.²⁴² At court, social hierarchies were made visible in the order of social dance or in the parts played in court performances. Drawing on the work of Norbert Elias, dance scholar

²⁴⁰ Pierre Rameau, *Abbrégé de La Nouvelle Methode, Dans l’art d’écrire Ou de Traçer Toutes Sortes de Danses de Ville* (Paris: Chez l’auteur, faubourg St Germain, 1725), 3.

²⁴¹ See Richard Templar Semmens, *The Bals Publics at the Paris Opéra in the Eighteenth Century* (Hillsdale, NY: Pendragon Press, 2004), 31. Semmens attributes this to an intensification of patronage and clientage across class boundaries under the astute machinations of the Regent Duc d’Orléans.

²⁴² This is convincingly argued by Semmens, *Bals Publics*, 32–33.

Richard Semmens explains, “In eighteenth century France [class] distinctions were particularly prominent, and, for the upper classes, the visible display of rank through dancing at a ball was certainly one of the more conspicuous ways in which that portion of society was able to demarcate its boundaries, to set itself apart from the others.”²⁴³

Masquerade balls were held frequently, particularly during the carnival weeks before Lent.²⁴⁴ Since the identity of the dancer was hidden, these balls were theoretically open to anyone who could dress the part, however, the enormous expanses of expensive cloth required for formal attire would have excluded most of the population. There was, nevertheless, a growing contingent of ambitious bourgeois elites who emulated the manners and ideals of nobility. This emulation included the practice of court dance. At a masked ball, the wearing of a mask or costume might conceal the identity of a dancer making it possible for elite members of the third estate – if they were educated in the art of dance – to dance with those of higher rank. At court dances, the identity of dancers was usually known, however, at other dances, a disguise could confer the power of anonymously pursuing a partner of unequal rank. To unmask and be recognized in the midst of such amorous adventures was to be avoided; to be hidden in a costume also gave aristocrats, even the king, license to pursue someone of a lower class.²⁴⁵ At a masked ball in 1745, Louis XV came dressed as a yew, identical in costume to seven of his courtiers. As the evening progressed, he left with Madame D’Etoiles (later Madame du

²⁴³ Semmens, *Bals Publics*, 107.

²⁴⁴ Thirteen masquerade balls were held in the month of February alone in 1700. These often featured exotic themes such as a “Mascarade of Amazones” to a “Mascarade of the Chinese” to the “Mascarade of Animals” described above. *Mercure galant*, February 1700, 154, 155, 157, 159, 164, 165, 166, 168, 169, 222, 224, 228, 229, 279.

²⁴⁵ Semmens, *Bals Publics*, 92-106.

Pompadour), who became the first official royal mistress (*maîtresse déclarée*) in France to come from the bourgeoisie.²⁴⁶

The presentation of Madame de Pompadour at court on September 14, 1745 marked a turning point in the status of bourgeoisie in France. Kings of France had long entertained mistresses whose power rivaled that of queens, but officially recognized mistresses had always come from the noble class. Pompadour was the first bourgeois to hold this position. Her ability to dance played a key role in her achievement. Jeanne Antoinette Poisson (1721-1764, later Madame de Pompadour) had been born into a wealthy Parisian family but she was considered a member of the third estate (even though the powerful Charles François Paul Le Normant de Tournehem, may have been her biological father).²⁴⁷ The wealthy De Tournehem made sure Jeanne Antoinette received the best education. She studied at the Ursuline convent at Poissy and then under numerous private tutors in Paris, including the dancing master Guibaudet.²⁴⁸ As was reported by eye-witnesses at the court presentation in 1745, Madame du Pompadour, accompanied by her sponsor, the Princess de Conti, as well as Mme d'Estrades and Madame de Lachau-Montauban, performed this court ritual perfectly:

...crossing the threshold of the King's council chamber, the Marquise made a deep curtsey, took several steps and bowed down again, then walked right up to

²⁴⁶ Olivier Bernier, *The Eighteenth-Century Woman* (New York: Metropolitan Museum of Art, 1981), 36-40.

²⁴⁷ This seems to be the consensus view, a plausible claim given the circumstances of her family and his interest in Jeanne Antoinette's advancement. De Tournehem had gained his fortune as a tax farmer (*fermier-general*), had served as the French ambassador to Sweden, and had been a director of the *Compagnie des Indes*. The "de" in his name does not necessarily mean he was a noble. The many "Poissonades" - derogatory songs about Mme de Pompadour's lowly origins indicates that she did not gain noble status through her benefactor. Evelyne Lever, *Madame de Pompadour: A Life* (Macmillan, 2003), 25; Elise Goodman, *The Portraits of Madame de Pompadour: Celebrating the Femme Savante* (Berkeley: University of California Press, 2000), 7; Kaiser, "Madame de Pompadour and the Theaters of Power," 1027.

²⁴⁸ Thomas E. Kaiser, "Madame de Pompadour and the Theaters of Power," *French Historical Studies* 19, no. 4 (1996): 1027.

the monarch and bowed deeply for the third time. ‘The conservation was very brief and the embarrassment great on both sides...then with confident movements, the Marquise walked backward, curtseying again three times as required by protocol.’²⁴⁹

Madame de Pompadour had effectively made her way to the highest echelons of society on the basis of her personality, education, and physical deportment. Pompadour’s presentation to the court in 1725 astonished the hundreds of courtiers attending the ceremony who did not expect her to walk and move as a noble so convincingly.²⁵⁰

Dance in the Encyclopédie

Madame de Pompadour was an avid supporter of the *Encyclopédie* of Diderot and d’Alembert and was painted sitting in front of her beautifully-bound and expensive folio edition. Like Pompadour, the readers of the *Encyclopédie* were, by and large, readers of means. Lower middle class readers may have perused quarto volumes of the *Encyclopédie* in the membership libraries, *cabinet littéraires*, that were found in towns throughout France, especially toward the end of the eighteenth century. Subscriptions for the quarto sold to lawyers, army officers, administrators and clerics. However, after an exhaustive search of sales records and subscriptions, Robert Darnton concludes that the main readers of the *Encyclopédie* were the “traditional elite.”²⁵¹ The *Encyclopédie* included many articles on activities of interest to elites – military arts, horsemanship, hunting, fencing, art – and dance.

The Chevalier de Jaucourt, who was a nobleman and quite familiar with court dance, wrote ninety-three of the over six hundred articles on dance. However, Diderot

²⁴⁹ Lever, *Madame de Pompadour*, 48.

²⁵⁰ Lever, *Madame de Pompadour*, 47-49; Nancy Mitford, *Madame de Pompadour* (New York Review of Books, 2012), 60-62.

²⁵¹ Robert Darnton, *The Business of Enlightenment: A Publishing History of the Encyclopédie, 1775-1800* (Cambridge: Belknap Press, 1979), 299.

engaged Louis-Jacques Goussier (1722-1799) to write the article on *Chorégraphie*. He seems to have considered the *Chorégraphie* entry as a technical topic. The article gives an overview of how to read the Beauchamp/Feuillet notation and offers a few examples.²⁵² Diderot could not have chosen a more unlikely candidate to write about noble dance.²⁵³ Goussier was far from being the sort of “well-bred man of his day” who would have participated in social dances of high society.²⁵⁴ Dance historians Rebekah Harris-Warwick and Carol Marsh assume that Goussier came from a gentlemanly background; however, they admit that Goussier seems to consider dance notation more on its technical merits than on its representation of an elite aesthetic.²⁵⁵ As they observe, Goussier “examines dance notation as a system of symbolic representation, viewed rather from the perspective of someone sitting at a desk than from that of someone accustomed to holding a book of notations in his hand as he moves around the room.”²⁵⁶ Goussier was a technician and an artist; the dance diagrams he details are technical images. They were meant to explain how to make particular movements in a particular order in a particular way. One did not need to be noble – or even a dancer – to inscribe and publish these diagrams.

²⁵² It also included information on a dance notation system by a late seventeenth-century dancing master known as Jean Favier the elder. See Rebecca Harris-Warrick and Carol G. Marsh, *Musical Theatre at the Court of Louis XIV: Le Mariage de La Grosse Cathos* (Cambridge: Cambridge University Press, 1994), for a discussion of the reconstruction of this notation and its implications for understanding dance of the period.

²⁵³ Georges Dulac, “Louis-Jacques Goussier, Encyclopediste et Original sans Principes,” in *Recherches Nouvelles Sur Quelques Ecrivains Des Lumieres*, ed. Jacques Proust (Geneva: Droz, 1972), 63–110.

²⁵⁴ Harris-Warrick and Marsh, *Musical Theatre at the Court of Louis XIV*, 88.

²⁵⁵ Most of the entry, “Chorégraphie,” is on the Beauchamp/Feuillet notation, however, included in the entry is a discussion of an older style of notation by Favier which uses a musical staff to describe movements of dancers.

²⁵⁶ Harris-Warrick and Marsh, *Musical Theatre at the Court of Louis XIV*, 88.

Goussier is best known for his drawings of workers, tools, and workshops based on his visits to artisan studios. These were scaled down and then sent to a team of etchers who prepared the plates.²⁵⁷ In Goussier's drawings, workers are cartoon-like, their faces and figures anonymous. The rooms in which they work, for the most part, are free of dirt and children. Tools, likewise, do not show any wear but are neatly presented on the page in straight rows, precisely labeled with letters or numbers. In a plate for blacksmithing heavy nails ("*Cloutier*"), for example, the ash from the fire stays confined to the hearth. The smiths themselves are clean-shaven, well-dressed, and tidy as they pound out forty-two different styles and sizes of spikes, nails, and staples (see Figure 3.17). These images in the *Encyclopédie* reflect Goussier's technical approach.

The first of two plates dedicated to "Chorégraphie," includes seventy-six basic notation symbols for steps in the Beauchamp/Feuillet system. These include the so-called "false" positions in which the toes are turned in; these positions would never have been used in *la belle danse*, but only in comic theatrical or peasant dances. Thirty-one of the symbols included indicate the movement of the arms. These were rarely included in published dances at the height of the system's popularity (1700-1725). The remaining symbols on the first page include simple steps forward and back. The step symbols are lined up on the page like tools rather than in the context of a choreographed dance, or even in step by step instructions. On Goussier's page, the steps are not presented in the order in which one would have learned them. The complex *pas torillé* (step with a swirling foot) is shown before the *plié* (plain bend of the knee) and before the common *glissé* (slide on one foot). Thus, the intent is not to lead the reader through the steps

²⁵⁷ Philipp Blom, *Enlightening the World: Encyclopédie, the Book That Changed the Course of History* (New York: Palgrave Macmillan, 2005), 46.

sequentially but rather to give a few examples of how the notation worked. Perhaps in an ironic gesture, Goussier includes the dance notation for “the first ten measures of a dance for two wrestlers, danced by M. Dupré & Javillier in the opera about the festivals of Greeks and Romans.” The choice of Goussier to write this article on “Chorégraphie” therefore says something about how Diderot thought about notations for dance – it is the *design* elements of the notation that interest him for his *Encyclopédie* project, not the actual reconstruction of dances in this style. Harris-Warwick and Marsh also note this lack of interest in the actual practice of dance, writing that Goussier seems to have deliberately omitted information crucial to actually reconstructing dances. Indeed, Jean Georges Noverre (1727-1810) who is credited with creating the first expressive story ballets (the *ballet d’action*) dismissed Goussier’s entry:

[Notation], which was only the rudiment of Dance, has insensibly become a magic spell-book. The very perfection that one wanted to give to the symbols which designates steps & movements only serves to muddle them & and make them indecipherable. The more the Dance becomes embellished, the more the characters multiply, the more this science becomes unintelligible. Judge, please, by the article *chorégraphie* inserted in the *Encyclopédie*; you will surely regard this Art as the dancer's algebra, and I strongly believe that the drawings will not bring any clarity to the dark places of our understanding of dance.²⁵⁸

Diderot himself wrote several articles on dance in the *Encyclopédie*.²⁵⁹ It is remarkable that someone who prided himself on his humble origins, and who had his portrait painted without a wig, would write on what could be considered a topic very much associated with court and aristocratic life, but Diderot was apparently familiar with Beauchamp/Feuillet dance notation. In his early years in Paris, he had studied at the

²⁵⁸ Jean Georges Noverre, *Lettres sur la danse, et sur les ballets*. (Lyon: Aimé Delaroche, 1760), 386-87.

²⁵⁹ These were mostly ancient dances about which nothing was known except their names: Apocinos, Calabrisme, Calatisme. Carpée was an ancient dance in which peasants enact being attacked by robbers. This was danced to give them practice in defending themselves. Diderot also mentions dance in his articles on Gout [Taste], Enfants [Children], and Passionner [Passion] in the *Encyclopédie*.

Collège de Louis le Grand, known for the excellence of its ballets mounted with student dancers.²⁶⁰ Although Diderot attempted without success to learn to dance in the 1730s, his knowledge of noble dance is evidenced by his description in the article “Chemin” [Path] in which he wrote about the line of dance characteristic of dance in the noble style.²⁶¹ In his article, Diderot wrote about the “figures” traced by the dancers and how the notation indicated how steps could be coordinated with the music, “right down to the smallest unit of time, during which the dancer can perform a movement.” Diderot explains dance notation by comparing it to musical notation, “all of *Chorégraphie* consists in tracing these lines, in dividing the entire [dance] in as many equal parts as the air of the dance has measures; in stepping on each of these parts.”²⁶²

Courts throughout Europe emulated France, the most influential power both culturally and politically from the reign of Louis XIV through the eighteenth century.²⁶³ French was spoken in court society and in intellectual circles from London to St. Petersburg, not to mention the West Indies and, at the end of the century, the fledgling United States.²⁶⁴ French dance and dancing masters also traveled. One scholar noted the connection between the diffusion of French culture and French military presence: “French music, whether courtly or for the dance, vocal or instrumental was being diffused [sic] by the musicians of the warships, as well as touring theatre companies licensed by the King. Indeed, on board every naval vessel there was a dancing master

²⁶⁰ See Judith Rock, *Terpsichore at Louis-Le-Grand: Baroque Dance on the Jesuit Stage in Paris* (Saint Louis: Institute of Jesuit Sources, 1996).

²⁶¹ “Chemin” would be called the “line of dance” by choreographers and dancers today. Denis Diderot, “Chemin,” *Encyclopédie*, vol. 3, 280. Regarding Diderot’s dance attempt, see David Coward, “Introduction,” Denis Diderot, *Jacques the fatalist and his master*, trans. David Coward, 2008th ed. (Oxford; New York: Oxford University Press, 1796).

²⁶² Diderot, s.v. “Chemin,” *Encyclopédie*.

²⁶³ H. M Scott and Simms, *Cultures of Power in Europe during the Long Eighteenth Century*, 65.

²⁶⁴ See Marc Fumaroli, *When the World Spoke French* (New York: New York Review Books, 2011).

charged with teaching the sailors all the classic steps, the pas français, glissades, bourrées.”²⁶⁵ Dance served as a common form of entertainment on long voyages.²⁶⁶

Authors of written dances and dance treatises using the Beauchamp/Feuillet system often compared the notation with music and stated it could be sent far and wide. For example, in his “Notes to the Reader” for the dance “Pavane de Saisons” published in 1700, Feuillet offered to compose original dances and to notate ones not yet written down and send them to dancing masters in the provinces and at foreign courts. “I will send a Dance written and composed with the taste the air demands and at a reasonable price,” he promises. In his *Chorégraphie Ou L’Art De Décrire La Dance*, Feuillet claims, “one can send dances in a letter and read them from chorégraphie as easily as one can read from musical notation.”²⁶⁷ Standardization of steps would have been necessary if these pieces were to make sense to those receiving them. Although evidence for dancing masters commissioning Feuillet to notate dances for them has not surfaced, dancing masters throughout Europe did notate their own dances using the notation Feuillet set out in his treatise.²⁶⁸ Over seventy years after Feuillet first wrote that his system would be useful for dancing masters and students not only in Paris but in the provinces and in other kingdoms, the dancing master Le Sieur Clement, in his 1771 publication *Principes de*

²⁶⁵ It may be that aboard ship, there were many *petit blancs* (lower class whites) who traveled to the new world in an effort to better their circumstances. Gabriel Banat, *The Chevalier de Saint-Georges: Virtuoso of the Sword and the Bow*, First Edition edition (Hillsdale, N.Y: Pendragon Press, 2006), 34 quoting Louis, M.A., *La folklore et la danse* (Paris: Mazonneuve et Larose, 1957), 48.

²⁶⁶ Marcus Rediker, *Between the Devil and the Deep Blue Sea: Merchant Seamen, Pirates and the Anglo-American Maritime World, 1700-1750* (Cambridge: Cambridge University Press, 1989), 147, 190. See also Marc-Antoine Caillot, *A company man: the remarkable French-Atlantic voyage of a clerk for the Company of the Indies : a memoir (1730)*, trans. Erin Greenwald, Historic New Orleans Collection (New Orleans, LA: Historic New Orleans Collection, 2013), 20-21, 92.

²⁶⁷ Feuillet, *Choreographie Ou L’Art De Décrire La Dance, Par Caracteres, Figures Et Signes Demonstratifs*, Preface.

²⁶⁸ I am not aware of the existence of any of Feuillet’s correspondence. He died only a decade after his first publication. It is possible that some of the dances he included in his annual collections had been requested by dancing masters outside Paris.

Coregraphie ou l'Art d'Écrire et de Lire la Danse Par Caractères Demonstratifs, made a similar claim. His goal, Clement wrote, was “to give to young *gens* [gentlemen and ladies] and to Persons who aspire to be dancing masters a means of teaching themselves the knowledge of *Chorégraphie*.”²⁶⁹ He promised they could, with the aid of his treatise, “read and write a dance the way a Musician Reads an air of music.”²⁷⁰

Francis Peacock, a dancing master in Scotland, praised the utility of written “chorography” noting that *L’Aimable Vainqueur*, or the *Louvre*, as he calls it, was taught the same way in every country. In his 1805 publication, *Sketches Relative to the History and Theory, but More Especially to the Practice of Dancing*, Peacock lamented the discontinued use of Beauchamp/Feuillet notation exclaiming, “what an advantage must this have been, and still might be, to masters at a distance from Paris or London, to have dances conveyed to them with as much ease as they could have a new song? ...Must the professors of the art of Dancing, then, have come, as it were, from the Antipodes to have learned it, or any other similar dance? Surely not!” The art of notating dances, he concludes, made it possible for dancing masters in “foreign parts” to become acquainted with the fashionable dances in vogue, either in England or in France.”²⁷¹ Relationships between people who lived far from each other had cultivated their common interest in dance through the use of diagrams. Like the *Encyclopédie*, which had served as a corpus of shared ideas to be discussed in local homes, salons and coffee shops, these notations served as shared introductions to the practices they represented.

²⁶⁹ Le Sieur Clement, *Principes de Coregraphie Ou l’Art d’Écrire et de Lire La Danse Par Caractères Demonstratifs* (Paris: Denis rue S Jacques vis avis le College de Louis le Grand, 1771).

²⁷⁰ Ibid.

²⁷¹ Francis Peacock, *Sketches Relative to the History and Theory, but More Especially to the Practice of Dancing ... Intended as Hints to the Young Teachers of the Art of Dancing*, 1805.

The French Contredanse

The French *contredanse*, distinct from French court dance and from the English country dance, was performed mostly in a square formation of four couples, with one couple on each side.²⁷² Contredanses had been enjoyed by dancers at court since at least the late seventeenth century. In his search for the origins of contredanses in France, dance historian Jean-Michel Guilcher turned to the British Isles and the tradition of English country dances that were first published by John Playford in 1651.²⁷³ In a journal entry for October 27, 1684, the Marquis de Dangeau notes that one “danced for the first time the contredanses which the English dancing master, named Isaac, had taught to all the ladies.”²⁷⁴ Some of these had appeared in the Beauchamp/Feuillet system, as has been noted. However, a flood of new contredanse notations emerged around the middle of the eighteenth century, featuring much-simplified diagrammatic notation and including textual descriptions that made them easy to follow.

In the notations, each dancer is indicated by a different shape.²⁷⁵ Lines of dance showing the movement of the dancers were indicated in successive diagrams while the steps were described in text on the facing page. These popular dances were generally simpler than the court dances notated in the Beauchamp/Feuillet system, but dancers

²⁷² I’m using the French term *contredanse* to refer to these dances rather than the English “contradance” which could be used to designate English country dances, except that these early dances first published by John Playford in 1651 should be distinguished from the modern “contradance” which is yet another dance form that has evolved from early Irish, Scottish, French-Canadian, and American traditions.

²⁷³ John Playford, *The English Dancing Master: Or, Plaine and Easie Rules for the Dancing of Country Dances, with the Tunes to Each Dance* (London: Thomas Harper, 1651). Playford also included the tune for each dance at the top of each page, but this did not function as a device for orienting the page but simply provided the tune to accompany the dance.

²⁷⁴ Philippe de Courcillon Dangeau Marquis de, *Journal du marquis de Dangeau*, vol. 1 (Paris: Firmin didot frères, 1854), 63.

²⁷⁵ These shapes are filled-in (for a man) or outlined (for a woman) triangles, circles, squares, or crosses as they appear in the volumes of dances published by de la Cuisse, but towards the end of the eighteenth century, the shapes for playing cards were often used, i.e filled-in or outlined hearts, diamonds, spades, and clubs.

could draw on court dance steps as is evident by a treatise and contredanse choreographies published by Sr. Clement in 1771 using the Beauchamp/Feuillet notation.²⁷⁶ Most contredanse publications were in a standardized format, usually consisting of four pages: 1. a title page, 2. a page of music, 3. the directions for the dance in text, and 4. a page of small diagrams demonstrating the patterns the dancers made (see Figure 3.18).²⁷⁷

Contredanse publications varied considerably. Most were fairly small in size. Simon Guillaume's 1769 *Almanach Dansant... Avec Un Discours Préliminaire Sur l'origine et l'utilité de La Danse* [Danced Almanac...with a preliminary discourse on the origin and utility of Dance] was printed in an octavo edition. A copy in the Bibliothèque nationale de France is bound in leather with gold gilt designs on the cover and hand-tinted engravings inside. The book is a "dancing" almanac so along with a set of pictures of a couple demonstrating dance positions and eleven pages of music, it included a 1769 calendar in chart form complete with each day's designated saint (or feast days), the time of the rising and setting of the sun, and the phases of the moon. This collection cost 30 sols for the entire book.²⁷⁸ A single dance (*la feuille*) by the prolific dancing master known as La Cuisse sold for 4 sols for each dance in two double-sided approximately 5" x 8" pages.²⁷⁹ One collector purchased hundreds of these dances by La Cuisse and had them bound in a five-volume set with a leather cover. These were printed on heavy paper

²⁷⁶ Le Sieur Clement, *Principes de Coregraphie Ou l'Art d'Ecrire et de Lire La Danse Par Caractères Demonstratifs* (Paris: Denis rue S Jacques vis avis le College de Louis le Grand, 1771).

²⁷⁷ These have not yet been systematically catalogued and studied.

²⁷⁸ About \$15. See footnote 265 below.

²⁷⁹ Ian Davidson estimates a sol to be about equal to \$10. If £1 = \$10, and 20 sols = £1, then 1 s. = £.50, or very roughly \$.50 USD. Thus, the *Etrennes Dansantes*, sold for about \$6 (12 s.), and each dance by La Cuisse for \$2 (4 s.). Davidson, *Voltaire: A Life* (New York: Pegasus Books, 2010), xi-xii.

edged with gold.²⁸⁰ In contrast, *Etrennes Dansantes*, a tiny pocket edition (about 2" x 3 1/2") on thin paper containing eight dances sold for only 12 sols for the entire collection.²⁸¹ This inexpensive pocket edition did not include the diagrams, either because the diagrams were too difficult to read in that small format or perhaps simply because the diagrams were an added cost (Figure 3.19).

Contredanses figured in a repertoire of informal entertainments that might include games and music as well as dancing. For example, one finds contredanse directions and/or tunes on playing cards. One extant collection of twenty cards included notations for the positions and steps in each dance written in hand in French and German. Each card measured about 2 1/4" x 3 1/2".²⁸² Another set was printed with music for a different contredanse tunes on each card. This was also used for card games: each card also featured an inset indicating suit and rank.²⁸³

Monsieur Jourdain, Molière's bumbling bourgeois from the beginning of this chapter, is mentioned in a 1762 publication of a collection of contredanses by the dancing master Sr. de la Cuisse.²⁸⁴ De la Cuisse writes in his preface that "Dance has always been regarded as one of the main arts" and that he would even argue that "Dance ought to be the first in importance," but he did not wish to "renew the Scene of the *Bourgeois Gentilhomme*." Therefore La Cuisse simply points out the multitude of public balls that

²⁸⁰ Bibliothèque nationale de France BNF – Opéra (look this up).

²⁸¹ Bibliothèque nationale de France BNF – Opéra: Res piece 89, 1er Partie.

²⁸² Anonymous, "Collection of Contredanse Notation Manuscript Cards and Other Material" (1770), Online Archive, University of California - Irvine.

²⁸³ London, circa 1770. Comprising 33 cards, one side engraved with identified cotillion tune and inset suit, 3 3/4 in. H., 2 1/2. https://www.liveauctioneers.com/item/55246300_longman-and-lukey-cotillion-playing-cards. Cotillion or quadrille were other terms used for contredanses late in the eighteenth century and into the nineteenth century.

²⁸⁴ "La Cuisse" is the term for thigh. One cannot help but wonder if this is a pen-name. Malpied is another dance treatise author whose name, literally "bad-foot," might also be fictitious.

took place at the beginning of each winter. Dance in the mid-eighteenth century looked very different than its earlier manifestation in the court of Louis XIV.

An analysis of a contredanse published by La Cuisse, dedicated to the Chevalier de St. Georges and called “La St. George Contredanse Nouvelle,” illustrates many of the features of diagrams discussed in the previous chapter (see Figure 3.20.1-4).²⁸⁵ The title page offers the usual publication information. At the top of the second page, a *Description des Figures de la Contredanse* (Description of the Figures of the Contredanse), one finds the composer of the tune (M. Petit), the choreographer/dancing master (M. De la Hante), and the composer of the bass line (M. Hanau). This is followed by a textual description of how to do the dance (Figure 3.20.2). After the *Grand rond ordinaire* (going around in a circle either to the right or left using either the *Gavôte* or *chassé* step), the dancers make two lines.²⁸⁶ In the first figure, each man leads his lady and goes to the left using the *chassé* step to change corners to form a line face to face. In the second figure, the men continue to take their ladies around, ending with all doing the *balancé* step then the ladies turn under the arms of their partners. These textual descriptions correspond to the diagrams on the third page (Figure 3.20.2 and 3.20.3). The juxtaposition of text with diagram illuminates the figures and steps. This simplification of movement into symbols and lines made the dances fairly easy to learn and practice, once one learned the notation system, though the dance steps were undoubtedly taught by dancing masters. The final page of the contredanse *feuilleton* (a single dance was printed on

²⁸⁵ De La Cuisse, *Le répertoire des bals*, 280–83.

²⁸⁶ These terms are explained at the beginning of De La Cuisse, *Le répertoire des bals*, 10-16. In La Cuisse’s manual, each step is paired with its diagrammatic representation on the next four pages, however, in most contredanse diagrams, steps are only indicated in the text.

one folded page and four parts) gave the music in what had become standard musical notation (Figure 3.20.4).

A publication by dancing master Thomas Wilson deserves mention because of his explicit appeal to science through diagrams. His 1808 publication was entitled *Country Dancing, wherein are displayed all the figures ever used in Country Dances In a Way so Easy and Familiar, that Persons of the meanest Capacity may in short Time acquire (Without the Aid of a Master) A complete Knowledge of that Rational and Polite Amusement*. This was further developed into his 1815 *Complete System of English Country Dancing, containing all the figures ever used...elucidated by means of Diagrams. Also Scientific Instructions for the Composing of Country Dances* (Figure 3.21). This not only featured numerous diagrams of figures interspersed throughout its pages, but added forty tables of different figures and numbers setting out possibilities for using them in choreographies. Although Wilson claimed to be the first to have notated English Country Dance in diagrams, he recognized his debt to the French.²⁸⁷ His 1819 book on the Quadrille was published in both English and French, and he acknowledged that “This fashionable species of Dancing is entirely of French origin.”²⁸⁸ A remarkable color fold-out lays out all the figures for the Quadrille in a large circle (Figure 3.22).

When dance styles changed again during the nineteenth century, in favor of partner dances led by men, social dance notation was no longer required. Dance in “figures” had benefited by publications of diagrammatic notations; partnered dances such

²⁸⁷ With the exception of a Nicholas Duke whose publication consisted of 88 loose sheets which were expensive and did not include directions for how to use the diagrams.

²⁸⁸ Thomas Wilson, *The Quadrille and Cotillion Panorama or, Treatise on Quadrille Dancing, in Two Parts: With an Explanation, in French and English, of All the Quadrille & Cotillion Figures Generally Adopted, as Described by Diagrams on the Plate* (Edinburgh: R. & E. Williamson, 1819), 1.

as waltzes and polkas depended only on the skill and imagination of the lead (male) dancer, who presumably had taken lessons. On stage, dance had become increasingly complex and athletic. While dance notation systems for professional dancers, such as the system devised by Stephanov in Imperial Russia, were taught in schools of ballet, these systems were not widely used and proved increasingly inadequate for the notation of the movements of modern professional dancers.

In the summer of 1914, upon the outbreak of World War I, the world-renowned Russian dancer Vaslav Nijinsky and his wife and child were held under house arrest in Hungary. Nijinsky, inspired by Baroque architecture he had seen earlier in his life, used the time of enforced idleness to work on his own system of dance notation. The police interrogated the couple about the dancer's manuscript found in his desk, "which looks like mathematics, but it is not geometry and it is not music."²⁸⁹ Experts in music and mathematics were called in and Nijinsky spent several days explaining his system to them before they were convinced that it was indeed dance notation he was working on and not a military plan in code.²⁹⁰

Dance and the dance-trained body had long been connected to the military, as a profession that had been reserved for the noble class up to the end of the eighteenth century. It makes sense that diagrammatic plans for movement were used in both areas of endeavor. It is to drill diagrams that we now turn.

²⁸⁹ Richard Buckle, *Nijinsky* (New York: Simon and Schuster, 1971), 346.

²⁹⁰ Romola Nijinsky, *Nijinsky* (New York: Simon and Schuster, 1934), 296–97.

CHAPTER FOUR

DRILL: BODIES ON A MAP

The same Care in chusing and instructing our young Soldiers in all military Exercises and Evolutions, will soon make them equal to the old Roman Troops who subdued the whole World.

Vegetius, *De re militare*, Fifth century²⁹¹

The question, whether war ought to be stiled a trade, or a science, is very properly thus decided by the chevalier Folard; *it is a trade for the ignorant, and a science for men of genius* (italics in original).

Maurice de Saxe, *Reflections*, 1757²⁹²

Introduction: Mapping Victory

In his *Les Rêveries, ou Mémoires sur l'art de la guerre* [Reflections, or Essays on the Art of War], Louis XV's famed military leader Maurice de Saxe (1696-1760) recalled a meeting with the Marshal General Villars (1653-1734). Villars, over the course of regaling the younger man with the details of a 1702 campaign at Friedlingen, pulled out his plans of the battle to demonstrate the actions of the French army against forces of the Holy Roman Empire. That he pulled out *plans* mapping the course of action is worth pausing over for a moment – what exactly was illuminated by these plans that could not be conveyed through words and sentences? Villars narrated the troops' triumph as they “repulsed the *Imperialists* with unparallel'd fortitude; had totally routed, and pursed them through a wood into a plain...” Then, suddenly, one of the soldiers mistakenly cried out

²⁹¹ Flavius Vegetius, *On Roman Military Matters: A 5th Century Training Manual in Organization, Weapons and Tactics, as Practiced by the Roman Legions*, trans. John Clarke, Reprint of 1767 English edition (St. Petersburg, FL: Red and Black Publishers, 2008), 73.

²⁹² Maurice de Saxe, *Reveries or Memoires upon the Art of War by Field-Marshal Count Saxe: Illustrated with Copper-Plates. To Which Are Added Some Original Letters, upon Various Military Subjects*, trans. Anonymous, Greenwood Reprinting Facsimile edition 1971 (London: J. Nourse, 1757), 14. *Les Reveries* could be translated as *Reflections*, however, I have kept the original title of the 1757 translation into English, a translation I have used to keep the flavor of eighteenth century English. *Les Reveries* refers not to de Saxe's reflections on his experiences but rather to his dreams for a future, more disciplined and triumphant French army.

that they were cut off. Villars continued, “these victorious troops instantly abandoned their triumphs, and took to flight in the most dreadful confusion.”²⁹³ According to Villars’ military maps, the battle had been won; nevertheless, the soldiers in the field ran for cover instead of pursuing the remaining vanquished troops. Villars made his point with diagrams of the scene, convincing Maurice de Saxe of the importance of drilling soldiers so that they would not lose their nerve. There was a science to maintaining morale.

Maurice de Saxe – later gaining the highest military rank of marshal himself – opened his *Rêveries* with this account because it exemplified the “*imbecilité de coeur humain*” [imbecility of the human heart] and the value of drill as an antidote to it.²⁹⁴ His counsel to generals was that they drill their troops extensively for “bravery is a variable and uncertain quality of the mind.”²⁹⁵ That Villars pulled out a map – a diagram really – of the troops’ movements was not unusual in the eighteenth century, but few such diagrams seem to have been consulted prior to the seventeenth century and it was not until the eighteenth century that one finds a high level of abstraction and precision.

These diagrams for the formations and marching of soldiers rationalized the movement of human bodies the way notations for dance of this period did. As in dance, the underlying postures and noble bearing of an officer had to be learned from a master – or were thought to be innate to natural-born aristocratic leaders. Nevertheless, as the movements involved in these aristocratic practices were committed to the page, they

²⁹³ Maurice de Saxe, *Reveries, or Essays upon the Art of War* (London: J. Nourse, 1757), vi.

²⁹⁴ The anonymous translator of de Saxe’s *Reveries* into English softens de Saxe’s prose, rendering “imbecility” as “frailty.” Maurice de Saxe, *Reveries, or Memoires upon the Art of War* (London: J. Nourse, 1757), v.

²⁹⁵ de Saxe, *Reveries*, v.

became legible to those outside the privileged class. Over the course of the eighteenth century, so many commoners rose through the ranks to become officers, members of the *noblesse d'épée* demanded a law put in place to restrict military leadership to men who could trace their noble lineage back four generations (Ségur law, 1781).²⁹⁶ I am arguing that the invention of drill diagrams reflected a new approach to military maneuvers, making them more precise and replicable in the heat of battle. This more rational, “scientific” approach, as Maurice de Saxe called it, was in tension with the sheer passion and noble character that traditionally had set officers apart from their plebian charges. Drill diagrams were pared down representations of military formations. They reflected Enlightenment concerns with simplicity, precision, and standardization.

“Drill” can be defined as the “rehearsal of prescribed movements,” particularly in military battle and parade formations. In early modern French military manuals, the terms often used are *manoeuvre* or *exercice*. For infantry with firearms, *manual drills* consisted of practicing the many careful steps one took to load and shoot firearms such as the long gun known as an arquebus.²⁹⁷ In *close order drills*, soldiers practiced moving together in tightly-coordinated group formations, from columns into lines, and from lines into columns. These drill maneuvers were called *evolutions*, as it was crucial to be able to turn

²⁹⁶ Many scholars trace the origins of the French Revolution, at least in part, to the unrest caused by the 1781 Ségur law. See Gregory Stephen Brown, *Cultures in Conflict: The French Revolution* (Westport, CT: Greenwood Publishing Group, 2003), 42; Bailey Stone, *Reinterpreting the French Revolution: A Global-Historical Perspective* (Cambridge: Cambridge University Press, 2002), 46; and the classic David Deckworth Bien, *Caste, Class, and Profession in Old Regime France: The French Army and the Ségur Reform of 1781*, trans. Jay Smith and Rafe Blaufarb (St. Andrews: Centre for French History and Culture of the University of St Andrews, 2010).

²⁹⁷ The arquebus was used as a defensive weapon in the fifteenth century. With the addition of a trigger in the late fifteenth century, it became a popular firearm in the field. The heavy arquebus was called a musket. Introduced in the early sixteenth century, it could pierce armor. Terms for different firearms varied from region to region.

quickly as a group to face an enemy in unison.²⁹⁸ Early modern soldiers practiced these movements until they became ingrained so their reflexes would be automatic in battle. Drill diagrams represented these movements on paper in increasingly abstract ways.²⁹⁹ Drill diagrams are a kind of map: they are maps of soldier bodies marching, turning, or just standing still. The earliest such maps are pictorial, often portraying a battle from a distorted bird's eye view. These became increasingly abstract with geometric symbols such as small circles or bars eventually standing in for pictures of individual soldiers. However, some early diagrams did feature abstract symbols for soldiers and some later ones were more pictorial than symbolic.

In this chapter, I begin with an overview of early drill diagrams. Many were created by humanists in their attempts to better understand classical military formations and strategies. I then turn to the reforms of Maurice of Nassau, Prince of Orange (1567-1625).³⁰⁰ Prompted by his own study of classical Greek and Roman texts, Maurice of Nassau, with his mathematician/engineer Simon Stevin (1548-1620), analyzed, simplified, and standardized the practice of drilling. His success in the overall professionalization of his army prompted the spread of his ideas and practices to the rest of Europe. In seventeenth-century France, reforms by the Secretary of State François-Michel le Tellier, Marquis de Louvois (1641-1691) and strict discipline under the

²⁹⁸ Open-order drills were not common until the advent of more reliable firearms which made close-order drill formations less effective in the nineteenth century. See "Drill," in *Oxford Encyclopedia of Military History* (LK).

²⁹⁹ For the purposes of this present study, a "drill diagram" may refer to any visual depiction of military movement of infantry, whether on the parade ground or in battle. Maps of all kinds have played an important role in reconnaissance and planning, however, for the purposes of this project, if no humans (or horses) are represented on a map, that particular map is outside the scope of this chapter. I also have not considered naval drills.

³⁰⁰ Maurice of Nassau served as a stadtholder (office of steward), a position in which he was in charge of national defense but was not the monarch.

infamous Jean Martinet (d. 1672) led to a much larger and more professional army in France. At the court of Louis XIV (1738-1715), movement diagrams informed both war maneuvers and court functions such as balls, operas, and *carousels*. In the eighteenth century, the increased publication of drill diagrams – and manuals to explain them – suggests that military leaders developed a shared visual vocabulary and set of expectations for how battles should be conducted, though conflicts did not always follow established protocols. These diagrams reflected an interest in simplifying and standardizing the practice of drill and making movements ever more precise. By the end of the eighteenth century, references to drilling in satires, pantomimes, and ballets spoke to its ubiquity in popular culture.

Military Humanists

The earliest drill diagrams in Europe were attempts to understand and resurrect classical Greek and Roman military practices. Plutarch, the first century Roman essayist, had described Spartan youth as dancing into battle accompanied by the tune of their flutes, “without any disorder in their ranks, any discomposure in their minds, or change in their countenances, calmly and cheerfully moving with the music to the deadly fight.” He continued, “Men in this temper, were not likely to be possessed with fear or any transport of fury, but with the deliberate valour of hope and assurance, as if some divinity were attending and conducting them.”³⁰¹ Plutarch’s portrayal of the noble Spartans, who claimed they did not need town walls because they had a wall of warriors to defend them, fueled the imaginations of later military theorists.³⁰²

A treatise, *On Tactical Arrays of the Greeks*, by the second century military writer

³⁰¹ Plutarch, *Plutarch: Lives of the Noble Greeks*, trans. Edmund Fuller (New York: Dell, 1966), 66-67.

³⁰² Plutarch, *Plutarch: Lives of the Noble Greeks*, 66-67.

Aelian/Aelianus Tacticus (not to be confused with the naturalist also known as Aelian), details drills performed in Macedonia as well as by Roman soldiers. The anonymous fourteenth-century artist who drew diagrams to accompany writings by Aelian used basic square and line formations made of simple short lines interspersed in the text to stand for soldiers (see Figure 4.1). Another early example, printed in Bologna in 1496, attempted to recreate drill formations using standard letter fonts (see Figure 4.2). This was a common practice for printing diagrams used by a number of printers. Later diagrams were printed using a woodblock or metal plate and employed a range of abstract symbols.

Niccolò Machiavelli (1469-1527) included woodblock prints of diagrams in his 1521 *Dell'Arte della guerra* [On the Art of War], one of the most widely read and translated military treatises from the Italian Renaissance.³⁰³ Machiavelli's diagrams of drill formations are elaborate drawings of static configurations drawn from descriptions of Roman maneuvers. These ornate diagrams included fourteen different symbols for the ranks represented and were accompanied by a chart indicating which symbol designated which rank. For example, a "W" stood for the General in command, a "Z" represented the flag bearer, and an "O" with a cross through it indicated the head of the battalion (see Figure 4.3a).³⁰⁴ The treatise is in the form of a dialogue between the young Luigi and the elder Fabrizio.³⁰⁵ Fabrizio explains one of the formations to Luigi: this consists of placing combatants on the outside of a square, protecting the food and other provisions in the center. Fabrizio continues,

³⁰³ Niccolò Machiavelli, *Dell'arte della guerra* (Firenze: Sansoni, 1971); It was translated into French by 1629: Niccolò Machiavelli, *L'art de la Guerre* (Paris: Claude Collet, 1629).

³⁰⁴ John R Hale, "A Humanistic Visual Aid: The Military Diagram in the Renaissance," *Renaissance Studies*, 1988, 287.

³⁰⁵ The interlocutors who question Fabrizio change over the course of the treatise.

Having ordered the army in this mode, one has to make it move and, while going, observe this order completely. And without doubt, it is secure against all the tumults of the peasants. Nor need the captain make any other provision against tumultuous assaults...Nor will it ever happen that these tumultuous troops end up finding you within range of sword or pike. For unordered troops fear ordered ones, and it will always be seen that they make a great assault with cries and with noises without otherwise getting near, just like snapping dogs around a mastiff.³⁰⁶

Part of ordering the square had to do with the placement of musical instruments.

Machiavelli gives detailed advice about the instruments that an army should have and where they should be placed. Horns and trumpets, as used by Alexander the Great and the Romans, were “more able to inflame the spirits of the soldiers and make them fight more hardily.”³⁰⁷ He also recommends placing trumpets near the captain-general, “not only as a musical instrument fit to inflame the army but more fit than any other musical instrument to be heard amidst every noise.”³⁰⁸ Musicians were marked by an S squiggle and appear in the diagram on opposite corners (See Figure 4.3b).

Machiavelli claims the Romans were able to turn perfectly in formation, giving them the flexibility to meet challengers in any terrain or situation. He outlines three purposes of drill: 1. to “harden the body,” and make it faster, more dexterous, and able to endure hardship; 2. to learn to use arms; and 3. to learn to observe the orders of the army, as much in marching as in fighting and encamping. He concludes, “if an army marches, encamps, and fights in an ordered and practiced way, the captain retains his honor therein, even if the battle does not have a good end.”³⁰⁹ Machiavelli laments the state of soldiers in his own time, noting how many things are lacking to reach the perfection of

³⁰⁶ Niccolò Machiavelli, *The Art of War*, trans. Christopher Lynch (Chicago: University of Chicago Press, 2009), 31.

³⁰⁷ Machiavelli, *The Art of War*, 217.

³⁰⁸ Niccolò Machiavelli, *The Art of War*, trans. Christopher Lynch (Chicago: University of Chicago Press, 2009), 217.

³⁰⁹ Machiavelli, 113.

the ancients.³¹⁰ He does not claim to have experience leading armies of the size he describes in his diagrams: that, he says, would be the preserve of a Prince since only a prince would have the resources to order an army to the high standards of the Romans. The main point of the reflections in his treatise is not so much to provide practical advice as it is to study the classics. In this, Machiavelli is as much a humanist as other military writers of his time, some of whom created drill formations in classical Roman or Greek designs such as the flying wedge or the more fanciful *fleur de lis* [Lily] (see Figure 4.4).³¹¹

The Thirty Years War (1618-1648) between Catholic and Protestant forces was the longest, most destructive and deadliest of the European religious wars, resulting in eight million casualties from battles, famines, and disease and a countryside scattered with ruins. During battles, there was widespread confusion with infantry soldiers scattering and deserting. Most battles ended in exhaustion on both sides with few conclusive victories. In the northern provinces of the Netherlands, however, the Protestant leader, Maurice of Nassau, had been able to stave off Catholic forces through an extensive fortress-building program and protracted training in drill. Maurice modeled his drill training after descriptions of exercises performed by Roman units as described by authors of classical military treatises such as Flavius Renatus Vegetius and Aelianus Tacticus. Vegetius' *De re militari*, for example, was one of the widely read Latin works in the Renaissance.³¹² In his treatise, Vegetius had commented:

³¹⁰ Machiavelli, 210.

³¹¹ John R Hale, "A Humanistic Visual Aid: The Military Diagram in the Renaissance," *Renaissance Studies*, 1988, 287.

³¹² Vegetius' *De re militari* rivaled the elder Pliny's *Natural History* in the number of surviving copies. N. P. Milner, *Vegetius: Epitome of Military Science*, second edition (Liverpool: University Press, 1996), xiii.

Nothing does so much honor to the Abilities and Application of the Tribune, as the Appearance and Discipline of the Soldiers, when their Apparel is neat and clean, their Arms bright and in good Order, and when they perform their Exercises and Evolutions with Dexterity.³¹³

Thus, Maurice invested considerable resources and energy in the training and uniforms of common soldiers.³¹⁴ He was committed to daily drill rehearsals and to fostering “ideas of self-discipline and of obedience as a *decorum*, something becoming in a soldier.”³¹⁵

Extending this sense of decorum to members of the military outside the traditional aristocratic class would have been resisted by powerful landed elites in other parts of Europe. However, Maurice of Nassau did not have a large cadre of aristocracy to oppose his reforms. He was able to promote this military reorganization, in part, because the northern Netherlands consisted of mainly low, non-arable land with few noble families to contest the arming and training of non-noble warriors.³¹⁶

Maurice’s forces could be considered the first professional army because of the way he trained and employed soldiers. Similar to many other armies of the period, many of his soldiers were mercenaries. Soldiers for hire had not been known for their honorable behavior: they had a “notorious readiness,” as one historian put it, to switch sides if a battle were not going well.³¹⁷ They often wore arm bands or other “tokens” that could be easily thrown off if warranted by unfavorable circumstances.³¹⁸ In contrast to other mercenary armies however, Maurice’s units were employed year-round and paid with

³¹³ Flavius Vegetius, *On Roman Military Matters: A 5th Century Training Manual in Organization, Weapons and Tactics, as Practiced by the Roman Legions*, trans. John Clarke, originally published 1767 (St. Petersburg, FL: Red and Black, 2008), 64–65.

³¹⁴ Cathal J. Nolan, *Wars of the Age of Louis XIV, 1650-1715: An Encyclopedia of Global Warfare and Civilization* (Westport, Conn: Greenwood Press, 2008), 111-14.

³¹⁵ Stephen Gaukroger, *Descartes: An Intellectual Biography* (Oxford: Clarendon Press, 1995), 65-67.

³¹⁶ M. D. Feld, “Middle-Class Society and the Rise of Military Professionalism: The Dutch Army 1589-1609,” *Armed Forces and Society* 1, no. 4 (1975): 419–42.

³¹⁷ Roberts, “The Military Revolution, 1560-1660,” 15.

³¹⁸ *Ibid.*

regular salaries rather than relying on plunder for compensation. This meant that soldiers could be drilled throughout the “off-season” winter months when most soldiers and officers had traditionally been sent home. This transition from sporadic campaigns financed with looting and pillage to a standing army – drilled during the winter and times of peace and supported by a budget item in the government payroll – had far-reaching consequences, including more conclusive victories.³¹⁹ Maurice’s commitment to drill training and professional conduct led to successful campaigns long before the Thirty Years’ War, including the capture of Breda in 1590 and then the seizure of a number of fortified towns including Zutphen in 1591, Steenwijk in 1592, and Groningen in 1594, and seven more in 1597, including Ling en. In effect, this created a ring of forts securing the border of the northern provinces of the Dutch Republic. Maurice’s year-round highly trained infantry were key to his defense of these border areas, securing the Dutch republic from further incursions.³²⁰

The study of geometry figured prominently in Maurice’s military strategy. He employed the mathematician and natural philosopher Simon Stevin (1548-1620) as a tutor and engineer to design stronger fortresses and more secure hydraulics. The *trace Italienne* (“Italian outline”) or star-shaped fort had begun to replace medieval castles beginning in the fifteenth century in response to larger artillery and more powerful gunpowder able to penetrate stone castle walls. The earthen banks and trenches constructed around the star forts were more resistant to cannon fire than stone. In

³¹⁹ Feld, “Middle-Class Society and the Rise of Military Professionalism: The Dutch Army 1589-1609,” 419.

³²⁰ The practice of infantry drill was further developed for offensive manoeuvres by Gustolf Adolphus (1594-1632) of Sweden, however, images celebrating his victories, such as his triumph over the Catholic League at Breitenfeld, are not rationalized in the abstract diagrammatic visual language that would be common in the Enlightenment.

addition, the multi-layered, multi-pointed star-shaped forts could better withstand the assaults because every wall was defended from an opposite side (see Figure 4.5). This gave defenders more directions from which to shoot down invaders and guarded against soldiers burrowing in the relatively protected area close to and underneath castle walls. Numerous prints celebrated the geometrically configured points and angles of star fortresses as a practical application of mathematics. Parade grounds were often built in the centers of these forts, demonstrating, again, the high esteem accorded to drill practice. Drill exercises kept siege defenders in shape. Equally important, drilling kept morale high and group cohesion strong. Outside forts, soldiers in drill formations functioned as moving human fortresses, with the exterior “walls” carefully constructed to protect all sides and bristling with firepower. While siege warfare and star fortresses remained central in military conflicts of this period, the organization of ordinary soldiers into a highly efficient moving war machine had the most significant impact on outcomes.³²¹

An innovation that promoted seeing at a distance as if looking at a drill diagram also came out of the Dutch Republic under Maurice of Nassau: the telescope (Figure 4.6a and 4.6b). The telescope that Galileo turned toward the sky was first a military instrument.³²² In 1608, Hans Lipperhey (1570-1619) applied for a patent for his invention from Maurice of Nassau. The pamphlet describing Lipperhey’s invention commended the telescope for its utility in “sieges and similar occasions, for from a mile and more away

³²¹ See Harald Kleinschmidt, “Using the Gun: Manual Drill and the Proliferation of Portable Firearms,” *Journal of Military History* 63, no. 3 (1999): 601–29. See also Kate Van Orden, *Music, Discipline, and Arms in Early Modern France* (Chicago: University of Chicago Press, 2005), 198.

³²² Galileo heard of the instrument and had his improved version made two years later. The Venetian Senate recognized the military significance of the telescope and on that basis – not on his astronomical discoveries – recognized Galileo’s improved telescope by doubling his salary and granting him a permanent position at the University of Padua. Fred Watson, *Stargazer: The Life and Times of the Telescope* (Sydney, Australia: Allen & Unwin, 2007), 55-59.

one can detect all things as distinctly as if they were very close to us.³²³” His timing coincided with Maurice of Nassau’s negotiations with the Spanish commander Ambrogio Spinola who had invaded the Netherlands in an effort to reconvert Dutch Protestants to Catholicism (a truce was established in 1609). Designed to look out over a battlefield and follow the progress of destruction from afar, the telescope/spyglass [*longue-vue*] offered the sort of *coup d’oeil* – comprehensive view at a glance – that a diagrammatic map of troops would portray.³²⁴

To assist in the training of Dutch soldiers, the painter/engraver Jacob de Gheyn II (1565-1629) was commissioned to create a manual demonstrating how to handle weapons. The importance of diagrammatic thinking is signposted on the title page: “Represented in Figures.” Gheyn writes, “All of the drawings are written for the utility of all aficionados of arms and also for all Captains and commanders...to be able to more easily teach to their inexperienced soldiers, the complete and perfect way to handle their weapons.”³²⁵ Gheyn’s underlying idea – that the loading, aiming, and firing of a weapon could be analyzed and broken up into smaller units, and set down on the page in successive images – informs the graphic display of his manual. Each step in loading and firing an arquebus was illustrated by a separate picture. The sequencing of images is similar to the sequencing of drill formation patterns. We also saw this in the previous chapter in the sequencing of danced patterns in Ménestrier’s carefully arranged symbols,

³²³ J. A. Bennett and Stephen Johnston, *The Geometry of War, 1500-1750: Catalogue of the Exhibition* (Oxford: Museum of the History of Science, 1996). Accessed online: <https://www.mhs.ox.ac.uk/geometry/cat81.htm>, May 24, 2018.

³²⁴ *Coup d’oeil* was also used to describe the “gunner’s eye,” a term used by cannon operators for the “unspecifiable, tacit skill” required to shoot artillery. Ken Alder, “French Engineers Become Professionals; or, How Meritocracy Made Knowledge Objective,” in *The Sciences in Enlightened Europe*, ed. William Clark, Jan Golinski, and Simon Schaffer (Chicago: University of Chicago Press, 1999), 105.

³²⁵ Jacques de Gheyn, *Maniement d’armes d’arquebuses, Mousquetz, et Piques. En Conformite de l’ordre de Monseigneur Le Prince Maurice Prince d’Orange* (Amsterdam: Robert de Baudous, 1608), Title page.

the diagrams at the edges of the print celebrating Conte di Vernio's horse ballet, or the sequences of pictures in André Lorin's contredanse publication. At the front of each section of images in Gheyn's manual, a list of instructions and a separate list of commands accompany each illustrated plate. There are forty two steps illustrated with full page pictures with short captions to match the spoken commands for each step. In Figure 4.7, for example, a soldier is demonstrating the delicate operation of gently placing a glowing wick in position to ignite the gunpowder he has already poured into inside of his arquebus. The command, "Soufflez le mesche" [Blow on the wick], is accompanied by these instructions "*Comme encor en sentinelle, il portera la mesche avec le poulce & le deuxieme doigt vers la bouche, la soufflera soubz la main, tenant ce pendant de la seule main gauche l'Harquebuse en contrepoix*" [As a precaution, he will carry the wick with the thumb and the second finger near the mouth, blowing on it under the hand, holding it while holding the arquebus as a counterweight with only the left hand].³²⁶ The clarity of the instructions was such that Gheyn's engravings were widely praised and copied. Gheyn's manual also included detailed instructions for handling other weapons such as a pike.

The engravings in *L'Art Militaire pour l'infanterie* (1615) by Johann Jacobi von Wallhausen (1580-1627) are very similar to Gheyn's.³²⁷ In Wallhausen's version, the series of soldiers demonstrating the loading and firing of an arquebus appear on one page, making the sequence of movements clearer (see Figure 4.8). Wallhausen also produced close-order drill diagrams with abstracted shapes to represent soldiers and horses (see

³²⁶ Jacques Gheyn, *Maniement d'armes d'arquebuses, Mousquetz, et Piques...Representé Par Figures, Par Jaques de Gheijn...* (Amsterdam: Robert de Baudous, 1608), plate 39. Spelling as in the original.

³²⁷ Jean Jaques de Wallhausen, *L'Art Militaire Pour l'infanterie*, trans. Anonymous (s.l.: s.n., 1615). Indeed, they appear to be pirated.

Figure 4.9). In this image, officers represented by pictorial figures line the edges of infantry and cavalry units. Soldiers in the units themselves are each represented by a dot, or, in the case of cavalry, each horse is represented by a peanut shape. Wallhausen's innovative diagrams are among the earliest that include abstracted shapes to represent soldiers. Wallhausen, like many young men across Europe, had served under Maurice of Nassau, where he came in contact with Jacques Gheyn's 1608 *Maniement d'armes d'arquebuses, Mousquetz, et Piques...Représenté Par Figures*. While he may have pirated Gheyn's illustrations demonstrating the handling of guns, Wallhausen's drill diagrams, in which soldier and equine bodies have been abstracted into geometric dots and shapes, do not appear in Gheyn's manual.³²⁸

Gheyn's technical images and other manuals during this period reflected a growing concern for greater precision and uniformity in the handling of fire arms which were notoriously dangerous to manipulate. Early firearms were slow to load, inaccurate, and unreliable. Close-order drill maneuvers were practiced in combination with manual drills to produce a volley of shots from a long infantry line. In "volley fire" formations, soldiers in the front row fired in unison (i.e. *en masse*) then retreated to the back line to reload while the new front line fired.³²⁹ By firing their arquebuses together in unison, at least some of the soldiers hit their mark. Soldiers organized several rows deep thus created a human machine gun by rotating the ranks of firing soldiers (see the upper right corner of Figure 4.9 for an example of how this was notated in a diagram by

³²⁸ Jacques Gheyn, *Maniement d'armes d'arquebuses, Mousquetz, et Piques* (Amsterdam: Robert de Baudous, 1608).

³²⁹ The first recorded instance of firearm volleys appears to have been deployed in Japan under General Oda Nobunaga who commanded a force of 3,000 soldiers shooting from rotating ranks in the battle of Nagashino in 1575. Nobunaga was likely inspired by the rotation system practiced by Japanese archers. Geoffrey Parker, "The Limits to Revolutions in Military Affairs: Maurice of Nassau, the Battle of Nieuwpoort (1600), and the Legacy," *The Journal of Military History* 71, no. 2 (2007): 333.

Wallhausen).

Ten years after the publication of Gheyn's manual, the young French philosopher René Descartes joined Maurice of Nassau's army.³³⁰ While serving in the Dutch military, Descartes studied drawing, military architecture, and mathematics.³³¹ As recent scholarship has argued, the diagrams and pictures that filled Descartes' letters and books proved to be critical tools in his thinking.³³² Drill diagrams, representing soldiers with abstract symbols and extending their presence on a landscape beyond what can be seen by the eye, follow a pattern like the one Descartes sets up in his geometric examples: the path of a tennis ball (see Figure 4.10) is indicated by lines of motion; the paths of battalions are indicated by similar lines of motion in a drill diagram. Such hybrid images can be found in numerous early modern manuscripts and publications as diverse as Sébastien Leclerc's 1690 *Traité de geometrie* (see Figure 4.11 and 4.12), and a sketch in the margins of a c.1580 anonymous manuscript book of secrets (see Figure 4.13). These visualizations offered a way to understand and see beyond the scene presented to the eye. From the evidence of drill diagrams that eventually developed over the seventeenth century, officers would have trained themselves to see beyond the individual soldier, and beyond the immediate landscape, to imagine a larger scenario of battalions moving in formation to engage in battle. Images such as these that juxtaposed pictorial illustrations with geometrical lines promoted this sort of abstract thinking about the visible world.

Many young aristocrats made their way to the Netherlands to study Maurice of

³³⁰ He joined Maurice of Nassau's forces in 1618. Stephen Gaukroger, *Descartes: An Intellectual Biography* (Oxford: Clarendon Press, 1995), 65-67.

³³¹ As well as Flemish. Gaukroger, 66.

³³² See Melissa Lo, "The Picture Multiple: Figuring, Thinking, and Knowing in Descartes's *Essais* (1637)," *Journal of the History of Ideas* 78 (2017): 369-399; and Brian Baigrie, "Descartes' Scientific Illustrations and 'La Grande Mécanique de La Nature,'" in *Picturing Knowledge: Historical and Philosophical Problems Concerning the Use of Art in Science* (Toronto: University of Toronto Press, 1996), 86-134.

Nassau's military methods and took those lessons back to their home countries. The military innovations of the Dutch republic were also disseminated by artisans such as Crispijn de Passe (c.1564-1637) who had been sent to France by Maurice of Nassau to teach drawing at the acclaimed *Academie d'Equitation* [Equestrian Academy].³³³ The academy had been founded by Antoine de Pluvinel (1552-1620) for the education of Louis XIII (1601-1643) and included lessons in fencing, writing, music, dancing, mathematics, and drawing, as well as horsemanship (see Figure 4.14). Along with his teaching, Crispijn de Passe also created the engravings for Pluvinel's *L'instruction du Roy en l'exercice de monter à cheval*. In his own 1643 publication on drawing, *La prima parte della luce del dipingere et disegnare* [The first part of understanding how to paint and draw], Crispijn reports that his students at the academy, especially the French, were impatient with drawing lessons since they were eager to acquire just enough facility with drawing to be able to sketch plans for battles and fortresses (see Figure 4.15). Thus, he devised a way to teach his gentlemen students, "using six or seven mathematical figures, a very clear and easy way of drawing all that one sees in the world."³³⁴ Drawing taught a geometric way of understanding the world that was reinforced in practice for young aristocrats by exercises in dance, equitation, and fencing, all of which entailed movement in prescribed patterns.

A striking example of the use of geometry juxtaposed with moving bodies can be found in the sumptuous 1628 volume on fencing, *Academie de l'Espée*, authored by

³³³ Crispijn van de Passe, *La prima parte della luce del dipingere et disegnare* (Amsterdam: Ian Iantsz, 1643), Preface "Aux amateurs de l'art." See also Frances Amelia Yates, *The French academies of the sixteenth century* (New York: Routledge, 1988), 278.

³³⁴ Crispijn van de Passe, op cit.

Gérard Thibault (1574-1627).³³⁵ Thibault was invited to Maurice of Nassau's court in 1611 to demonstrate his innovative style of fencing in an exhibition that won him fame throughout Europe. In his treatise, Thibault drew on mystical Pythagorean geometry as well as his experience teaching fencing to create an intricately decorated album (completed by a large team of engravers after his death). This collection of diagrammatic pictures in forty-three chapters includes pictorial representations of swordsmen demonstrating fencing movements inside and on top of diagrams of circles and squares drawn with mathematical precision.³³⁶ As Thibault explains in a note to the reader at the front of his book, many of the images are not portrayed realistically. His engravings of fencers in imaginary spaces create a virtual academy of fencing.³³⁷ He references the hermetic tradition in his opening discourse on the perfection of the human body as a microcosm of the universe and relates the body to principles of proportion in architecture. In one engraving, Thibault includes his own versions of Vitruvian men along with signs of the zodiac, emblems, animals, and clocks (see Figure 4.16). As in the Vitruvian Man by Leonardo, the placement of the human figure in a circle and a square signified the unification of heavenly and earthly qualities. In these images, the circle/square image is further complicated by a web of intersecting lines and angles, pointing to the place of fencing as a practice with deep spiritual as well as physical implications. This ornate Renaissance diagram is neither simplified, standardized, nor precise – the imagery is

³³⁵ Girard Thibault d'Anvers, *Académie de l'espée de Girard Thibault d'Anvers. Où se démontrent par reigles mathématiques sur le fondement d'un cercle mystérieux la théorie et pratique des vrais et jusqu'à présent incognus secrets du manement des armes à pied et à cheval* [Academy of the sword by Girard Thibault of Antwerp. In which is demonstrated by mathematical rules on the foundation of the mysterious circle, the theory and practice of the true and not known until now secrets of arms on foot and on horseback] (Leiden: B. et A. Elzevier, 1628). This was published posthumously in 1630.

³³⁶ See John Michael Greer, "Translator's Introduction," in Girard Thibault d'Anvers, *Academy of the Sword*, 1630, trans. John Michael Greer (Highland Village TX: The Chivalry Bookshelf, 2006), 1-5.

³³⁷ Ibid. There is no evidence that Thibault actually opened an academy.

evocative but at least some of the meaning is hidden.

Most of the engravings in Thibault's book feature pairs of fencers on geometrically parsed circles or squares. Movement is indicated by showing two depictions of the same pair of fencers. For example, in Figure 4.17, the swordsman in the bottom right corner takes a step forward with his right foot, from one point on the grid to the next. The image just behind this one shows the advanced position. In these diagrams, fencers go through their paces in stylized one-on-one combat patterns. The movement of the feet is a key feature of fencing and this is reflected in the detailed instructions and depictions of exact points on the grid where the feet are to be placed. The text also describes the placement of the sword, but only the feet are given geometric coordinates. The positions of the feet in fencing will later inform the positions of the feet in dance, as systematized by Beauchamp under Louis XIV.

Centralizing the Military in France

In 1610, the French army had numbered fewer than 20,000 men. Under Louis XIII (1601-1643) and his chief Minister of State, Cardinal Richelieu (1585-1642), the army grew to 150,000 soldiers.³³⁸ During this period, the king and his government systematically dismantled the power of competing French nobles, destroying castles of rebel forces and denouncing "private violence" in favor of a stronger, centralized government.³³⁹ Louis XIV's childhood was marked by a complicated series of conflicts with French nobles called the *Fronde*. This had been suppressed and a strict hierarchy of

³³⁸ Colin Jones, "The Military Revolution and the Professionalisation of the French Army under the Ancien Régime," in *The Military Revolution Debate: Readings on the Military Transformation of Early Modern Europe* (Boulder: Westview Press, 1995), 149.

³³⁹ Tilly, Charles (1985). "War making and state making as organized crime," in *Bringing the State Back In*, edited by P.B. Evans, D. Rueschemeyer, & T. Skocpol (Cambridge: Cambridge University Press, 1985), 174. See also Jones, "The Military Revolution and the Professionalisation of the French Army," 149–50.

the military had been established with the king at the head by 1653.³⁴⁰ As a consequence of his involvement in the Fronde, the general Louis II, Prince of Condé (1621-1686), had been imprisoned and then exiled to Spain. After his return to France in 1659, to demonstrate his loyalty to the crown and to remind Louis XIV of his earlier service to the crown, the Condé commissioned a series of eleven paintings, each depicting a famous battle including the Battle of Rocroi (1643) – in which the French won a decisive victory over the Spanish infantry “Tercio” formations.³⁴¹ This battle had been won just days after Louis XIV had ascended the throne. The artist, Sauveur Le Conte (1659-1694), demonstrated the superior ability of diagrams to convey the details of a battle over strictly pictorial depictions by superimposing diagrams of battle formations onto detailed landscapes. In these paintings, the scenes are staged as if in a theater with rich velvet curtains and gilded architectural frames. Sub-images on the side panels are presented as if through a spyglass, focusing on various details of the campaign. One views the battlefields from the perspective of the king or a general looking out over the landscape (see Figure 4.18 through 4.21).

Louis XIV sought to create an all-seeing presence such that even if he were not physically present, his subjects would be mindful of his existence. He accomplished this through an elaborate system of symbolic objects such as thrones, portraits, and publications.³⁴² Jay Smith explains this "sovereign's gaze" as a carefully cultivated relationship between the king and his courtiers. However, in the growing and increasingly

³⁴⁰ The same year that the fourteen-year-old Louis XIV danced as Apollo, the Sun King, in *Le Ballet de la Nuit*. Michael Burden and Jennifer Thorp, *The Ballet de La Nuit* (Hillsdale, NY: Pendragon Press, 2010).

³⁴¹ The tercios consisted of well-organized infantry squares comprised of smaller company units, often with mixed weapons in the same square – pikes, arquebuses, etc.

³⁴² Jay M. Smith, *The Culture of Merit: Nobility, Royal Service, and the Making of Absolute Monarchy in France, 1600-1789* (Ann Arbor: University of Michigan Press, 1996), 184.

centralized absolutist state, personal relationships with the monarch based on noble qualities such as honor, loyalty, and generosity were gradually replaced by bureaucrats with administrative skills needed for governance. The "sovereign's gaze" increasingly relied on structural and symbolic tools of state control rather than the monarch's personal set of eyes.³⁴³ Changes in the French military provide the most visible example of the associated shift in values as military leadership, traditionally reserved for men of noble blood, incorporated educated officers who were rewarded more for efficiency and expertise than for their noble lineage.

Louvois, under the direction of Louis XIV, did much to foster the growth of the French army. Following the example of Maurice of Nassau, he instituted regular pay for troops. Measures to lower rates of desertion included harsher punishments for *passe volantes* (i.e. soldiers who only marched on parade, not in battle), and the use of barracks as a "discipline factory" for recruits.³⁴⁴ This incidentally curbed the spread of venereal disease as new regulations strictly outlawed prostitution and kept tighter control over the movements of soldiers. Louvois also oversaw the construction of the *Hôtel des Invalides* for the care of sick, wounded and impoverished soldiers.³⁴⁵ The provision of healthcare not only rewarded the meritorious veteran, but kept impoverished and desperate ex-soldiers off the streets. Professionalization of the military extended to appearances – only young, smart-looking and trim soldiers were to be seen, adding luster to the military

³⁴³ See Michel Foucault, *Discipline and Punish: The Birth of the Prison* (New York: Pantheon Books, 1977) for the classic study of the ways such surveillance could be internalized .

³⁴⁴ Jones, "The Military Revolution and the Professionalisation of the French Army," 162.

³⁴⁵ Building a *Hôtel des Invalides* [Hospital for wounded soldiers], had also been recognized as important earlier under the powerful Chief Minister Cardinal Mazarin (1602-1661) who observed, "there is nothing which produces a better effect in armies than that the sick and wounded are looked after," but construction on *Les Invalides* did not begin until 1670. In 1708 alone, fifty additional military hospitals were created. Jones, "The Military Revolution and the Professionalisation of the French Army," 160-61.

vocation. Uniforms conveyed the prestige of officers and signalled membership in a particular regiment. The French army in the early to mid-eighteenth century relied less on mercenary soldiers and/or the forced labor of peasants in the service of an aristocratic lord/officer and more on men who submitted to the rigors of military training (i.e. drill) inspired by a sense of nationalism, adventure, and honor.³⁴⁶

Military recruits had been organized into regiments since at least the mid-sixteenth century in France, but during the reign of Louis XIV, they were organized into much more precisely-drilled units under the notoriously strict Jean Martinet. Martinet served as lieutenant-colonel of the *Régiment du Roi*, a company convened specifically to model proper and exact drill formations for the rest of France's army. Housing soldiers in barracks made more extensive drill training possible. Soldiers had traditionally been "billeted" (hosted) in private homes (often as a way of persecuting suspected Protestants) making it difficult to gather them together for regular training.³⁴⁷ Martinet instituted a strict regimen of intricate marching patterns which soldiers were required to master over the winter months.³⁴⁸ He also engaged in an extensive program of road improvement which facilitated the movement of troops throughout the country. His "depot" system of warehouses located alongside this newly developed network of roads made it much easier to supply the army when out on military exercises or practicing maneuvers in France.

³⁴⁶ For more on the development and professionalization of the French army in the eighteenth century, see Ken Alder, *Engineering the Revolution: Arms and Enlightenment in France, 1763-1815* (Princeton, N.J: Princeton University Press, 1997); Robert S Quimby, *The Background of Napoleonic Warfare; the Theory of Military Tactics in Eighteenth-Century France*. (New York: Columbia University Press, 1957); and H. M Scott and Brendan Simms, *Cultures of Power in Europe during the Long Eighteenth Century* (Cambridge: Cambridge University Press, 2007).

³⁴⁷ Jones, "The Military Revolution and the Professionalisation of the French Army," 162. In 1742, three hundred towns had barracks. By 1775, up to 200,000 men were housed in them - about half of the French army at its largest in the eighteenth century.

³⁴⁸ Cathal J. Nolan, *Wars of the Age of Louis XIV, 1650-1715*, 284.

Under his command, the army became a key and visible component of the larger machinery of France's absolutist government.

Toward the end of his life, Louis XIV commissioned a newly elected member of the *Académie Royale de Peinture et de Sculpture* [Royal Academy of Painting and Sculpture], Pierre Giffart (1643-1723), to create an updated French drill manual, "*comme il se fait aujourd'huy*" [as they do today], for firearms.³⁴⁹ The frontispiece depicts a scene of courtly deportment as elegant officers in wigs bow to each other, toes turned out, while infantry in pike squares drill in the background (see Figure 4.22). Giffart's manual, like Gheyn's earlier volume, features pictures of the steps involved in loading and shooting an arquebus. In Giffart's version, however, the soldier demonstrating each step in loading and shooting is flanked by a line of soldiers making the exact same movement in precise unison (see Figure 4.23 and 4.24). One finds groups marching or moving in unison throughout Giffart's manual. This continues in the later manual, Maurice de Saxe's *Les Reveries* (see Figure 4.25). In Giffart's depictions of manual drill (loading a firearm), a drummer is beating time to keep individual soldiers exactly together. The drummer is accompanied by a drill sergeant conducting with an *esponton* (half-pike).³⁵⁰

Military musicians had played to keep drilling infantry marching and moving together at least since the flautists of ancient Sparta urged on young soldiers, however their role was amplified in *ancien régime* France as the number of soldiers involved in

³⁴⁹ "As they do today." Giffart became a member in 1691 of the *Académie Royale de Peinture et de Sculpture* (Royal Academy of Painting and Sculpture, founded 1648).

³⁵⁰ "Esponton," is defined as a "sorte de demi-pique, que portent les Officiers d'Infanterie," Dictionnaires d'autrefois.

pitched battles increased dramatically.³⁵¹ In early modern France, an extensive array of drum beat patterns, rolls, and rim-shots accompanied an ample vocabulary of drill commands. Arbeau's sixteenth-century *Orchesographie*, a treatise on war as well as on dance, includes eighty-one such drum riffs. Drums were also used to signal formations, convey news of a battle, and proclaim national identity. Each army employed a unique set of tunes. Musicians often served as spies, especially if they were multilingual and familiar with the tunes and signals used by an enemy.³⁵²

Drills and military maneuvers depicted on paper formed an important part of the education of the young Louis XV (1710-1774).³⁵³ His tutor, Robert d'Hermand, commissioned a series of eighty large volumes of engravings so that his pupil would know the history of his forces and how they conducted battles. These volumes included a collection of drill diagrams created for the young king's education by the artist and engraver Jacques-Antoine Delaistre (1690-1765). The diagrams depict long columns of troops marching or fording a river (see Figure 4.26a and 4.26b). One is struck by page after page of patterns for tailoring numerous different military outfits for different levels of soldiers and officers. Delaistre seems to assume a certain graphic imagination as he includes plates in which the pieces of the uniforms are not yet made up but are laid on the page as pattern pieces waiting to be assembled (see Figure 4.27).³⁵⁴ Uniforms not only distinguished nationality, but importantly, marked one's hierarchal rank in the military (see Figure 4.28a and 4.28b). Thus, the introduction of uniforms was an important part of

³⁵¹ See Kate van Orden, *Music, Discipline, and Arms in Early Modern France* (Chicago: University of Chicago Press, 2005), 190-196, for a discussion of the Phyrrie, a battle dance (often armed) endorsed by Plato, Xenophon, and Lucian of Samosata (c.120-200 CE). This was "not just a dance of war, but musical warfare," according to Lucian (see van Orden, 195).

³⁵² Kate van Orden, 210.

³⁵³ And other Bourbon princes.

³⁵⁴ See, for example, the Jacques-Antoine Delaistre, *Albums Delaistre*, 1721 in the Musee de l'Armee.

the military reforms and of the professionalization of the army in the eighteenth century. The cut of an officer's military uniform could designate status, as could additional decorative elements.³⁵⁵ While uniforms could convey prestige for officers, for the common conscript, uniforms would more likely be part of the anonymity and interchangeableness of the "rank and file."³⁵⁶ Wearing the exact same outfits turned rough lower ranking conscripts into cogs in the war machine, or, dots on the page, where they could be read or maneuvered.

Learning the Drill

What kinds of movements made up the corpus of eighteenth century drill? There were five basic movements that a soldier, or in the case of cavalry, horse and rider, needed to master: "manual" exercise, which had to do with the handling of weapons; "platoon exercise," the rapid switching of lines when volley firing; "evolutions," the complicated patterns moving groups of soldiers from one formation to another, often in geometrical fractions of circles; "firings," complicated sequences of gunfire performed by various subdivided groups; and "maneuvers," an extensive repertoire of close-order linear movements. The officer class needed to learn these drills so they could teach them to their subordinates.

Already at the beginning of the eighteenth century, the concept of drilling was so commonplace that it could be spoofed in popular culture, as in this satire in *The*

³⁵⁵ Some officers were notorious for their love of ostentatious clothing. The Baron Von Steuben, for example, spent thousands of dollars (that he had not yet earned) on plumes. See Lockhart, *The Drillmaster of Valley Forge*.

³⁵⁶ Uniforms were not widely worn by infantry until the reign of Louis XIV. Jones, "The Military Revolution and the Professionalisation of the French Army, 159.

Spectator, comparing a woman's use of her fan to a manual drill.³⁵⁷ Written from the point of view of a "Mr. Spectator," these witty essays were read on both sides of the Channel. The fictional Mr. Spectator claims that through his training, women can become adept in using their fan as a weapon, even learning to discharge a "Pop loud enough to be heard at the further end of a Room."³⁵⁸ He commences his training, modeling the training of infantry soldiers in the early modern army, with these "words of command" that cast the fan as a woman's weapon:

Handle your Fans,
Unfurl your Fans,
Discharge your Fans,
Ground your Fans,
Recover your Fans,
Flutter your Fans.³⁵⁹

With tongue-in-cheek humor, Mr. Spectator claims that these motions are easily learned. The new recruits in his "regiment," he writes, will soon be adept at handling their "weapons." Mr. Spectator boasts:

Upon my giving the Word to discharge their Fans, they give one general Crack that may be heard at a considerable distance when the Wind sits fair. This is one of the most difficult Parts of the Exercise; but I have several Ladies with me, who at their first Entrance could not give a Pop loud enough to be heard at the further end of a Room, who can now discharge a fan in such a manner, that it shall make a Report like a Pocket Pistol.³⁶⁰

In this passage, not only is a fan compared to a gun, but the discharging of fans is performed *en masse* and in unison upon the word of command, much like the lines of volley delivered by an infantry platoon. All of the elements of the early modern army are

³⁵⁷ *The Spectator* was a widely read periodical published in London beginning in 1711. It aimed to bring philosophy "out of closets and libraries, schools, and colleges, to dwell in clubs and assemblies, at tea-tables and coffee-houses." Joseph Addison, "No. 10 The Spectator, March 12, 1711.

³⁵⁸ Joseph Addison, "No. 10 The Spectator, March 12, 1711.

³⁵⁹ Ibid.

³⁶⁰ Ibid.

thus presented in this spoof for a popular audience: the heightened use of firearms, the crucial organization and training of soldiers through drill, and – a development that I argue has been underestimated by military historians – the description in print of the movements involved that both inspired and communicated a new, more rigorous approach to military practices.

In the sixteenth and seventeenth centuries, many members of the nobility of the sword in France had sent their sons to schools in Italy where they learned aristocratic pursuits such as dancing, fencing, riding, and playing the lute. In eighteenth century, French academies became the center of military education, and aristocratic young men from all of Europe attended. It was assumed that noble qualities had been passed from father to son; the role of the academy was to nurture “a certain natural grace,” that was already inherent.³⁶¹ Dress and other expensive trappings of the noble could be imitated, so it was believed, but the *je ne sais quoi* of noble bearing and behavior could only be encouraged, not learned. Instruction at officer academies continued to include dance, fencing, and riding. Increasingly studies also included mathematics and engineering.³⁶² The education of officers included daily drill exercises (“especially on Sundays and Holidays”) and displays of these exercises paralleled the theater and dance spectacles of the colleges.

According to the author of the *Encyclopédie* article on military academies and the first director of the royal military school, Jean-Baptiste Pâris de Meyzieu (1718-1778),

³⁶¹ Baldassare Castiglione, *Le parfait courtisan et la dame de cour* (Paris: Estienne Loyson, 1690), 6; Nicolas Faret, *L'honneste-homme ou, L'art de plaire a la court* (Paris: Toussancts du Bray, 1630), 10-11.

³⁶² Ken Alder, “French Engineers Become Professionals; or, How Meritocracy Made Knowledge Objective,” in *The Sciences in Enlightened Europe*, ed. William Clark, Jan Golinski, and Simon Schaffer (Chicago: University of Chicago Press, 1999), 94–125. See also Paris de Meyzieu, s.v. “Ecole Militaire,” *Encyclopédie*.

dance was “particularly useful for placing the body in a state of equilibrium for the best flexibility and lightness. Experience has shown us that those who apply themselves [to dance], execute with much more facility and quickness all the movements of military exercises.”³⁶³ He writes that the education of the body had been neglected: “we are far inferior not only to the Greeks and Romans, but even to our ancestors, whose better-trained bodies were more fit for war than ours.”³⁶⁴ In his article, Pâris de Meyzieu discusses the focus of the military school as encompassing only those subjects needed by the future officer: theology and jurisprudence were not needed as there were already schools for those subjects. The military school “might not produce philosophers, because that is not the subject being taught.”³⁶⁵ He notes the new importance of engineering and artillery. Other subjects included “Grammar, French, Latin, German, & Italian languages; Mathematics, Drawing, Geography, History, Logic, a little Natural Law, a lot of Morality, military orders, the theory of war, drill exercises; Dance, Fencing, and Horsemanship.” Pâris de Meyzieu was himself a bourgeois.³⁶⁶ So it is not surprising that he makes a point of writing that the king recognized the talents of soldiers who had not been favored with a noble birth and that this had met with resistance from noble families. By 1750, the military was an important avenue for social success and many non-nobles had managed to rise through the ranks.

The army became an increasingly nationalized force over the course of the reign of Louis XV. Earlier, many mercenaries had been drawn from the poorer nations (Ireland,

³⁶³ “La Danse a particulièrement l'avantage de poser le corps dans l'état d'équilibre le plus propre à la souplesse & à la légèreté. L'expérience nous a démontré que ceux qui s'y sont appliqués, exécutent avec beaucoup plus de facilité & de promptitude tous les mouvemens de l'exercice militaire.” Jean-Baptiste Pâris de Meyzieu, s.v. “Ecole militaire,” *Encyclopédie*.

³⁶⁴ Pâris de Meyzieu, s.v. “Ecole militaire,” *Encyclopédie*.

³⁶⁵ Pâris de Meyzieu, 308.

³⁶⁶ However, he did have a family connection to Louis XV's official mistress Madame du Pompadour.

Switzerland, and Scotland were infamous for providing soldiers to the rest of Europe). By the reign of Louis XV, France's army consisted largely of French soldiers – born and raised in France and, not incidentally, Roman Catholic. Officers overseeing the newly specified *French* infantry, the *infanterie française*, drew on the sons of noble families. Particularly for those who were noble but not rich, service in the army offered a chance to prove one's honor and, if one survived, draw a respectable pension. In *Les Reveries*, Maurice de Saxe had proposed the army be made up of citizen soldiers recruited from the entire population of France. By extending military participation to all men, he forwarded Enlightenment ideals of equal service and the rational treatment of soldiers well before the more familiar writings of Montesquieu (1689-1755) and other philosophes advocated they be applied in the military. Maurice de Saxe, himself a naturalized citizen of France, placed great emphasis on the employment of French citizen soldiers, modeling the Enlightenment army after the Roman Republic. Certainly, rank and file soldiers continued to be recruited from prisons and poor houses, but the ideal of the "citizen soldier," regardless of actual practice, emerged in the eighteenth century as a new kind of soldier.³⁶⁷

Le Blond and the Encyclopédie

The importance of drill and diagrams in eighteenth-century warfare is evident in the *Encyclopédie*. Among over a thousand articles on various "Art Militaire" (Military Arts) in the *Encyclopédie* covering everything from military architecture to heraldry, foraging to fuselage, and Grenadiers to the Knights of Malta, the articles on drill and military exercises are among the longest. Many of the most complicated drill formations

³⁶⁷ Jones, "The Military Revolution and the Professionalisation of the French Army," 160.

are described in detail in the *Encyclopédie*.³⁶⁸ The eleven volumes of images include a section on “Arte Militaire” including five plates demonstrating manual drill for soldiers with firearms in multiple pictorial poses, fourteen plates of drill diagrams indicating the movement of large bodies of troops on foot, and one plate showing the movement of soldiers riding on horses in formation. The horses and their riders pivot in closely-packed lines. The bird’s eye view offered by the notations positions soldiers or soldiers on horses (indicated by the horse-shaped dots) as tiny parts of large moving bodies. Symbols for officers were often positioned to the side to indicate their supervision over the precise movements of the main corps.

Guillaume Le Blond (1704-1781) contributed nearly eight hundred articles on military topics to the *Encyclopédie*.³⁶⁹ He was a geometer and mathematician, not a military commander nor of the noble class, but he purchased a post at the *École des pages de la Grande écurie du roi* [School for pages of the Large stables of the king], a prestigious school at Versailles for the sons of nobility. He taught mathematics, military theory, and engineering and published two volumes on arithmetic and geometry for officers that included lessons in cartography. His *Encyclopédie* article on “Evolutions,” at eighty-eight pages, is even longer than Diderot’s loquacious entry on “Encyclopédie.” This article accompanies a series of engravings that present evolutions or maneuvers in various configurations: there are fourteen engravings for infantry maneuvers and one for cavalry. There are also pictorial illustrations for the handing of arms. Le Blond writes that

³⁶⁸ Guillaume Le Blond, s.v. “Evolution” and “Exercice (Arte Militaire),” *Encyclopédie*, vol. 6, 169-206 and 238-252.

³⁶⁹ “Guillaume Le Blond,” in Frank A. Kafker and Serena L. Kafker *The Encyclopedists as Individuals: A Biographical Dictionary of the Authors of the Encyclopédie* (Oxford: Voltaire Foundation at the Taylor Institution, 1988). Le Blond is designated in the *Encyclopédie* by the letter Q.

the men in closed ranks (horizontal lines) and files or columns (vertical lines) would actually be packed together shoulder-to-shoulder but to depict that more realistically in the diagrams would make the image too difficult to read. On each little dot, Le Blond tells us, there are tiny lines that represent the weapons (*les armes*) of each soldier and the direction he is facing (see Figure 4.29, 4.30, and 4.31).

In his entry on “Evolutions,” Le Blond explains why military exercises are important and – in painstaking detail – outlines exactly how they should be executed. He states that it is essential for troops to be well-trained in evolutions so that they can easily do all they are ordered to do in the heat of battle. He continues with an appeal to Polybius (c.200-c.118 B.C.E.), the historian of the Roman Republic, to argue that a well-constructed army is like a well-constructed building. Diagrams, as this analogy suggests, are the blueprints. Le Blond uses his diagrams to think through how a maneuver works and to envision difficulties. In “Fig. 43” at the top of one of his pages of examples, Le Blond notes a problem illuminated by the diagram: in order for battalion A B D E to make a quarter turn, the leader (point C) in the middle of line (i.e. rank) A B would need to serve as a pivot point (see Figure 4.30). Soldier M should serve as a pivot point for his line, but actually he cannot be a stationary pivot but rather needs to make a U to face around and then march in a curve to point N at the same time that each side of his line is turning to face the correct direction ending in line I F. In another diagram, Le Blond makes a suggestion to improve on another writer’s work, concluding, “This movement would be executed in this manner with greater grace, regularity, and facility, than by making the soldiers march on the side, as it is taught in the different treatises on

evolutions.”³⁷⁰ He includes only one example for the drilling of cavalry, noting that not much has been written on it and that he is only offering rudimentary rules and principles. Other articles by Le Blond include a one-line definition of an obsolete cannon (*Aspic*), a covered corridor in a fortress (*Chemin-couvert*), the polygonal interior plan of a fortress (*Figure*), and saluting a prince of the blood or marshal of France by artillery discharges (*Le Salut*). Above all, Le Blond is writing to make war more civilized. It is drill that separates the civilized nation from the savage. As he writes, “all civilized nations have always had rules for the training, order, and movements of their troops. Without the knowledge and the practice of these rules, a troop of men of war will be nothing but a confused mass, in which all parties will be entangled.”³⁷¹ In his entry on *Victoire* [Victory], Le Blond admonishes the victorious to care for the wounded and bury the dead. In the Enlightenment spirit of the *Encyclopédie*, Le Blond adds, “this is a duty prescribed by humanity.” He ends his entry with another reference to Polybius who cautions generals and kings to be prepared for a reverse of fortune, “as the past has furnished an infinity of examples.”³⁷²

Maurice de Saxe: Diagrams to Simplify Action

Unlike Le Blond, whose meticulous descriptions were based on his research and reading, Maurice de Saxe was one of the most celebrated war heroes of eighteenth-century France. In spite of the title, *Reflections or Memoires on the Art of War*, his treatise is not a collection of war stories, but rather practical suggestions for the conduct

³⁷⁰ Guillaume Le Blond, s.v. “Evolution,” *Encyclopédie*..

³⁷¹ “Toutes les nations policées ont eu dans tous les tems des regles pour la formation, l'arrangement, & les mouvemens des troupes. Sans la connoissance & la pratique de ces regles, une troupe de gens de guerre ne sereit qu'une masse confuse, dont toutes les parties s'embarrasseroient réciproquement.” Le Blond, “Evolution,” 6:169.

³⁷² Ibid.

of war. It is dedicated to *Messieurs les officiers generaux* [Gentlemen officers] who are addressed thus: “*A qui pouvois-je mieux l’offrir qu’ à Vous, Messieurs, puisqu’il n’a été fait que pour votre usage?*” [To whom can I offer it better than you, gentlemen, since it was only made for your use?].³⁷³ In his Preface, Maurice distinguishes the “science” of war, which he defines as rules and procedures, from the “sublime.”³⁷⁴ The *sublime*, covered in his second volume, had to do with the natural world and features of environments to be traversed or defended such as mountains, rivers, and plains; the first volume, covering the science of war, concentrated on training.³⁷⁵ Although at the outset, Maurice wrote that he considered war to be “une Science couverte de ténèbres dans l’obscurité des quelle on ne marche pas assuré” [a Science covered by shadows in the darkness of which one does not walk with a sure foot], he had a lot to say about how war – particularly the formation of troops – should be approached scientifically.³⁷⁶ This science of war, according to de Saxe, consisted of details and careful planning: preparing troops for battle by incessant drilling and close attention to clothing and provisions. He drew on his own extensive experience. As Maurice explained in his treatise, “One can make a very careful plan when he goes to build, if he does not know how to cut the stone

³⁷³ The *Epître Dedicatoire* [Dedicatory Letter] was written by C. de Bonneville, de Saxe’s amenuensis who published *Les Reveries* a year after Maurice de Saxe had died.

³⁷⁴ “Toutes les Sciences ont des Principes & des Regles (*), la Guerre seule n’en a point” [All the Sciences consist of Principles and Rules (*), only War has not one.” Ibid., 2. However he qualifies this in a footnote: “*La Guerre a des Regles dans les parties de détails; mais elle n’en a point dans les sublimes” [War has Rules in the parts of details; but she has none in the sublimes]. Maurice de Saxe, *Les Réveries, Ou Mémoires Sur l’art de La Guerre*, ed. M. de Bonneville (La Haye: Pierre Gosse Jr., 1756), 1.

³⁷⁵ In his second volume, Maurice also noted the achievements of the famed French engineer, Sébastien le Prestre de Vauban (1633-1707), who had been responsible for building or updating fortifications in nearly three hundred towns to defend France. Vauban’s work fit under the category of the sublime because it altered natural landscapes to better serve the state. Topographic maps and directions for moving cannon were included in Maurice de Saxe’s second volume along with drill diagrams.

³⁷⁶ de Saxe, *Les Reveries*, 1.

nor how to lay the foundation, the entire building will soon crumble.”³⁷⁷ The foundation he was referring to here is not that of a fortress but of the troops that formed the army. Drill diagrams – images of battalions on paper – served as the plans for building and thinking about the foundation of an eighteenth century army: the infantry troops.

After learning how to stand, soldiers in training learned how to march in time. The pace of the march in drill changed over time and from location to location. In one manual, the marching step was clocked at exactly 60 steps per minute.³⁷⁸ However, the pace could also change depending on the maneuver being performed and the terrain being traversed. Maurice de Saxe placed marching first in forming troops for action, realizing that this “will appear very extravagant to the ignorant.”³⁷⁹ His approach, which he calls marching in “cadence, or equal measure” imitates the Prussian drill. Music played an essential role in drill according to Maurice de Saxe. It was not just “a warlike ornament.”³⁸⁰ Some soldiers march quickly; others slowly. To keep troops together – this is a secret de Saxe attributes to the Romans – marching “in cadence” should be preserved. The use of music to speed up or slow down, in short, to regulate the pace of marching soldiers is what de Saxe calls “tactique.”³⁸¹ He continues,

Nothing is more common, than to see a number of persons dance together during a whole night, even with pleasure; but, deprive them of music, and the most indefatigable amongst them, will not be able to bear it for two hours only; which sufficiently proves, that sounds have a secret power over us, disposing our organs to bodily exercises, and, at the same time, deluding, as it were, the toil of them.³⁸²

De Saxe attributes the endurance of the Romans to their sense of cadence. He asserts that

³⁷⁷ de Saxe, *Les Rêveries*, 4.

³⁷⁸ Frederick II, *Military Instruction*, 7.

³⁷⁹ Maurice de Saxe, *Les Rêveries*, 23.

³⁸⁰ Maurice de Saxe, *Les Rêveries*, 23.

³⁸¹ Maurice de Saxe, *Les Rêveries*, 24-25.

³⁸² Maurice de Saxe, *Les Rêveries*, 25.

the Romans marched twenty-four miles in five hours and wished to do an experiment to see if his own army could match them.³⁸³

Maurice included a full page key to the symbols he used (see Figure 4.32): he designated unique symbols for officer ranks, whether a ball with a (pictorial) sword for the lofty *Général Legionnaire* (top left) or simply a ball with an (abstract) line and circle at the end for a *Caporal* (top right). Infantry and Cavalry, however, are marked by rectangular bars with no indication on the plate of the numbers of men represented by these bars. While officers do appear on many of the subsequent diagrams, the majority of these diagrams feature the rectangular bars of infantry and cavalry with their positions in the field or movement indicated by two diagrams on the page showing positions before and after a manoeuvre. In the text of his treatise, Maurice describes the movement of the troops depicted in the plates and offers his rationales for the particular configuration he has given in his diagrams.

Often, he draws on accounts of battles in ancient Greece and Rome. For example, Plate VII depicts formations based on a classical Roman model in which cavalry back up infantry battalions (see Figure 4.33). In this mid-eighteenth century diagram, the landscape has been omitted, the formations sit squarely on the page, and each officer is represented by a symbol in exactly the right spot.

In France, the posture of dance and drill had much in common. Status at court through dance and one's physical presence and rank in the military both required assuming erect, regal posture. Thus, in both dance and drill manuals of the period, instructions for how one should stand are specific and very similar: in both, the reader is

³⁸³ de Saxe, *Les Rêveries*, 26.

advised to stand with the feet turned out, arms by one's side, and with the head turned slightly. Echoing advice found in Castiglione's *Book of the Courtier*, the ideal standing position was not rigid nor affected but to have a quality of "*négligence si contraire à l'affectation*" [negligence so contrary to affectation], what Castiglione called *sprezzatura*, which was the source of "*la bonne grace*" [good grace].³⁸⁴ This posture was supported by well-fitting shoes, according to Maurice de Saxe, who devoted three pages to the subject of clothing. With regard to feet, he advocates "shoes made of thin leather, with low heels; which fit perfectly." These shoes will make soldiers "march most gracefully; because low heels oblige men to turn out their toes, keep their knees from locking, and consequently to open their shoulders."³⁸⁵ He advocated the use of tallow to grease the naked foot to prevent dampness and blisters, as well as the use of galoshes in the winter.³⁸⁶ The leg and foot were the most important part of military action for de Saxe. The manual drill was a necessary training in the use of firearms, but it was synchronized marching on the field that de Saxe felt was essential. He insisted that the principal part of all discipline depends upon the legs, and not the arms: the personal abilities which are required in the performance of all maneuvers, and combat, are totally confined to them."³⁸⁷

The drill movements practiced by companies of soldiers and their officers consisted of several different kinds of maneuvers. Movement diagrams offered a basic pattern for the movement of entire groups of soldiers which an officer who studied them could modify according to the contingencies of the landscape. Jacques-Antoine-

³⁸⁴ Baldassare Castiglione, *Le parfait courtisan et la dame de cour* (Paris: Estienne Loyson, 1690), 66-67.

³⁸⁵ Maurice de Saxe, *Les Rêveries, Ou Mémoires Sur l'art de La Guerre*, ed. M. de Bonneville (La Haye: Pierre Gosse Jr., 1756), 12-13.

³⁸⁶ de Saxe, 13.

³⁸⁷ Maurice de Saxe, *Les Rêveries, Ou Mémoires Sur l'art de La Guerre*, ed. M. de Bonneville (La Haye: Pierre Gosse Jr., 1756), 22.

Hippolyte de Guibert (1743-1790) lists several different formations in which one might configure a battalion: with eight platoons, one could have two columns of four rows each; a battalion of nine, two columns of four and one in reserve, a battalion of ten, two columns of five, one of eleven, two of five, and one in reserve, and so on. He explains that with as much practice as possible, battalions could then, depending on the situation, march as easily forward to attack, as in retiring, or forming in order to meet the needs of particular battles. As long as he kept his troops well-exercised, a military leader could move them as circumstances changed. With a practiced eye, such a leader could grasp in a glance – a *coup d’oeil* – the tactical qualities of a terrain to judge where troops should move and how they should get there.³⁸⁸

Gabriel Pictet: Diagrams for Precision

The Swiss officer Gabriel Pictet (1710-1782), the author of one of the most important drill manuals of the eighteenth century, devoted his life to military service, serving the King of Sardinia who during this period also ruled over Savoy, the Piedmont, and Nice. His career could serve as an example of the soldier who rises through the ranks through merit, although being of noble birth continued to confer considerable advantage.³⁸⁹ At the age of twenty-three, he had attained the rank of *enseigne* and over the next ten years, he worked his way up to the rank of captain, and then to brigadier in 1778. In a portrait of Pictet painted about 1750, one can see all the accoutrements of an aspiring elite: the carefully coiffed and powdered wig, the brilliant red jacket with a hint

³⁸⁸ Jacques-Antoine-Hippolyte de Guibert, *Essai Général de Tactique, Précédé d’un Discours Sur l’état Actuel de La Politique et de La Science Militaire En Europe* (Londres: Chez les Libraires Associes, 1772), 360.

³⁸⁹ Many authors of influential military manuals such as Maurice de Saxe (1696-1750), Jacques-Antoine-Hippolyte, Comte de Guibert (1743-1790), and Louis Drummond, comte de Melfort (1722-1788) were born into noble families but also claimed to have achieved their fame due to their own merit.

of lace at the neck and gold braid and buttons, the steady gaze – all speak of a man becoming well-established in the world.³⁹⁰

Key to Pictet's success was his comprehensive manual on infantry training. After seeking a publisher in Paris, the Hague and Liège, Pictet finally printed his two-volume *Essai sur la Tactique de l'Infanterie: Ouvrage Méthodique où l'On trouve en détail et par ordre Les Principes, les Règles & les Maximes qui sont propres à cette partie de l'Art de la Guerre, avec des Applications continuelles de la Théorie à la Pratique* [Essay on Infantry Tactics: A Methodical Work in which one finds in detail and in order the Principles, Rules & Maxims which apply to this part of the Art of War, with constant applications of theory to practice] in 1761 in Geneva as a demy-quarto.³⁹¹ Pictet published his work anonymously since he was still serving under the Comte de la Roque and did not want to appear critical of his superiors. Nevertheless, it was well known that he was the author of the treatise and he eventually garnered considerable fame for his six hundred page essay with eighteen fold-out engraved plates of diagrams.

Pictet describes in minute detail how to read and perform each drill illustrated in the engravings. He takes twelve pages to discuss in narrative prose Plate VII, one of the simpler examples (see Figure 4.34). In this engraving, there are five figures. The first figure shows a battalion made up of nine darkened rectangles, each standing for a small group of soldiers (a "Peloton"). To the right of the center rectangle, one can see two tiny flowing flags emerging from the rigid lines representing the bodies of soldiers. The only pictorial images on the page are these two flags. Everything else is abstracted into

³⁹⁰ Jean-Daniel Candaux, *Histoire de la famille Pictet, 1474-1974* (Genève: E. et M. Pictet, 1974), 161-164.

³⁹¹ "Demy" refers to the larger sheet of paper that went through the press from which a quarto (or quarter of the page) was printed. At about 8" x 11", it was slightly smaller than a quarto (9.5" x 12.5") which was printed from a regular blank sheet.

perfectly formed geometric shapes for soldiers and the straight or curved lines indicating movement. Pictet tells his readers that the battalion indicated by the coordinates C D march in the direction E D to arrive at their field of battle A B, with B to the left, and with the right group C in the head. While the nine rectangles are solid masses, Pictet writes that he supposes that this battalion has marched with a “free and open” step, and continues to march in the same way to arrive at D C. Pictet distinguishes this less regulated step used for covering distances from the parade step that required a more uniform, measured pace.³⁹² Even the well-ordered march had to conform to the expected choreography of drill. Like the steps of a dance, the movements were to appear natural, even though they were well-rehearsed and planned out in advance: Pictet takes two full pages to describe the first figure and twelve pages to detail the movements of all five simple figures.

Pictet’s aim is the practical logistics of moving large numbers of men in and out of camps and onto (and away from) the battlefield by ranks and files, turning to face the enemy as a group (see Figure 4.35). The diagrams serve as visual hypotheses. Going back to Fig. III in the first example by Pictet (Figure 4.34), the second Peloton CD which followed the first group, marches to the line IT which is perpendicular to the front. Coming up to the left of the first Peloton AB, the CD Peloton also does a quarter conversion to the right to march into place along the perpendicular lines IL and RP (Fig.

³⁹² Gabriel Pictet, *Essai Sur La Tactique de L’infanterie: Ouvrage Méthodique Oú L’on Trouve En Détail et Par Ordre Les Principes, Les Règles & Les Maximes Qui Sont Propres À Cette Partie de L’art de La Guerre, Avec Des Applications Continuelles de La Théorie À La Pratique: Ouvrage Nécessaire Aux Officiers D’infanterie, Qui Désirent D’acquérir Une Connoissance de Leur Métier Fondée Sur Des Principes Raisonnés, et Pour Ainsi Dire Démontrés* (Geneva: Emmanuel Etienne du Villard, 1761), 88-89. Pictet recommends a medium step to accommodate the smaller men that might be in a troupe. Both the size and speed of step must be taken into consideration. The “uniform and regulated step,” he writes, suitable for a Troop is about sixty steps over a hundred and twenty feet in a minute. Pictet also recommends the soldier avoid “affectation,” advice one also finds repeatedly in dance manuals.

III of plate 7). Pictet then uses the diagram to think through how this might actually work. He admits that there is a difficulty “of little consequence in truth,” which must be remedied: when the first Peloton AB makes its quarter turn into place (B to I), this takes 18 steps; since it is only 12 steps from CD to the pivot point, the second Peloton C D would already be on the heels of the first if it proceeds at the same pace. So that Peloton CD is not obliged to stop and wait, Pictet writes that the Sergeant on the right should march slowly in small steps to advance beyond pivot point A. This movement is made to facilitate getting into position for battle. Pictet claims it is neither “inconvenient nor irregular” to march with this small wing slightly ahead because it is but a question of distances between Pelotons. While it is inconvenient to make the Peloton in back stop, those who practice this method of compressing or elongating their steps will not find this difficult. Throughout his explanation, Pictet refers to lines of geometry. A I is the horizontal line along which the groups are moving. A G (misprinted as C) is the perpendicular line towards which the Pelotons are moving to get into formation. Pictet writes in a deliberate, thoughtful manner, adding further observations to consider other cases in which such maneuvers might be used.

Some of the strategies used to indicate movement in drill manuals included: 1. before and after pictures of positions, as seen in the manual drill illustrations by Jacques Gheyn or Pierre Giffart; 2. lines to indicate the path along which soldiers should march, exemplified by Jacques-Antoine Delaistre’s wavy lines of travel or geometrically precise lines in Gabriel Pictet’s examples; or 3. standardized dots arranged to represent individual soldiers outlined and filled in shapes (i.e. white and black circles) to show starting and ending positions as in the plates for the *Encyclopédie*. Rectangular bars

eventually came to represent larger groups and became the standard form of representation. From the earliest depictions, designers of diagrams were aware of the difficulties in accurately portraying the formation and action of troops.³⁹³ As different strategies were tested, features of the landscape were often, though not always, omitted. It is difficult to tell how these diagrams were used. One writer even suggests that they could serve as program notes to allow young noble amateurs to follow the proceedings of a siege “with minimal effort.”³⁹⁴ This comment is telling for while the proliferation of manuals for military exercises in the mid-eighteenth century suggests a heightened interest in the importance of publication in the dissemination and standardization of drill theory and practice, it was not until France was defeated in the Seven Years’ War that drill and discipline reshaped how war was conducted by the French.

Drill after the Seven Years’ War

The French/Austrian defeat at the hands of the Prussian/British forces in the Seven Years’ War (1756-63) radically changed the configuration of the French army and military discipline. In this global military conflict, France lost colonial holdings in Canada, the territory of Louisiana, and Senegal.³⁹⁵ In the wake of this disaster, the Duke of Choiseul (1719-1785), appointed chief minister of both the army and navy in 1761, was able to put into place sweeping reforms. These included reorganizing regiments and centralizing recruiting and supplies, including uniforms which were “standardized down

³⁹³ An example apparently by an aide to the Baron von Steuben included algebraic equations alongside a very rough sketch of a drill formation on American terrain. See Friedrich Wilhelm Ludolf Gerhard Augustin Steuben, “The Papers of General Friedrich Wilhelm von Steuben, 1777-1794” (Kraus International Publications, 1982).

³⁹⁴ Guillaume Le Blond, *Traité de l’attaque des places* (Paris: Jombert, 1743). See Alder, *Engineering the Revolution*, 359, fn 25.

³⁹⁵ As well as parts of the West Indies and influence on the Indian subcontinent.

to stamping the regiment's number on the buttons."³⁹⁶ All of this had an impact on noble officers who had eagerly volunteered to serve in the Seven Years' War motivated by a passion for glory that was matched by Amerindian warriors who also turned to battle to advance their social status.³⁹⁷ As Julia Osman argues, in French culture, war exploits served as a primary vehicle for noble officers to "revive their honor."³⁹⁸ This led many of them to fight for promotions, decorations, and pensions rather than to be effective leaders.

Many eighteenth-century military theorists had blamed a reliance on firearms for the losses in the Seven Years' War. Even toward the end of the century, firearms were slow to load and rarely accurate when fired.³⁹⁹ Thus, after 1763, Choiseul emphasized drill maneuvers, mandating long summer training for all members of the army. As Ken Alder explains, disciplined, drilled soldiers were the key to making artillery and muskets effective. "Mixed tactics" referred to the use of firearms along with the pike or bayonet used to charge in close-order columns. A debate raged between those who advocated "thin" lines to accommodate newer models of guns versus those who insisted on the power of the massed ("deep") columns of the Ancients.⁴⁰⁰ Alder notes that "French weapons outperformed those of her rivals only when operated in tandem with the new

³⁹⁶ Rene Chartrand, *The French Army in the American War of Independence* (London: Osprey Publishing, 1991), 7.

³⁹⁷ Julia Osman, "Pride, Prejudice and Prestige: French Officers in North America during the Seven Years' War," in *The Seven Years' War: Global Views* (Leiden: Brill, 2012), 191–92.

³⁹⁸ Osman, "Pride, Prejudice and Prestige," 211. See also M. John Cardwell, *Arts and Arms: Literature, Politics, and Patriotism during the Seven Years War* (Manchester, UK: Manchester University Press, 2004); Mark Danley and Patrick Speelman, eds., *The Seven Years' War: Global Views*, History of Warfare (Leiden: Brill, 2012); Frans De Bruyn and Shaun Regan, *The Culture of the Seven Years' War: Empire, Identity, and the Arts in the Eighteenth-Century Atlantic World* (Toronto: University of Toronto Press, 2014).

³⁹⁹ See Ken Alder, *Engineering the Revolution: Arms and Enlightenment in France, 1763–1815* (Princeton, N.J.: Princeton University Press, 1997), 96, 192.

⁴⁰⁰ Alder, *Engineering the Revolution*, 110.

mixed tactics (which the artillerists did much to promote), and when handled by self-disciplined Revolutionary officers, cannoneers, and soldiers (for which the artillerists served as a partial model).”⁴⁰¹ This too led to an emphasis on drill training.

The success of Frederick the Great’s Prussian army, particularly the precision of his drill maneuvers, had prompted the French to adopt his training methods and codes of discipline which, in the words of Colin Jones, “were Spartan at best, Draconian at worst.”⁴⁰² French officers were ordered to follow Prussian disciplinary measures.

Reading the military manual attributed to the Prussian king, Frederick the Great, one is struck by the harshness endured by common recruits. In these directions for training, soldiers were corralled as if they were in a prison gang. Officers were instructed to keep a close eye on soldiers and the manual lists numerous ways to deter or prevent desertion:

1. By not encamping too near a wood or forest unless sufficient reason require it.
2. By calling the roll frequently every day.
3. By often sending out patrols of hussars, to scour the country round about the camp.
4. By placing chasseurs in the corn by night, and doubling the cavalry posts at dusk to strengthen the chain [of guards that surrounded soldier conscripts].
5. By not allowing the soldiers to wander about, and taking care that each troop be led regularly to water and forage by an Officer.⁴⁰³

There are fourteen of these stipulations. Ironically, ignoring the severe measures taken to retain soldiers, the author extolls the virtues of “disciplined” troops, writing that with

⁴⁰¹ Alder, *Engineering the Revolution*, 345.

⁴⁰² Colin Jones, “The Military Revolution and the Professionalisation of the French Army under the Ancien Régime,” in *The Military Revolution Debate: Readings on the Military Transformation of Early Modern Europe* (Boulder: Westview Press, 1995), 163-64.

⁴⁰³ King of Prussia Frederick II, *Military Instruction from the Late King of Prussia to His Generals. (Illustrated with Plates.) To Which Is Added, (by the Same Author) Particular Instruction to the Officers of His Army, and Especially Those of the Cavalry. Translated from the French, by Lieut. Foster, 1st (or Royal) Dragoons*, 2nd ed. (London: printed by William Cruttwell; and sold by Egerton Military Library, 1797), 3-4.

them, one could “conquer the world.” A soldier trained in drill was a valuable commodity, though not necessarily a willing one, especially after the Seven Years’ War.

Another example of increased emphasis on drill training after the Seven Years’ War can be found in a “catechism” for soldiers. Church leaders regularly employed this question and answer format in religious education, particularly among less literate populations such as the masses of lower class soldiers recruited by officers to fill the ranks of their companies. The familiar educational genre of the catechism – read out loud and drilled over and over – was an apt medium for the training of lower class soldiers. In one military manual, the questions begin with, “What is the position of the soldier?” The answer was a detailed description:

The body straight, the head high, [and] to the right, free, and loose from the shoulders, the arms falling naturally in a line without rounding, the shoulders open, the hips equal, not protruding or receding too much, the feet equally open 19 to 20 thumb widths. This measure is necessary, because if one has the feet too far apart, one could too easily lose equilibrium.⁴⁰⁴

The catechism format suggests that much training of common soldiers took place through oral instructions, a genre very familiar to the French rank and file who came from a devout Catholic populace.

Diagrams of the formation and movement of large groups of soldiers depersonalized human soldiers, replacing individual differences in height, strength, and ability with a standard uniform symbol in print. This standardization and drive toward uniformity could be found in many aspects of Enlightenment life and culture. For example, towards the end of the eighteenth century, Honoré Blanc (1736-1801), one of the king’s gunsmiths and an inventor, had come up with a system of interchangeable

⁴⁰⁴ M. Flamant, *Catéchisme Militaire, Ou Instruction Simple et Facile Pour Apprendre L’exercice En Peu de Temps* (Paris: Gueffier, 1792), 5–6. All translations are mine unless otherwise noted.

parts for putting together flintlock muskets. He predicted that constructing muskets using uniform parts made by comparing them to a standard model would cut down on labor costs by ten percent.⁴⁰⁵ First, similar to the simplification and standardization that went into drill diagrams, the steps in making a musket had to be analyzed and broken down into smaller parts. This system of “interchangeable parts” can be seen earlier in the construction of the early modern army. By training and drilling the common soldier to play his part as mechanically as possible and by training numerous soldiers who could be switched in and out as needed, the concept of the interchangeable part in industry had already been invented. The common soldier, then, as an interchangeable moving part in a war machine, presaged this aspect of the Industrial Revolution – especially in France.⁴⁰⁶ Military drill diagrams, like mechanical drawings in industry and engineering, played a key role in creating the eighteenth century military apparatus.

The disciplined approach to battle developed through the practice of drilling was considered distinctly European. In one popular 1766 manual, *Manœuvres for a battalion of infantry, upon fixed principles*, by William Young, a sugar plantation owner who was serving as the governor of Dominica at the time, wrote one section of his manual as if he were an Amerindian “Canibal” considering how to avoid being massacred by invading Europeans. This fictional Amerindian observes:

I am as strong and active as they are, but am not skilled in all these things they do at Kingston, walking in lines, turning about from one side to another, and twirling their guns about: Do these things make them invulnerable? It must help, for I

⁴⁰⁵ Ken Alder, *Engineering the Revolution: Arms and Enlightenment in France, 1763-1815* (Princeton: Princeton University Press, 1997), 3.

⁴⁰⁶ The industrialization of France was more complicated than in Britain, with a more diverse mix of larger factories, artisan workshops, and piecework out-sourced to home workers. William H. Sewell uses the term “industrial society” to describe developments in late-eighteenth century France. Sewell, *Work and Revolution in France: The Language of Labor from the Old Regime to 1848* (Cambridge: Cambridge University Press, 1980), 143.

never see any part of them, but their front, except the sides of six and the backs of twenty when the line turns about, though I counted sixty when they had done.⁴⁰⁷

For Governor Young, military drill was the key to European military supremacy. In his manual, Young includes words of command in a table format with corresponding instructions in the column to the right of each phrase. Young advises the reader to copy these commands onto cards for use in the field. His instructions attend to the smallest movement of the body. For example, when “Making ready,” he writes:

As the Body is sinking, the Right Knee is to be thrown so far back as the Left Leg may be right up and down, the Right Foot to be thrown a little to the Right, the Body to be kept straight, the Head up looking to the Right along the Rank, the same as if Shouldered; the Firelock to be upright, and Butt about four Inches to the Right of the inside of the Left Foot.⁴⁰⁸

Each movement of the body was carefully choreographed to produce a uniform (and uniformed) product. Although advances in weapons and increased artillery use of guns gave European armies the crucial advantage over the populations they began to subdue and colonize in the early modern period, it was the physical – and psychological – advantage of drill that printed manuals discussed at length.

By the end of the eighteenth century, marching had become increasingly standardized, precise, and highly regulated. Examining the introduction of drilling to George Washington’s continental army offers a revealing case study. First, many histories of the American Revolution assume that independence was won through largely independent guerrilla tactics; one thinks of minutemen trained in frontier skirmishes

⁴⁰⁷ William Young, “A New System of Fortification, ...or The Sentiments of a West-India Savage on the Art of War Prepresented on a Copper-Plate, lately meant to prevent the present cruel intended general Massacre of the present Natives of St. Vincent,” in William Young, *Manœuvres for a Battalion of Infantry, upon Fixed Principles.: With Seventeen Copper Plates.: Including the Late General Wolf’s* (London: Printed for J. Millan, near Whitehall, 1766), pl. 85-102.

⁴⁰⁸ William Young, *Manœuvres for a Battalion of Infantry*, 27.

shooting Redcoats from the woods. However, as Paul Lockhart has convincingly argued, the professionalization of the American army, particularly through the precise execution of drill maneuvers, proved to be a key development, not only in winning the war of independence but also in commanding the respect of European nations.⁴⁰⁹ The French government sent Baron von Steuben, an unemployed Prussian tutor, to assist with the American war effort. When the Baron arrived at Valley Forge, he found Washington's army in disarray and despondent. His solution was to instill discipline and pride through the practice of drill. His flamboyant manner seemed to be just what the troops needed to rally. And yet, it was his insistence on precision in drill, as well as making sure the troops were outfitted in sharp uniforms and had sufficient food, that made the difference. One of Von Steuben's letters show his use of a diagram to think about military maneuvers. His assistant also drew diagrams as well as faces and algebra problems in his notebook. After the war, Von Steuben worked diligently to publish a drill manual for the use of the newly formed United States and its army.

Drill on Parade

Earlier displays of military prowess had taken place at court in grand spectacles honoring the king and aristocracy. By the end of the eighteenth century, the drilling of soldiers in smart uniforms was a familiar sight. Soldiers paraded down the streets of Paris and practiced in fields in the provinces. On stage, a performance of a *ballet d'action* entitled "La Feste de Mirsa" at the Royal Academy of Music elicited cheers when a

⁴⁰⁹ Paul Douglas Lockhart, *The Drillmaster of Valley Forge : The Baron de Steuben and the Making of the American Army* (Washington, DC: Smithsonian Books, 2008), 115.

company of soldiers executed a military precision drill on stage.⁴¹⁰ A century earlier, the rumor of soldiers marching nearby prompted villagers to lock up goods and run for protection. By the 18th century, comments Jones, “civilians were as likely to turn up and cheer as the gallant soldiery marched by with their bright uniforms to the regular beat of the drums and the sound of military music.”⁴¹¹ During the eighteenth century, there were few military conflicts fought in France itself. Furthermore, with the sequestering of soldiers in barracks or hospitals and heightened discipline, civilians had fewer unpleasant encounters with soldiers. The growth of state control over military subsistence reduced pillaging and other bad behavior on the part of soldiers.⁴¹² It was easier for the civilian population to maintain an idealistic view of the military and of the glory and honor that supposedly accompanied military campaigns when the inevitable damage wrought by warfare to civilians and environments was confined to places outside France.

Drill diagrams also distanced the reality of disabled and disfigured bodies and destroyed lives and property that were the result of war. Perhaps this is why Louis Drummond, comte de Melfort (1722-1788) in his 1776 *Traité sur la Cavalerie* [Treatise on Cavalry], included both pictures and diagrams in the elephant folio atlas of engravings that accompanied his treatise. The pictorial representations of dead and wounded soldiers on a field carry an emotional weight that diagrams do not possess. The enormity of the landscapes on which the fallen figures lie adds to the pathos of the battle scene.

Drummond commissioned several artists to draw and engrave these thirty-two prints.

⁴¹⁰ Ivor Forbes Guest, *The Ballet of the Enlightenment: The Establishment of the Ballet D'action in France, 1770-1793* (London: Dance Books, 1996), 144.

⁴¹¹ Colin Jones, “The Military Revolution and the Professionalisation of the French Army under the Ancien Régime,” in *The Military Revolution Debate: Readings on the Military Transformation of Early Modern Europe* (Boulder, CO: Westview Press, 1995), 162.

⁴¹² Ibid.

When looking at them, one is struck by the immensity of the pages some of which fold out in a seamless seven foot sheet. Then one is drawn in by the crisp detail of the tiny figures on the landscape, a chevalier gaily riding off toward a river, the neat rows of tents in a camp, a boy playing in a town square. The first few engravings feature scenes from a riding school. Subsequent engravings depict various aspects of cavalry life: setting up camp (two images that compare the right and wrong way to do this, in order or confusion), cavalry drills with faint dotted lines indicating the paths to be followed, “Z” formations for cavalry going through a pass to keep riders in a line together, and battle scenes. Drummond pairs pictures of a scene with an abstract diagram in an insert to show how drills are to be performed: in 1776, a diagram still needed translation. Drummond’s treatise and luxurious volume of prints was dedicated to the king. Most of the sixty-seven subscribers were aristocracy. None are women. The list is headed by the Duke of Chartres, the Prince of Condé, and the Duke of Bourbon.⁴¹³

The copy of Drummond’s treatise I examined at the *Musée de l’Armée* had belonged to Mottin de la Balme (1733-1780), a noble officer who died as a volunteer in the American Revolution, ambushed by Chief Little Turtle of the Miami tribe.⁴¹⁴ He had apparently left this book behind, but a British officer who mistakenly wrote that de la Balme had been captured, noted that his papers had also been seized. Although we do not know what papers de la Balme had taken with him to the New World, we do know that he had carefully studied Drummond’s treatise with its diagrams and diagrammatic

⁴¹³ Louis Hector Drummond de Melfort, *Traité Sur La Cavalerie* (Paris: Guillaume Desprez, 1776), xxiii-xxiv. Drummond was commissioned Commander of *l’Ordre royal et militaire de Saint-Louis* [Royal military order of Saint-Louis, the highest honorary medal, available only to noblemen] in 1779 and then Lieutenant-general a year later.

⁴¹⁴ Frédéric Magnin, *Mottin de la Balme: Cavalier des Deux Mondes et de la Liberté* (Paris: Harmattan, 2005).

images. How did this study inform his short foray into the American plains? The expense and care that went into the publication of Drummond's treatise, which de la Balme owned, indicates that he valued it highly. Compared to most of the dance manuals examined in this study, published drill manuals were larger and more expensive, particularly compared to the contredanse notations published later in the eighteenth century. A survey of manuscript examples of drill notations would be useful in understanding how drill diagrams were used in the field.

In this chapter, I have traced the development of drill visualizations from the earliest examples in Renaissance Italy to the ever more precise and abstract exercises published in Enlightenment-informed military manuals. Maurice de Saxe's dream of a more rigorously ordered and well-drilled army was not realized until after the Seven Years' War demonstrated the need for such a well-trained force. As it turned out, nobility of birth did not confer the skill needed to lead the modern army – an education informed by precision drill and well-developed tactics was essential. Many aristocratic contenders did pursue this education, as Ken Alder has pointed out. By the beginning of the nineteenth century, as Napoleon took the reins, this training became available to a larger group of citizens.⁴¹⁵

As the more inclusive contredanse took over the ballroom floor in the second half of the eighteenth century, leadership positions in the military also opened to a wider group of men, prepared not by birth but by training. The Ségur law of 1781 was only a final gasp of the *ancien régime* nobility and the privileged positions they had enjoyed in

⁴¹⁵ Ken Alder, "French Engineers Become Professionals; or, How Meritocracy Made Knowledge Objective," in *The Sciences in Enlightened Europe*, ed. William Clark, Jan Golinski, and Simon Schaffer (Chicago: University of Chicago Press, 1999), 94–125.

the army. The instructions provided by the authors of drill manuals – and the diagrams they incorporated to make those instructions clear – provided new ways of thinking about military drill formations and informed tactics of the French army at the end of the eighteenth century. As we have seen, students of the military arts were eager to learn to draw, and indeed drawing as well as mathematics, were offered to soldiers well into the nineteenth century.⁴¹⁶ The difficulty of executing precise drill maneuvers led authors to make their diagrams and descriptions increasingly precise. By 1777, one military leader advised employing images to “convey to the soldiers a clear understanding of what goes on in a wheel.” He writes, “when a wheel is done well, you have the impression that the alignment has been regulated with a ruler, that one flank is tied to a stake, and the the other is describing an arc of a circle.”⁴¹⁷ It was a diagrammatic image he believed even a common recruit would understand.

⁴¹⁶ Hélène Guilcher and Jean-Michel Guilcher, “L’Enseignement Militaire de La Danse et Les Traditions Populaires,” *Arts et Traditions Populaires* 18, no. 1/3 (1970): 273–328.

⁴¹⁷ C. Griesheim, *Pflichten des Leichten Reuters* (Warsaw: n.p., 1777) quoted in Christopher Duffy, *The Military Experience in the Age of Reason* (New York: Atheneum, 1988), 113.

CHAPTER FIVE

CONCLUSION: RATIONALIZING EMBODIED PRACTICE

Science, as a philosophical concept, means the clear and certain knowledge of something, whether founded on self-evident principles, or via systematic demonstration.

Encyclopédie, s.v. “Science.”⁴¹⁸

In the other arts there are monuments to the skill of those who have distinguished themselves: paintings survive the painter, the sculptor lives on in his marble, musicians and poets live on in their works of music and poetry; it is not so with the exercises of the body: dance, arms, and horsemanship leave no traces of the perfect execution of those who have distinguished themselves [in these arts].

La Boëssière, *Traité de l’art des armes*, 1818⁴¹⁹

Diagram, Dance, and Drill

The diagrammatic notations that have been the focus of this study were meant to illuminate, teach, and prompt embodied movement: beautiful movement, ordered movement. Diagrams for dance and drill did not simply record the physical mechanics of these activities. To create a diagrammatic system for court dance or set down the movements of a battalion, the creators of these diagrams had to analyze movement patterns, decide which aspects of movement were to be notated, and figure out a symbolic language to convey those aspects clearly. As evidenced by the number of examples using the same or similar visual vocabulary, notation systems for eighteenth-century dance and drill were standardized in order to be read the same way everywhere. This process of education, negotiation and use began in the sixteenth-century Dutch Republic for drill (and then Paris) and in late seventeenth-century Versailles, and later Paris, for court dance and contredanse respectively.

⁴¹⁸ *Encyclopédie*, s.v. “Science,” vol. 14, 787.

⁴¹⁹ La Boëssière, *Traité de l’art des armes*, xvi.

For court dance, Beauchamp emphasized the paths/patterns on the floor traced by dancers and created a short-hand for the step vocabulary that had developed over the course of the reign of Louis XIV. He also included indications for how the steps fit with the music. He considered other aspects of *La Belle Danse* – the movement of the arms, inclination of the head, shading of the shoulders, and overall posture – to be nuances best taught by a dancing master. That genteel movement came naturally to those of noble blood was only partly fiction: aristocratic children learned the movements of deference and imitated their elders' noble carriage at a very early age. Aristocrats also took dance lessons.

The diagrams created for contredanses after the middle of the eighteenth century consisted of geometric patterns recorded frame by frame (see Figures 3.18, 3.19, and 3.20.3). These were similar to some of the earlier dance notations that focused on floor patterns and shared many graphic strategies employed in drill diagrams. With the addition of a standardized vocabulary of movements, named and explained in an accompanying text (and music), these patterns were sufficient for eighteenth-century dancers to recreate published dances.

Military drill diagrams, like contredanse notations, depicted set formations, relying on extensive textual explanations and spoken or musical commands to indicate how troops were to move from one formation to the next. Later examples employed lines of march, similar to lines of dance, to indicate movement. The most striking difference between military and dance diagrams is the number of people involved. Symbols in contredanse diagrams stood for eight individuals in a square; the rectangular bars that

came to be used in military diagrams toward the middle of the eighteenth century, eventually stood for hundreds of closely packed men.

In my discussion of dance diagrams, I have identified some of the strategies dance notators used to convey the movement of bodies in two distinct dance styles, court dance and contredanse. In the former, the most important elements to notate were the precise movements of the feet, the strength of the body evidenced in bends and rises, and the matching of dance movements to music, as well as the pleasing paths of the “figures.” In contredanses, it was the symmetry of the group patterns that mattered most, more than fancy footwork or styling of the body. This reflected the less court-centered cultural context of the latter half of the eighteenth century. What was left out of these contredanse notations – the orientation toward the king and the hours spent mastering difficult steps – is as informative as what was included. The cultural contexts in which they were created shaped dance notations as well as the dances they recorded and described.

Drill diagrams in the eighteenth century became more precisely measured on the page. Like dance notations, they reflected changes in warfare over the early modern period. Drill diagrams mapped bodies on the page as if from a bird’s eye view as did dance diagrams, but diagrams for drill are notated as if seen from very high up, as if by a hawk rather than by a sparrow. The drill diagrams for Machiavelli’s Renaissance *Art of War* included special symbols to designate different ranks and functions, as did many of the diagrams in Maurice de Saxe’s 1756 manual. Pictorial elements continued to appear in luxury albums such as that produced by the Count of Melfort in 1776, however, one also sees a proliferation and progression of drill diagrams that used stick figures, then dots for soldiers and then rectangular bars for groups of soldiers. By the nineteenth

century, these rectangles were standard and could be found on thousands of drill and battle diagrams right up through the twenty-first century.⁴²⁰

Marching and Dancing Together in Time

My study has been inspired, in part, by historian William McNeill's experience during World War II as a new recruit in basic training,

marching about on a dusty, graveled patch of the Texas plain under the command of an illiterate noncom. A more useless exercise would be hard to imagine. Given the facts of twentieth-century warfare, troop movement in the rear was a matter of trucks and railroads. Close-order marching within range of machine guns and rifles was a form of suicide. All concerned realized these simple facts, yet still we drilled, hour after hour, moving in unison and by the numbers in response to shouted commands, sweating in the hot sun, and, every so often, counting out the cadence as we marched: Hut! Hup! Hip! Four!⁴²¹

To explain the continuance of this seemingly obsolete military practice, McNeill conjectured that the “muscle bonding” resulting from drill was somehow fundamental to the development of complex human societies. In his book, *Keeping Together in Time: Dance and Drill in Human History*, McNeill considered the many forms of rhythmic, coordinated movement of bodies in a broad sweep beginning with the evolution of *homo sapiens* from their primate cousins through various manifestation of group dance and drill in religious, military, political, and court contexts; however, McNeill did not notice the diagrams developed for these practices. I have focused on notation systems for drill and dance as they were developed, printed, and disseminated during the Enlightenment. At least partly through the process of notation, these activities became increasingly codified, rationalized, and made accessible to a larger group of people.

⁴²⁰ They are ubiquitous in the 1965 *Encyclopedia Britannica* and continue to be included in *Wikipedia* articles as well.

⁴²¹ William Hardy McNeill, *Keeping Together in Time: Dance and Drill in Human History* (Cambridge, MA: Harvard University Press, 1995), 1.

Over the course of my research, I found a number of similarities in the visual strategies used to diagram dances and drills. Strategies for visualization included simplification of data, standardization of diagrammatic languages, and sometimes the juxtaposition of unlike elements to prompt more involved thinking about these physical practices. Early in the eighteenth century, court dance notation was complex and drill manuals relied on pictorial representations as well as diagrams; by 1760 contredanse notation and drill formations employed similar pared down graphic tactics. As the creators of these different kinds of diagrams simplified movement into symbols, standardized the visual vocabulary so it could be shared over long distances, and juxtaposed elements on the page, they also recorded – or possibly prescribed – the increased the coordination of people moving together in dance and drill, usually to music.

I also found many connections between dance and war generally. Louis XIV's court spectacles and opera/ballets often centered on martial themes, whether drawing on ideas of martial dance practiced by Greeks and Romans or performances portraying mythology of Mars and Venus.⁴²² Numerous contredanses were named after military officers (Baron von Steuben and George Washington as well as the Chevalier de Saint-Georges) or weapons (*Les Plaisirs de l'Arquebuse* – Pleasure of the Arquebus) and dances were mentioned in the biographies of many military leaders.⁴²³ Drill diagrams appeared earlier but became more precise during the Enlightenment. Maurice de Saxe's

⁴²² See Kate Van Orden, "Chapter 5: Pyrrhic Dance and the Art of War," in *Music, Discipline, and Arms in Early Modern France* (Chicago: University of Chicago Press, 2005), esp. 188-89, in which she argues that a military ethos emerged out of "the theatrical hothouse of court spectacle" where it was more easily nurtured than out in the battlefield.

⁴²³ Kate Van Winkle Keller, *George Washington: A Biography in Social Dance* (Sandy Hook, CT: Hendrickson Group, 1998); Library of Congress dance collections; and E. M. L., "James Wolfe 1727-1759," *Oxford Dictionary of National Biography* (Oxford: Oxford University Press, 1900); Gabriel Banat, *The Chevalier de Saint-Georges: Virtuoso of the Sword and the Bow*, First Edition (Hillsdale, N.Y: Pendragon Press, 2006).

admonition to apply reason over routine reflected Enlightenment thinking in the formation, training, and deployment of troops.⁴²⁴

Reenactment as Theater and/or Epistemology

Dance companies such as *L'Eventail* [the fan] in France, Seattle Early Dance and the New York Baroque Dance company in the United States, and *Les Jardins Chorégraphiques* [Choreographed Gardens] in Canada have used Beauchamp/Feuillet notation for the reconstruction of eighteenth century dance performances. Contredanses are beginning to enjoy a resurgence of interest by dancers and scholars.⁴²⁵ Reenactors, especially for the American Revolution and Civil War, have recreated drills and historic battles using diagrams and other period sources. These “Living History” participants are often very knowledgeable and self-reflective and their insights as embodied investigators of the past have added much to our understanding of the past.

As a historian of science, I have been interested in these diagrams as a window into historic epistemology. Drawing on the research of historians like Pamela Smith, who has taken early modern recipes into the lab, I have been interested in how reconstructions can inform our understanding of early modern science and its cultural, social, and political contexts. Smith, in her book, *The Body of the Artisan: Art and Experience in the Scientific Revolution*, discusses the role of embodied cognition—the non-verbal thinking that happens as the artisan or craftsperson carefully poured molten silver, tested the temperature of beer, mixed colors, or shaped a piece of clay. My experiments with

⁴²⁴ Maurice de Saxe, *Les Rêveries, Ou Mémoires Sur l'art de La Guerre*, ed. M. de Bonneville (La Haye: Pierre Gosse Jr., 1756), 1.

⁴²⁵ Amanda Danielle Moehlenpah, for example, is researching eighteenth-century French contredanses on stage (Ph.D. dissertation in progress, department of Romance languages, University of North Carolina at Chapel Hill), Email correspondence, April 30, 2018.

eighteenth century dance and drill have been mostly thought experiments, however, I did reconstruct a “Menuet for Mrs. Santlow” in Beauchamp/Feuillet notation and a contredanse called “La Frayeur de Gonesse (sic),” which commemorated the launch of a hot air balloon in 1783 which landed near the village of Gonesse.⁴²⁶ I also corresponded with a reenactor of eighteenth century drills.⁴²⁷ In my investigation of historic reconstruction, I have drawn on studies from the history of science that recreated experiments to reveal invisible technicians and assistants, and to revisit claims about scientific instruments.⁴²⁸ I am interested in the embodied, visceral knowledge of people who walked, rode horses, and danced in their everyday lives. Dance, in particular, and military drills – which were much more commonly seen than has been recognized – consisted of moving in patterns. These patterns informed cognition and the reading of diagrammatic images on paper. Reconstructions in science have focused on using scientific instruments again to recreate experiments and demonstrations. Diagrams, I add, can also be tools for reconstruction of historical knowledge production.

The Science of Becoming Noble

As many studies in the history of science have shown, the nobility of a natural philosopher was a significant factor in the authority of scientific witnessing well into the

⁴²⁶ Performance with *Musica Antiqua*, April 2016: M. L’Abbé, “Menuet for Mrs. Santlow” (London: n.p., 1709). Moira Goff, *The Incomparable Hester Santlow: A Dancer-Actress on the Georgian Stage* (Aldershot, England; Burlington, VT: Ashgate, 2007). Seattle English Country Dance, March 2018: M. Landrin, “Frayeur de Gonesse” (Paris: Mlle Castagnery, n.d.). The frightened villagers attacked the balloon with pitchforks.

⁴²⁷ Boris Megorsky, Facebook messaging, October 28, 2016. See http://peter.petrobrigada.ru/index_e.htm.

⁴²⁸ Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life* (Princeton, N.J.: Princeton University Press, 1985); H. Otto Sibum and Ginette Morel, “Les Gestes de La Mesure: Joule, Les Pratiques de La Brasserie et La Science,” *Annales. Histoire, Sciences Sociales* 53, no. 4/5 (July 1, 1998): 745; and Peter Heering, “The Enlightened Microscope: Re-Enactment and Analysis of Projections with Eighteenth-Century Solar Microscopes,” *The British Journal for the History of Science*, Vol. 41, No. 3 (Sep., 2008), 358, are excellent examples of work in this vein.

nineteenth century. In his article, “Self Evidence,” Simon Schaffer gives an extended treatment of the importance of the character of an experimenter or demonstrator.⁴²⁹ In his example, no one could replicate the results of an electrical experiment conducted by the country gentleman Granville Wheeler in the 1730s. Only after many trials was it finally determined that Wheeler must have moved his arm without being sensible of it. Wheeler’s testimony as a reliable witness, however, remained intact. As Schaffer observes, because of this “Cartesianism of the genteel: in polite society, members could be treated as capable of separating their disorderly bodies from the cool deliverances of their intellectual judgment.”⁴³⁰ Men of lower rank (not to mention women) could not be trusted with the same separation of body and mind. Indeed, the body and mind were never so separate: authority rested in the presentation of the male aristocratic body of Mr. Wheeler. Nobility of the body was deeply implicated in the production of truth claims. Cultivating a noble presence through the presentation of one’s highly trained and exercised body is an aspect of the history of science that has been under-theorized. As the eighteenth-century diagrams for dance and drill discussed here have demonstrated, taking a scientific approach to these bodily practices bolstered one’s authority as a reputable witness to scientific findings.

Jennifer Neville, in her research on *The Eloquent Body: dance and humanist culture in fifteenth-century Italy*, suggests that dance was the aristocratic answer to artisan bodily claims for epistemic authority. The claims of artisans were quite vocal, judging from accounts in Pamela Smith’s *Body of the Artisan*. If aristocrats were not supposed to “work” (manual labor being forbidden by tradition and often by court edict),

⁴²⁹ Simon Schaffer, “Self Evidence,” *Critical Inquiry* 18, no. 2 (January 1, 1992): 327–62.

⁴³⁰ Simon Schaffer, “Self Evidence,” *Critical Inquiry* 18, no. 2 (January 1, 1992): 337–38.

then the bodily presentation of nobles—evident in the posture and practices of dance and fencing—was what set the noble body apart from the artisan body. When Guglielmo Ambrosio (c.1420-1484) wrote in his treatise *Trattato dell' arte del ballare* (Treatise on the Art of Dancing) that dance makes men noble, he meant that all the virtues were cultivated as part of learning to dance, not just eloquent movement but moderation, prudence, courage, and wisdom as well.⁴³¹ The practice of dance created the person of quality, of noble carriage and character. The noble officer also cultivated a noble bearing and posture and embodied corresponding virtues of valor and courage.⁴³²

The “courage to use your own understanding,” according to the philosopher Immanuel Kant (1724-1804), was the motto of the Enlightenment. As tools of reason, diagrams offered a way to study and understand a topic on one’s own: instructions in the form of diagrams could even be applied to evanescent aspects of the noble body. The enlightened body, as Kant described it, was a *moving* body. In his essay, “What is Enlightenment?” Kant employs numerous references to bodily movement as emblematic of enlightenment:

Freed from guardians...[who] carefully prevent the docile creatures from taking a single *step* without the leading-strings to which they have fastened them...[they then] show them the danger that would threaten them if they should try to *walk* by themselves. Now this danger is really not very great; after *stumbling* a few times they would, at last, learn to *walk*...the man who casts off [his “nonage” or bondage] would make an uncertain *leap* over the narrowest ditch, because he is not used to such free *movement*. That is why there are only a few men who *walk* firmly, and who have emerged from nonage by cultivating their own minds [*italics mine*].⁴³³

⁴³¹ Jennifer Nevile, *The Eloquent Body: Dance and Humanist Culture in Fifteenth-Century Italy* (Bloomington, IN: Indiana University Press, 2004), 94.

⁴³² In contrast to the commoner soldiers that de Saxe described in his Preface. Maurice de Saxe, *Les Rêveries, Ou Mémoires Sur l'art de La Guerre*, ed. M. de Bonneville (La Haye: Pierre Gosse Jr., 1756).

⁴³³ Emmanuel Kant, “What Is Enlightenment?,” trans. Mary C. Smith, 1784, <http://www.columbia.edu/acis/ets/CCREAD/etscc/kant.html>. Accessed December 2, 2016.

Kant describes the enlightened man as one who has learned to think independently and walk, stumble, leap, and move freely. In the enlightenment diagrams for dance and drill presented here, scientific principles such as abstraction, precision, and standardization were applied to the human body in motion. As diagrams are essential in science – an endeavor that is highly visual and abstract – a history of science that does not consider the application of diagrams to areas of activity not usually considered scientific is an incomplete history. As my research into diagrams for dance and drill establishes, science was not an atomized practice restricted to certain bodies of knowledge, but rather a way of thinking that extended to myriad arenas including dance at court and on the ballroom floor, as well as in well-honed manoeuvres on the battlefield and in the spectacle of military drill.

FIGURES
CHAPTER ONE
INTRODUCTION: DIAGRAMMING NOBLESSE

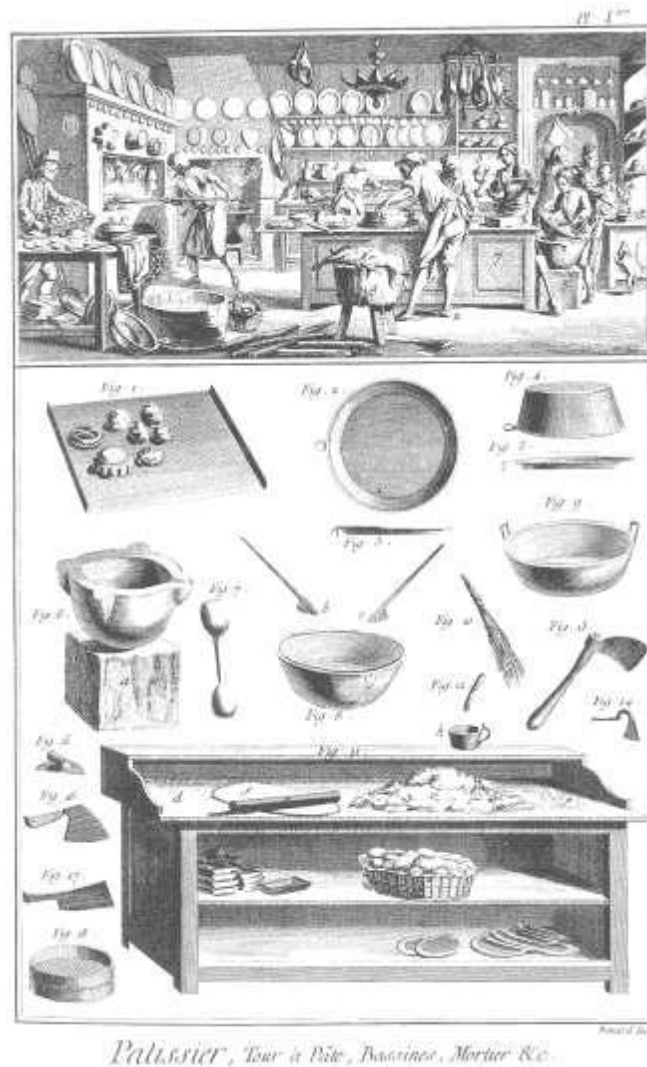


Figure 1.1. Depiction of workshop in which pâté is being made. At the top is a Pictorial representation of the workshop; on the bottom the tools of the shop are laid out abstracted from the work of making pâté; at the very bottom is a piece of furniture on which pastry dough is being rolled out to be filled with meat or liver extracted from the hanging birds.

Unknown, s.v. "Pâtissier," *Encyclopédie*. Public domain.

CHAPTER TWO
 DIAGRAM: BODIES ON THE PAGE



Figure 2.1. Diagrams on the beach noticed by Aristippus and other shipwrecked Greek philosophers. Aristippus declares the diagrams proof that civilized people live on the island.

Euclid, *Euclidis Quae Supersunt Omnia*, ed. David Gregory (Oxford: Oxoniae, E Theatro Sheldoniano, 1703). Public domain.

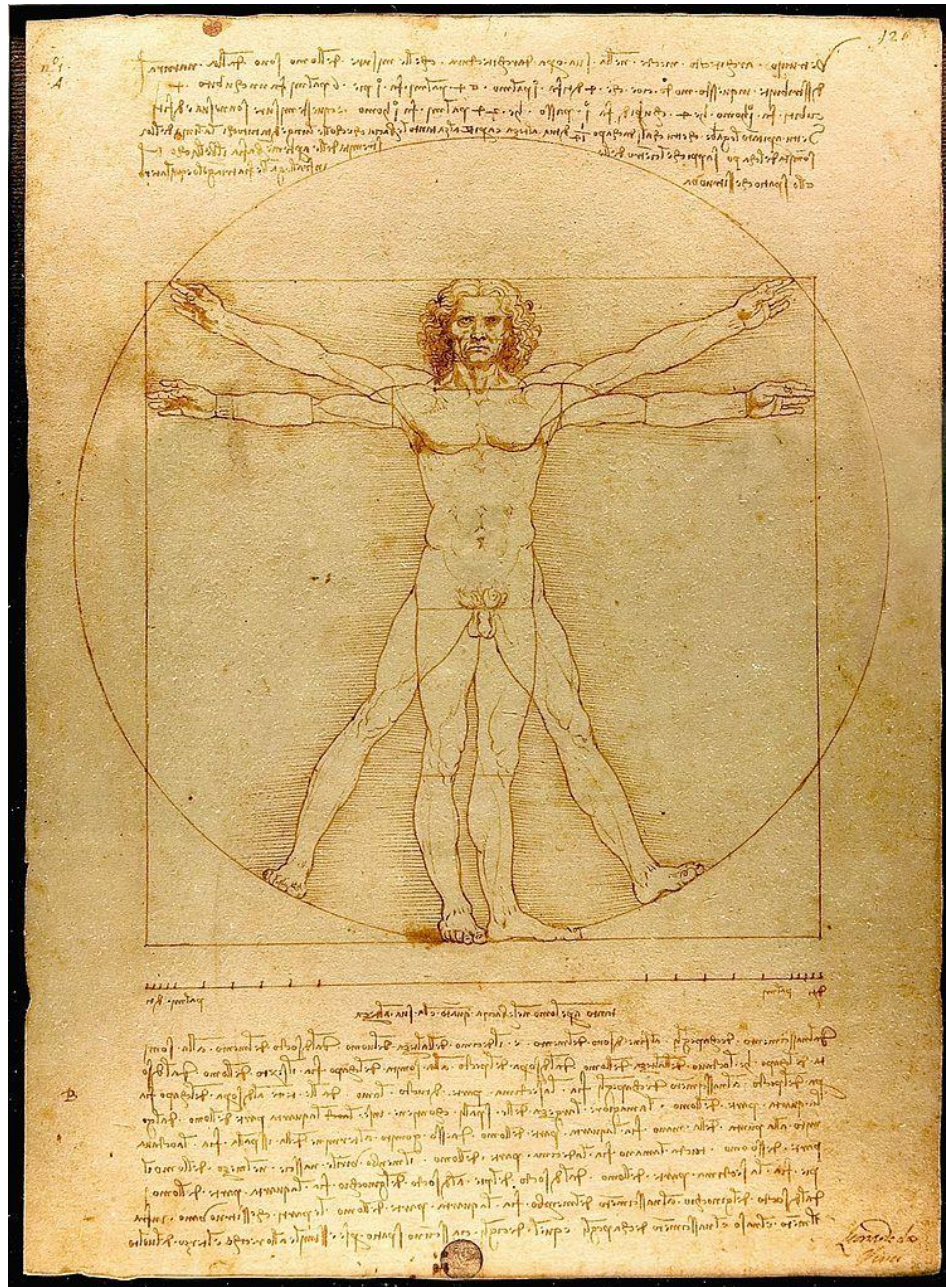


Figure 2.2. Vitruvian Man. Nobility geometrized as the ideal body fits perfectly in a square (symbolizing earth) and circle (symbolizing heaven).

Leonardo da Vinci, "Vitruvian Man," c. 1490. Public Domain.

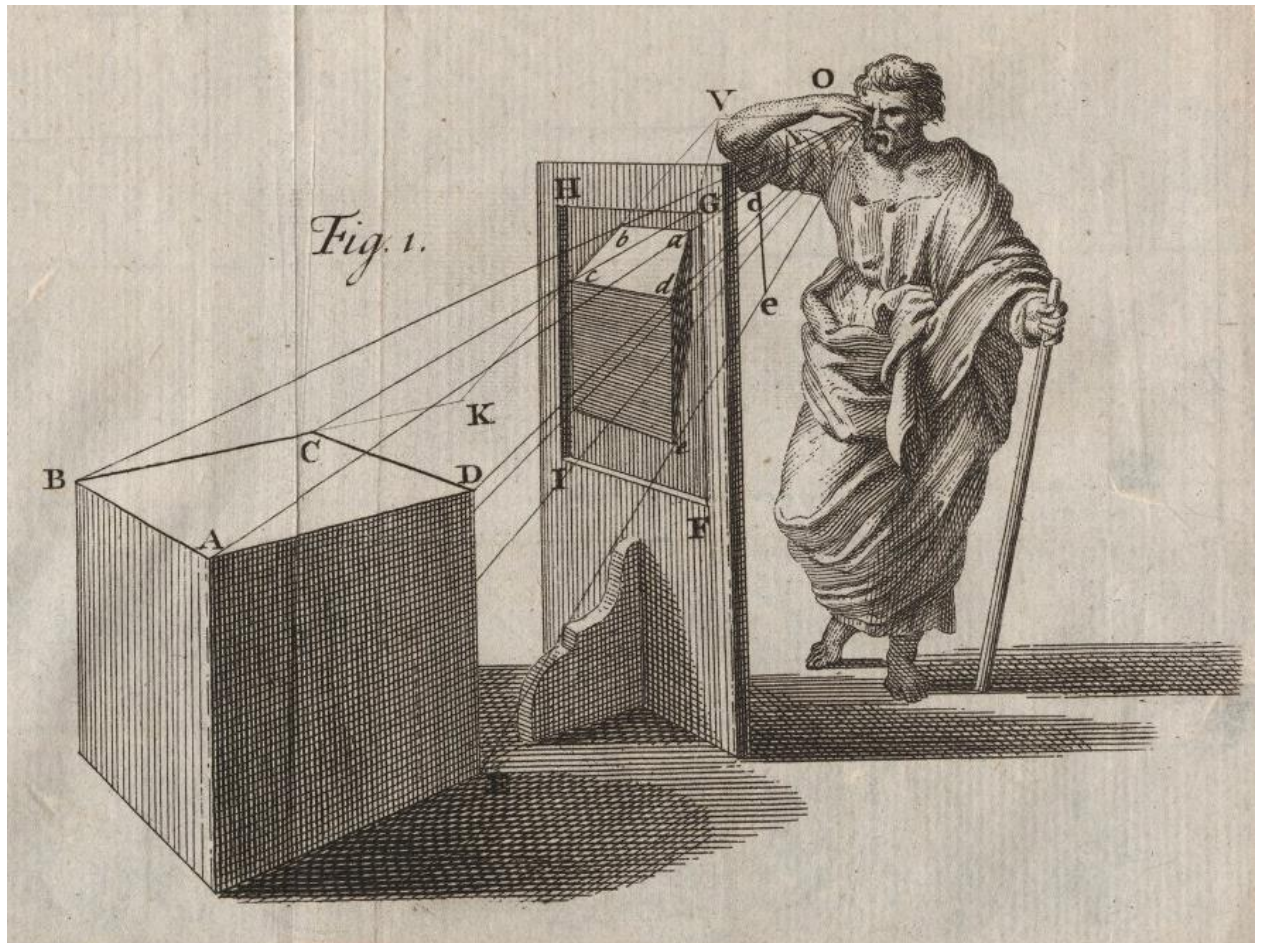


Figure 2.3. Diagrammatic lines indicating perspective of a toga-clad viewer.

Brook Taylor, *New Principles of Linear Perspective, or the Art of Designing on a Plane the Representations of All Sorts of Objects, in a More General and Simple Method than Has Been Done Before* (London: R. Knaplock, 1719), view 90 cropped. Max Planck Institute for the History of Science. Creative Commons (CC-BY-SA).

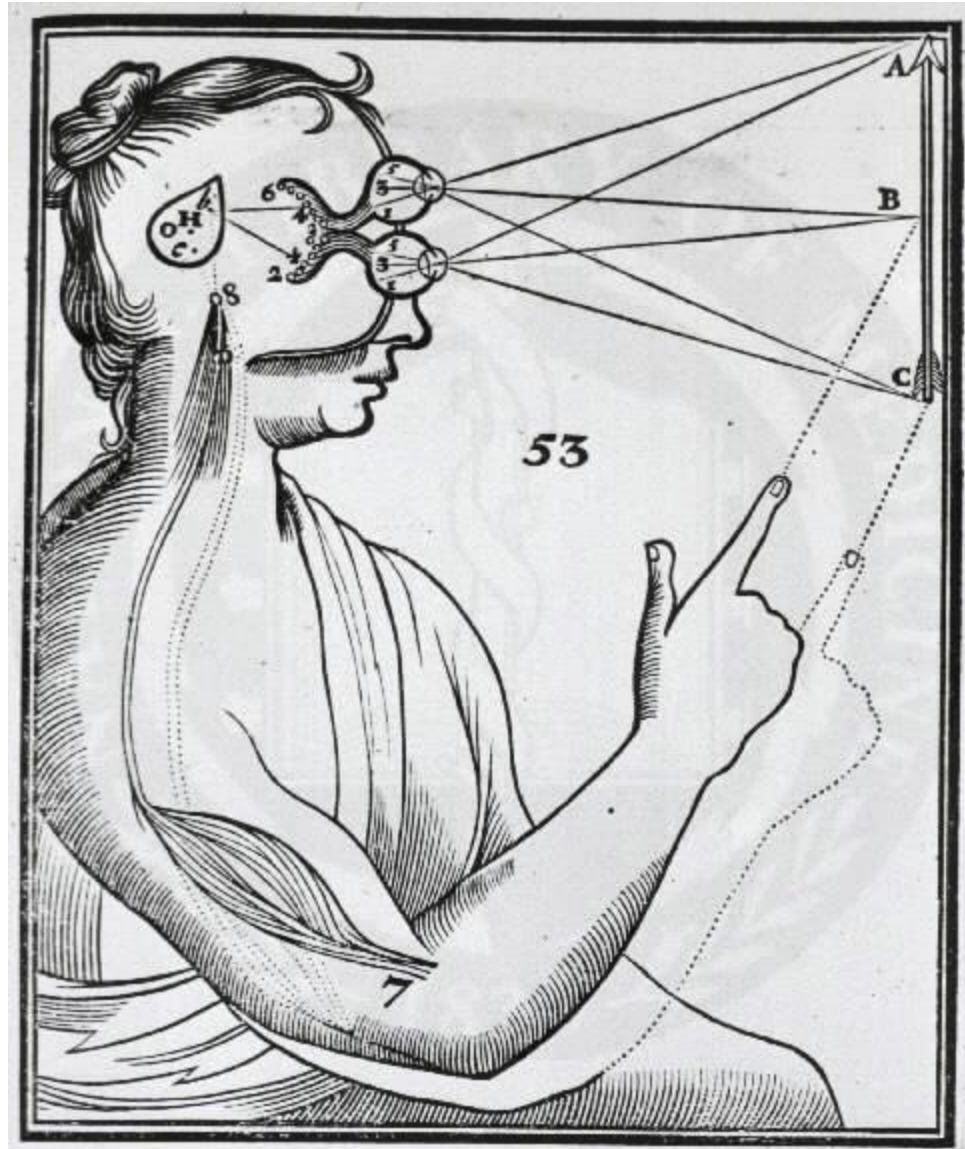


Figure 2.4. A hybrid illustration of how sight works. The human figure is pictorial; the lines of sight are diagrammatic.

René Descartes, *L'Homme de René Descartes et un Traitté de la formation du foetus du mesme auteur, avec les remarques de Louys de La Forge* (Paris: C. Angot, 1664), 79.

Source: gallica.bnf.fr / BnF.



Figure 2.5. Envisioning the Sciences and Arts as diagram-dependant endeavors.

Sébastien Leclerc, “L'Académie des Sciences et des Beaux-Arts.” 1698. 27.2 x 40.3 cm. Copperplate Engraving. Source: © Trustees of the British Museum, CC BY-NC-SA 4.0.

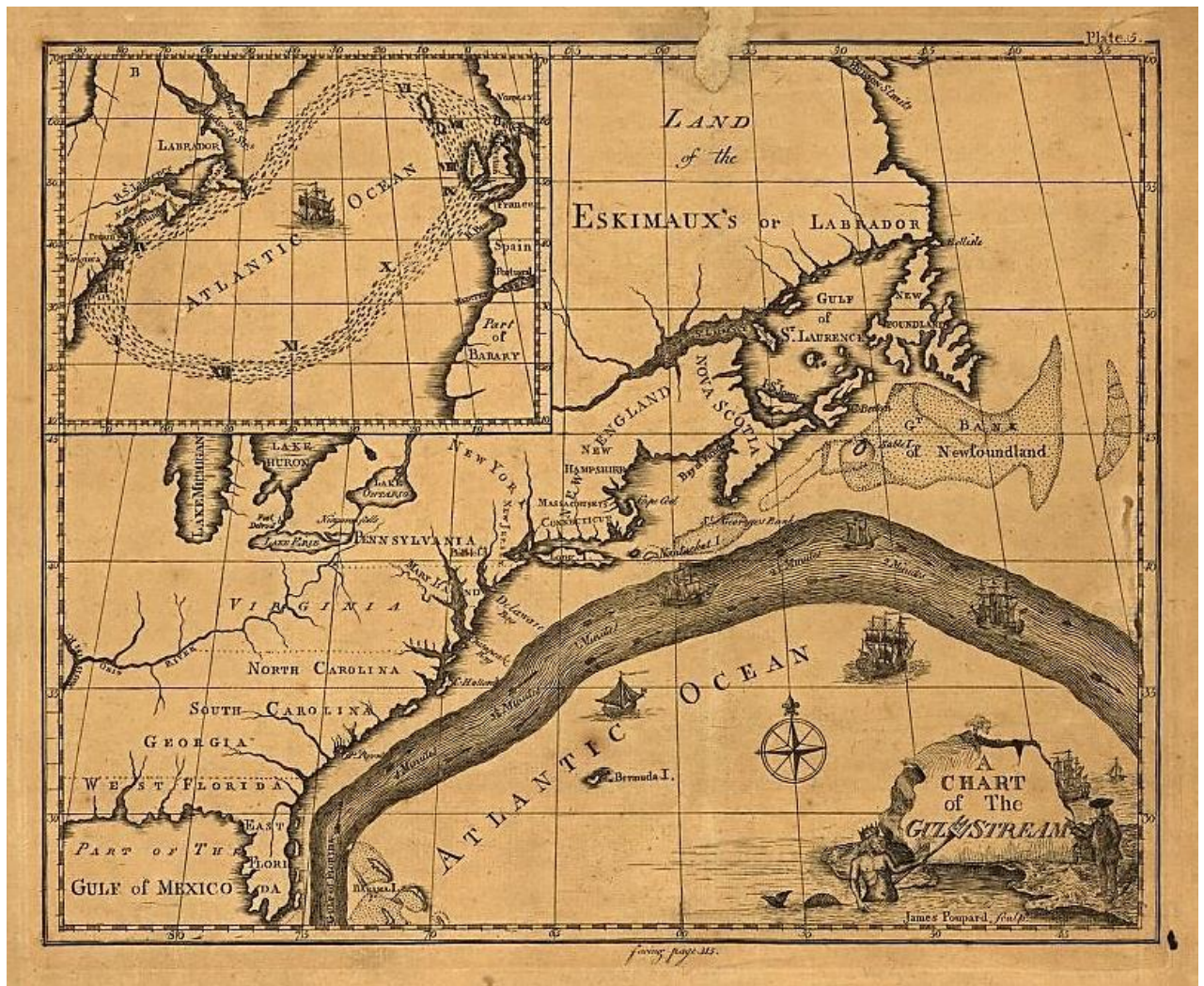


Figure 2.6. Benjamin Franklin's mapping of the Atlantic current visually clarified why it was much faster to sail from America to Britain rather than the other way around.

James Poupard and Benjamin Franklin. *A Chart of the Gulf Stream* (Philadelphia: American Philosophical Society, 1786). <https://www.loc.gov/item/2004627238/>. Library of Congress, Geography and Map Division. Public Domain.



Figure 2.7. Tycho Brahe in his observatory.

Tycho Brahe, *Astronomiæ instauratæ Mechanica*, Section 5: Quadrans Muralis Sive Tichonicus [The Mural, or Tychonian, Quadrant], Description and Use of the instrument (Wandsbek, 1598).

TABLE GENERALE.
DE LA DIVISION DV CORPS HVMAIN.

<i>Le corps humain est diuisé commu- nemēt en quatre parties généra- les, ſça- voir est en la,</i>	Supé- rieur, appellée Teſte, ou ven- tre pre- mier, au- quel ſont conte- nues les	La teſte qui cō- tient le cerueau: Icelle ſe diuiſe en parties,	Conte- nantes dont les vnes ſōt,	Com- munes qui ſont cinq. Les au- tres, Propres, ſçauoir eſt,	L'Epiderme. Le cuir. La graiſſe. Le panicule mé- braneux. Et la membrane commune. Le pericrane. Le crâne. La dure mere. Et la pie mere.
	parties a- nimales depuis le vertex iuſques aux Cla- uicules:	La face laquel- le a ſes parties,	Côte- nātes, Et Cōte- nues cōme,	Et Propres leſquel- les ſont ou, Les yeux, & les parties qui les cōſtituent. Le meat auditoire. Le nez & la bouche	Offees, les deux mendibules. Cartilagineuſes, les extremi- tez du nez, & les oreilles. Charnuēs, comme les muſcles de la face, & de la maſchoire inferieure.
	Icelle ſe ſubdiuiſe en trois parties, ſçauoir eſt en,	Le col lequel a auſſi ſes par- ties cō- tenan- tes, & conte- nues, deſquel- les les vnes ſont,	Ante- rieures cōme ſont, Les au- tres, Poſte- rieu- res,	Les cinq tegumens communs. Le larynx. L'oſ hyoide. Les flexeurs de la teſte. Les veines iugulaires, & Arteres caroti- des. Les nerfs de la ſixieſme coniugaifon & autres. Les communes. Le ceruix. Les muſcles extenſeurs de la teſte. Les eleuateurs de l'omoplate. Les ſept vertebres premiers, & la moël- le y contenuē.	

Figure 2.8. Ramist Brackets. General Table of the division of the Human Body, *Alphabet anatomic*, 1614.

Barthélemy Cabrol, *Alphabet anatomic* : auquel est contenue l'explication exacte des parties du corps humain, réduites en tables selon l'ordre de dissection ordinaire, avec l'ostéologie et plusieurs observations particulières.. (Lyon: P. Rigaud, 1614), <http://gallica.bnf.fr/ark:/12148/bpt6k1039541>. Source: gallica.bnf.fr / BnF.

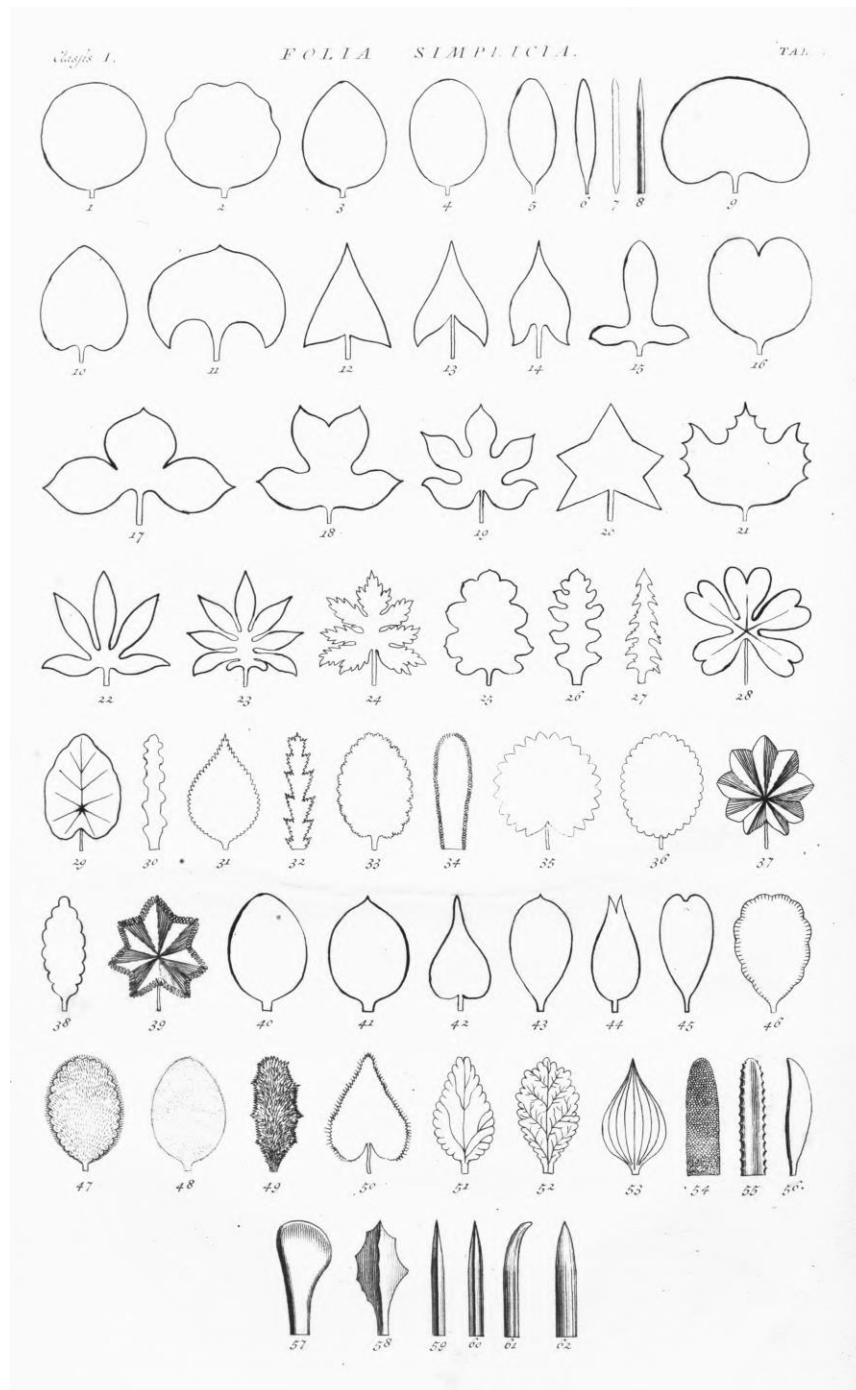


Figure 2.10. "Folia Simplicia." A chart of simple leaf forms.

Carl Linnaeus, *Hortus Cliffortianus* (Amsterdam: n.p., 1737), view 31. Source: The Internet Archive (archive.org). Public domain.

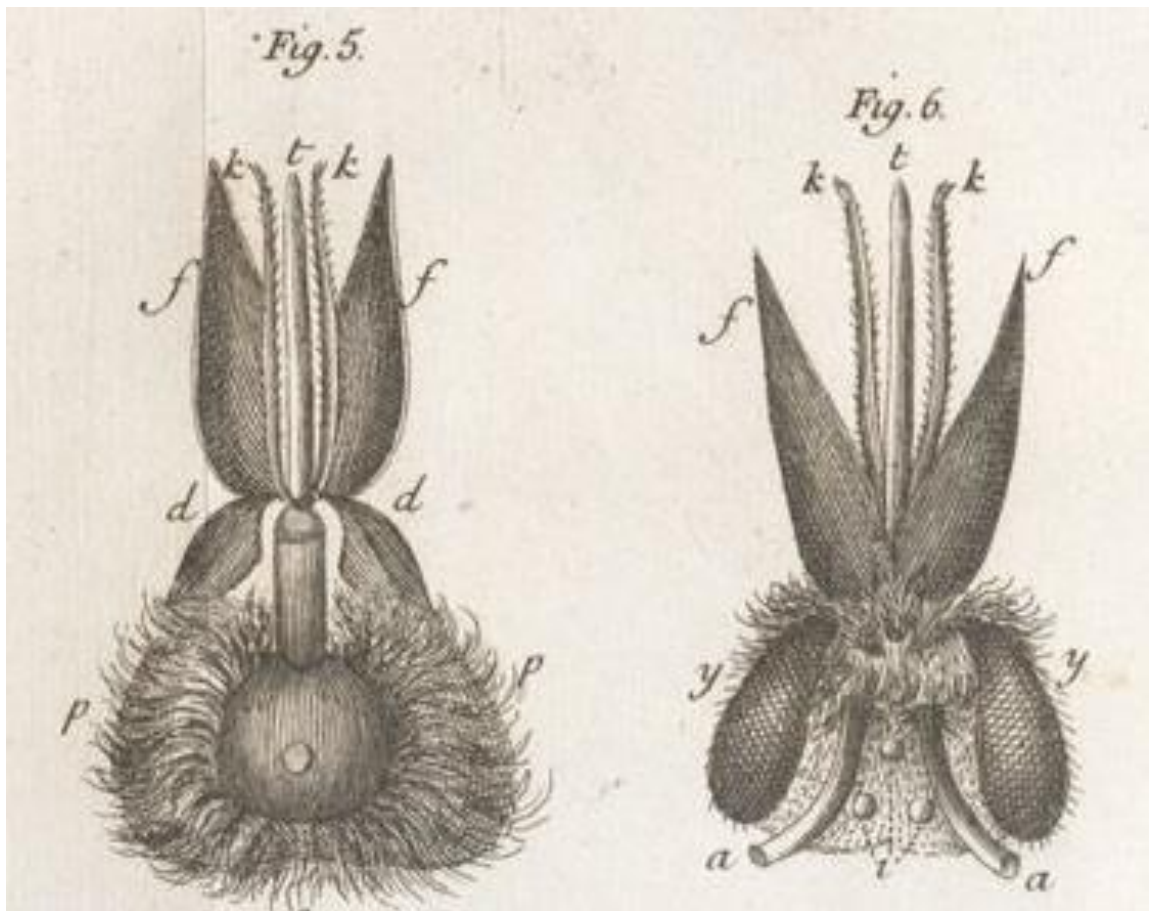


Figure 2.11. Head and proboscis of a wood-boring bee. Fig. 5 is the view from underneath; Fig. 6 is from above.

René Antoine Ferchault Réaumur, *Mémoires pour servir à l'histoire des insectes*, vol. 6 (Paris: Imprimerie royale, 1742), plate 5, figures 5 & 6.

Source: gallica.bnf.fr / BnF. Public domain.



Figure 2.12. Second position of the feet. Increasing level of abstraction increases viewer identification with an image.

Photo by Natalie Caulkins (top); Sketch in Kellom Tomlinson, *The Art of Dancing Explained by Reading and Figures* (London: Printed for the author, 1735), plate VIII. Public domain (middle); Raoul Auger Feuillet, *Chorégraphie, Ou L'art de Décrire La Dance Par Caractères, Figures et Signes Démonstratifs* (Paris: Feuillet & Brunet, 1700), 32. Pubic domain (bottom).



Figure 2.13. Ferrante Imperato, *Dell'Historia Naturale* (Naples 1599). Public domain.



Figure 2.14. Collection of Coral in a Cabinet. Early 18th century.

Berlin: Naturkundenmuseum. Licensed under Creative Commons.

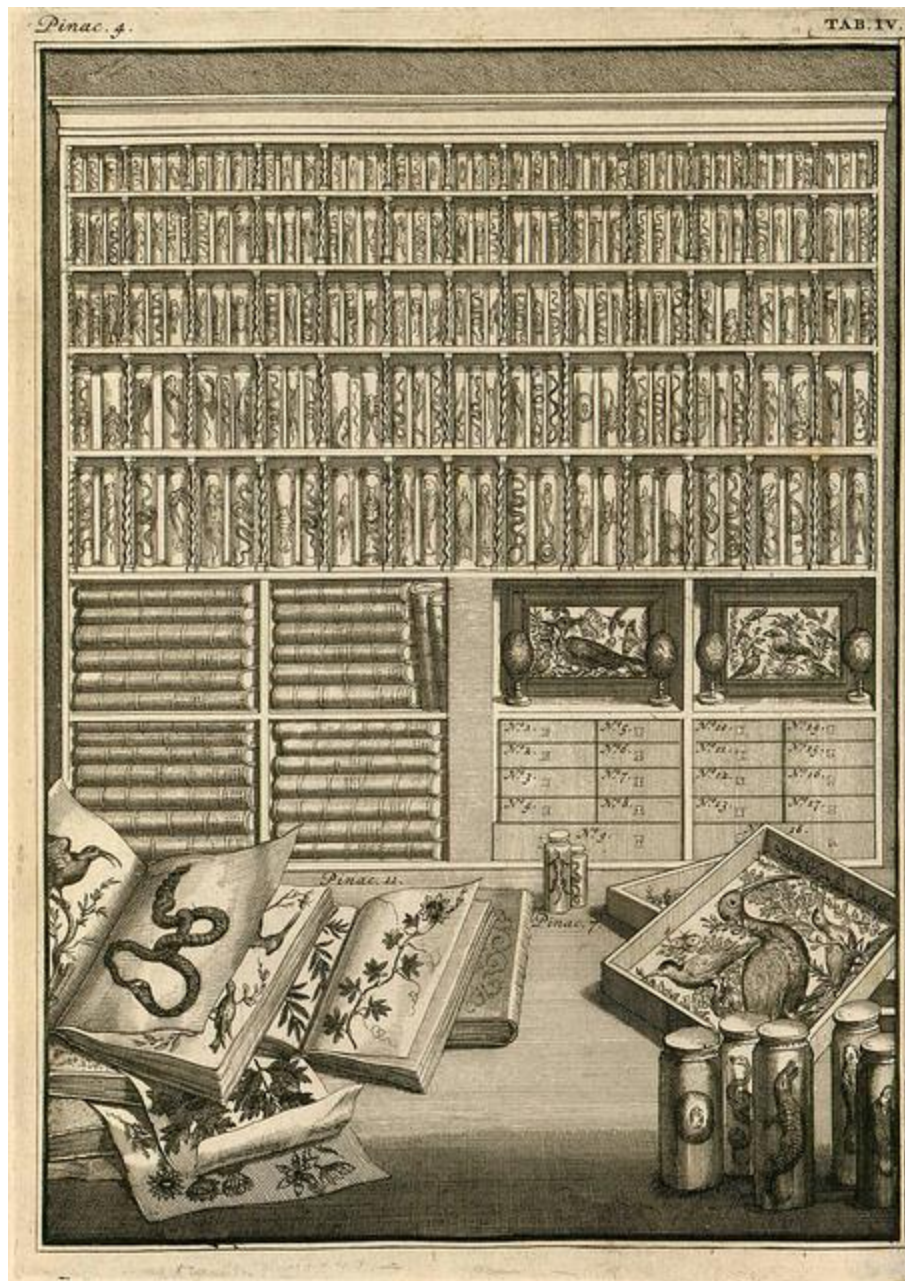


Figure 2.15. Taxonomy in jars.

Vincent Levin, *Wondertooneel der nature, geopent in eene korte beschryvinge der hoofddeelen van de byzondere zeldsaamheden daar in begrepen* (Amsterdam: printed for François Halma, 1706), Tableau 4. Public domain.

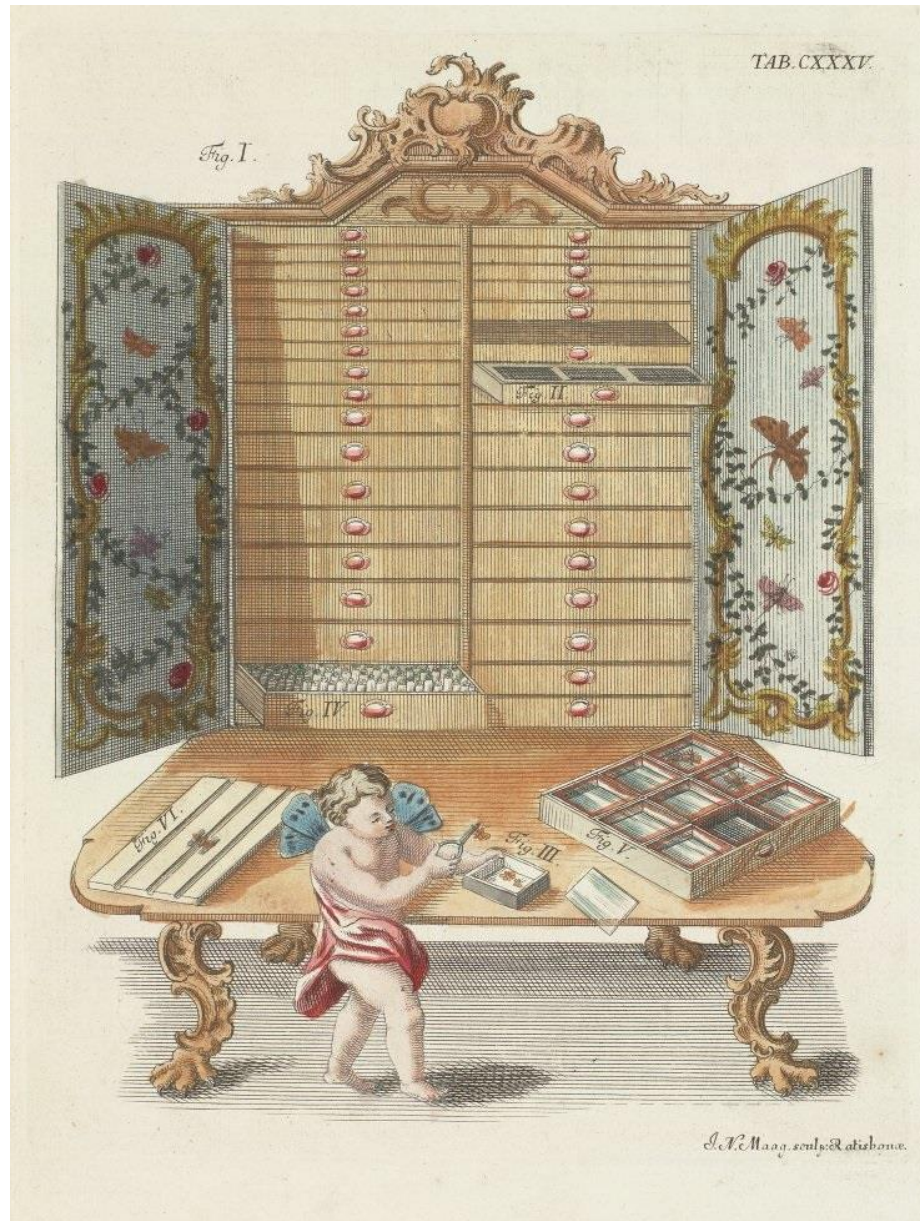


Figure 2.16. A 1766 entomological collection neatly arranged in drawers.

Jacob Christian Schäffer (1718-1790), *Elementa entomologica* (Regensburg: by the author, 1766). Public domain.

The image displays two pages from Jean Rou's 'Nouvelles tables historiques' (1675). The top page is titled 'TABLEAU DE L'HISTOIRE UNIVERSELLE' and the bottom page is titled 'TABLEAU DE L'HISTOIRE PARTICULIERE'. Both pages are filled with dense, multi-column text, organized into a complex grid-like structure. The text is written in French and includes various historical events, names, and dates, arranged in a way that facilitates connections between different historical periods and figures. The layout is highly structured, with numerous columns and rows, and the text is written in a small, dense font. The pages are framed by a double-line border, and the overall appearance is that of a highly detailed and organized historical reference work.

Figure 2.17. Jean Rou's tables combining history, chronology, and genealogy to make connections between events and people in history.

Jean Rou, *Nouvelles tables historiques* (Paris: F. de la Pointe, 1675). Source: gallica.bnf.fr / BnF. Public domain.

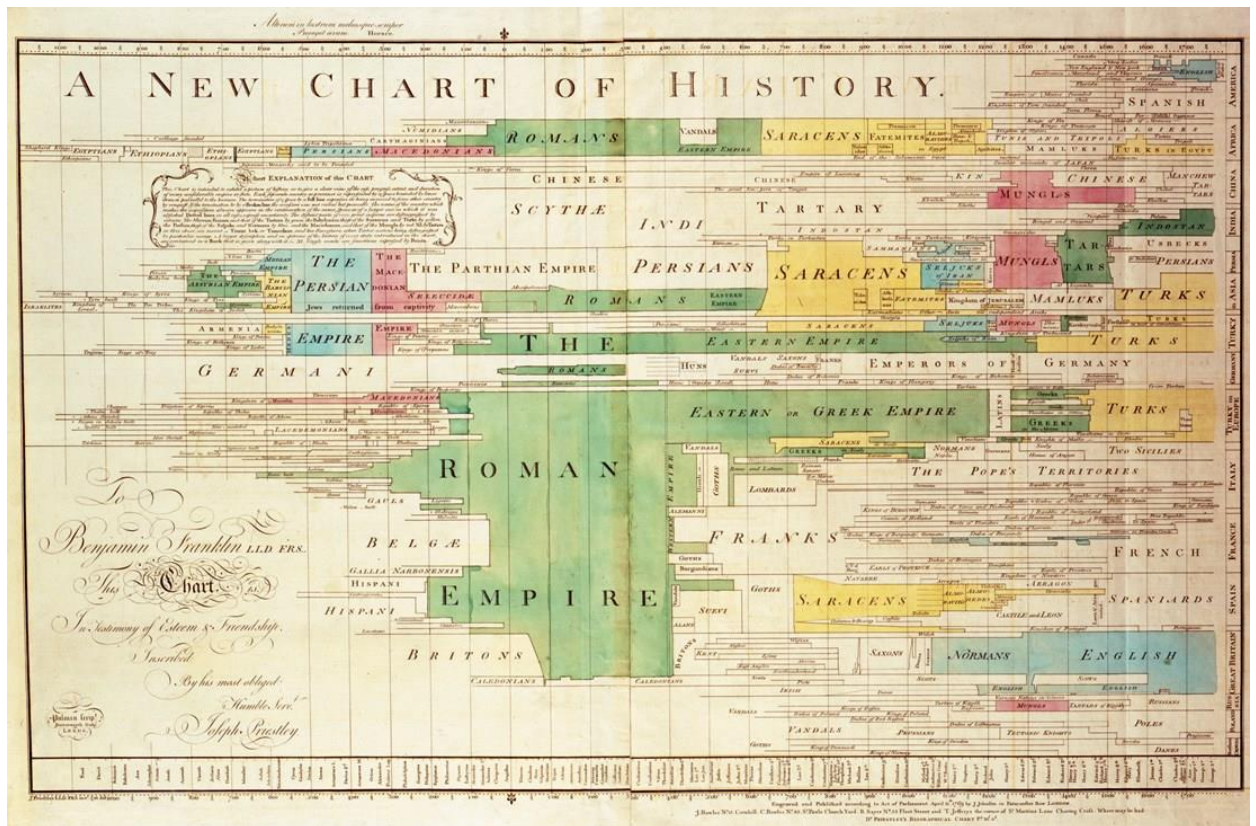


Figure 2.18. Joseph Priestley (1733-1804). *A New Chart of History* (1769). Public domain.

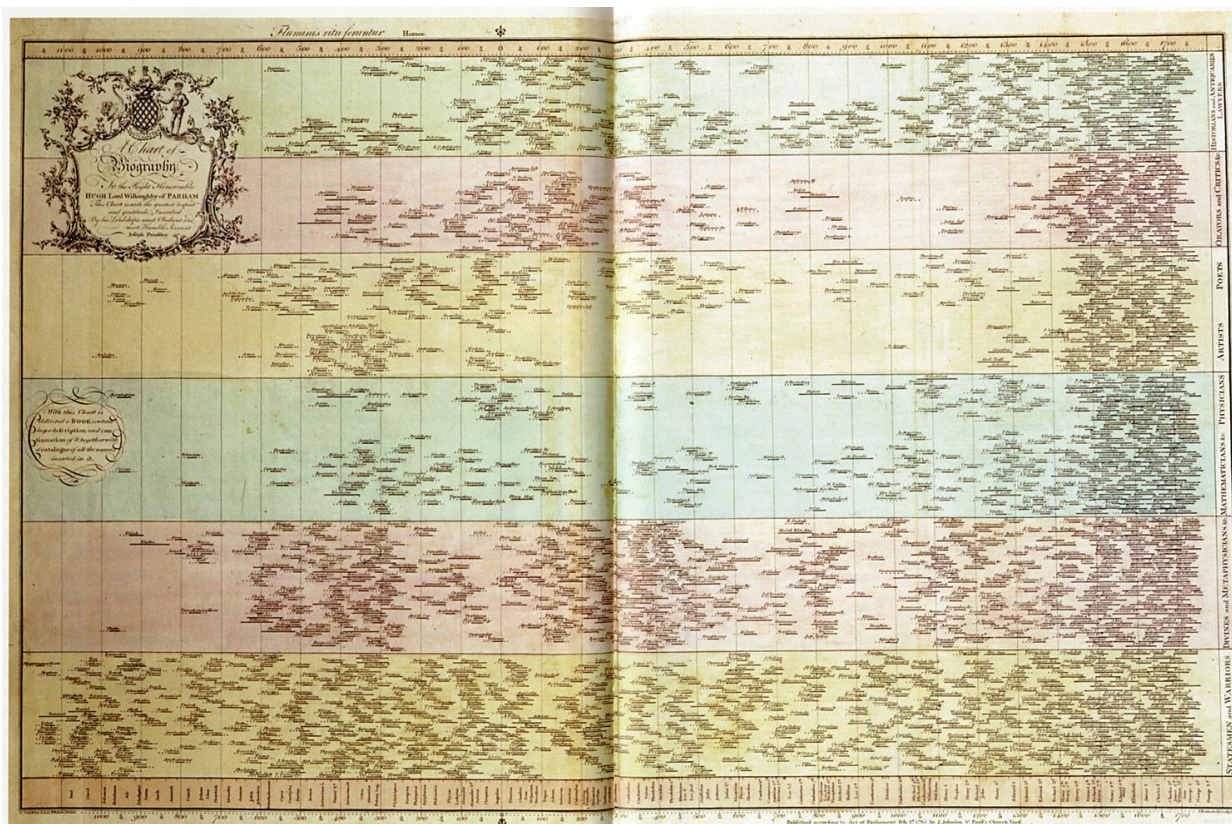


Figure 2.19. Joseph Priestly (1733-1804). *A Chart of Biography* (1765). Public domain.

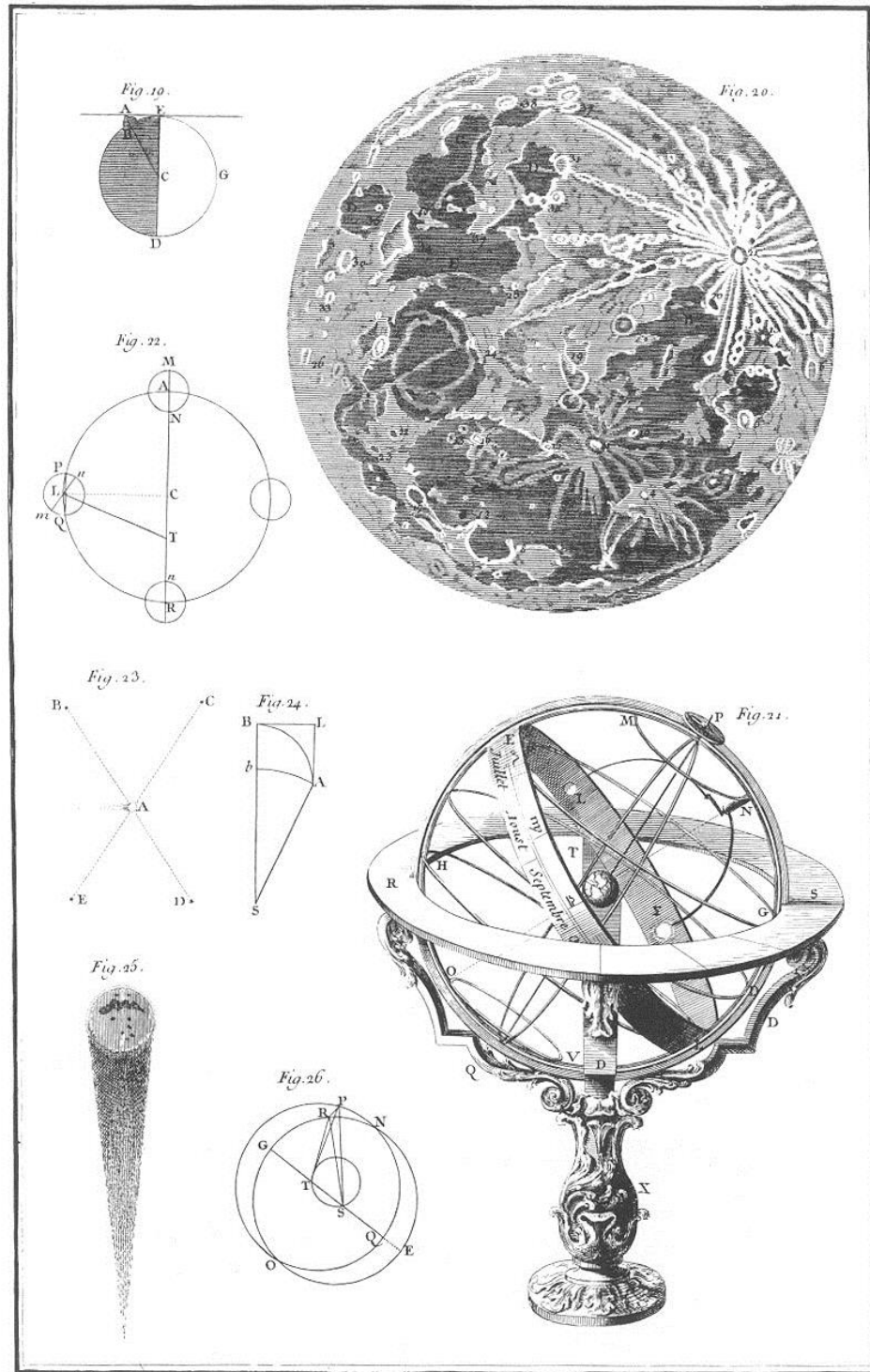
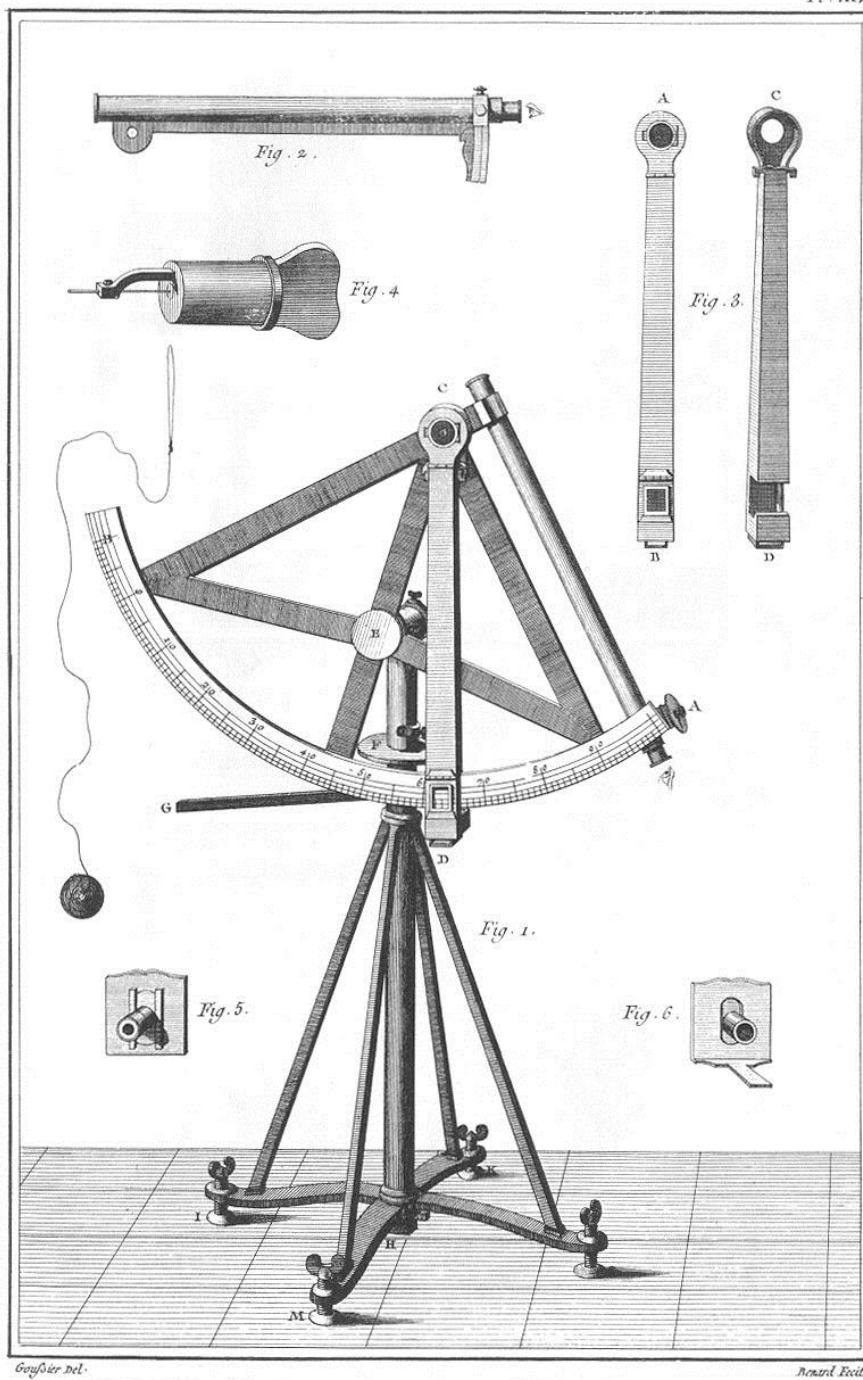


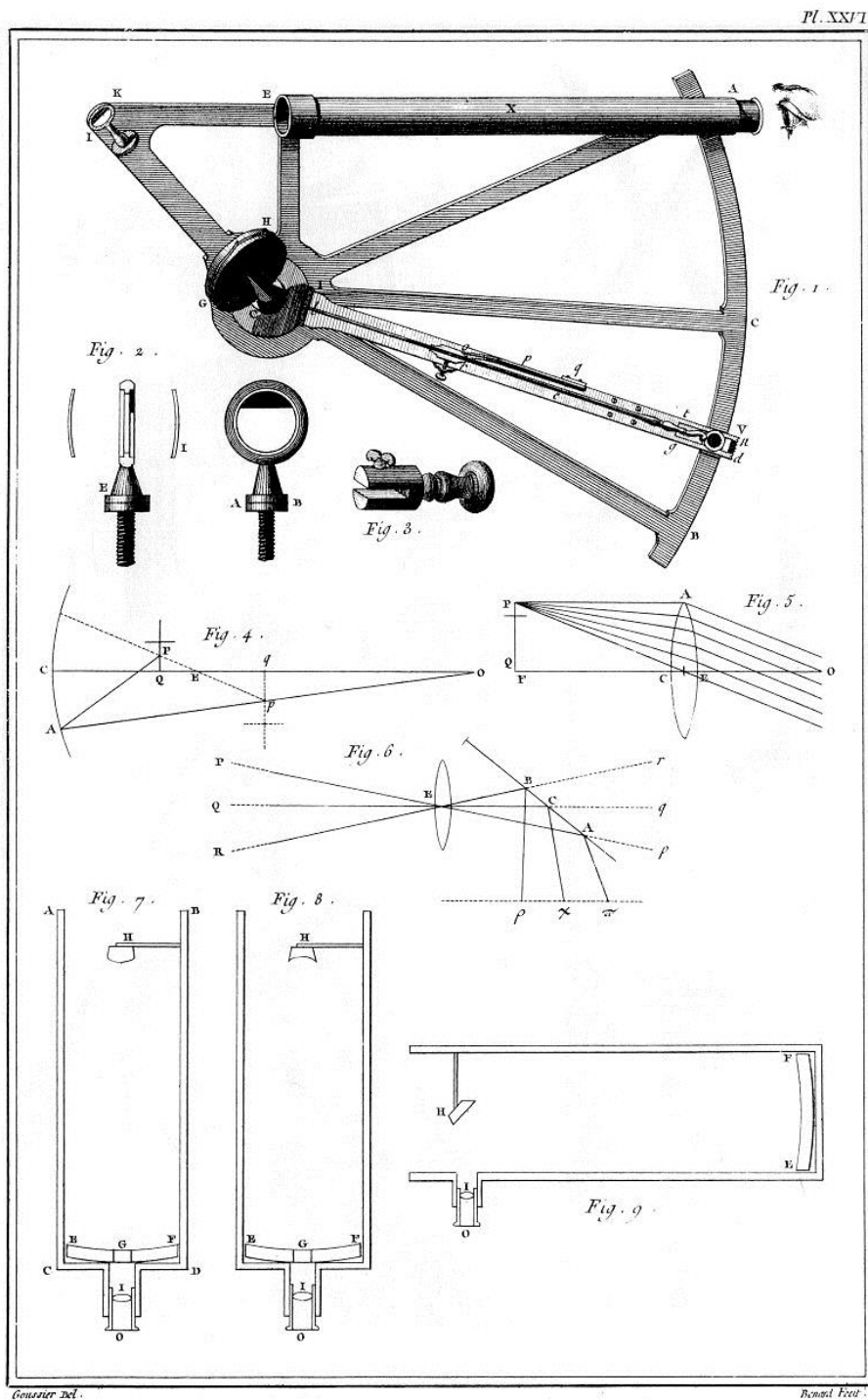
Figure 2.20. “Astronomy,” including at least three kinds of images: pictorial, geometric, mechanical (part picture/part diagram).

Anon, s.v. “Sciences/Mathématiques/Astronomie,” *Encyclopédie*. Public domain.



Astronomie, Instrumens, Quart de cercle Mobile.

Figure 2.22. s.v. "Sciences/Mathématiques/Astronomie." *Encyclopédie*.



Astronomie, Instrumens, Secteur de M^r de Fouchi &c.

Figure 2.23. s.v. "Sciences/Mathématiques/Astronomie." *Encyclopédie*.

CHAPTER THREE
DANCE: BODIES ON THE PAGE



Figure 3.1. Monsieur Jourdain, title character in Molière's *Le Bourgeois Gentilhomme*.
Note M. Jourdain's parallel position of the feet and his fancy, but sloppy, ill-fitting
clothing and somewhat slouching posture.

Victorian Costume Designs for the Plays of Molière, c. 1860. Public domain.



Figure 3.2. In this fifteenth century manuscript, steps are indicated by letters lined up with musical notes. Floor patterns are not specified.

Anon, “Collection of Basses dances owned by Marguerite d'Autriche,” also known as *The Burgundian Manuscript* (c. 1490), image 24. Bruxelles, Bibliothèque Royale de Belgique, Ms. 9085. Source: Library of Congress, Music Division. Public domain.

DE THOINOT ARBEAV. 31

Tabulature pour dancer le tourdion incontinēt
aprez le retour de la basse-dance.

*Air du tourdion reduict
en minimes blanches, qui
font la mesure du temps.*

*Mouvements que le danceur doit
faire en dāçant le tourdion,
lequel se dance incontinent
aprez la basse-dance.*



Pied en l'air gaulche.
Pied en l'air droict.
Pied en l'air gaulche.
Pied en l'air droict.
Sault moyen.
Posture gaulche.

Le reuers des precedents.

Pied en l'air droict.
Pied en l'air gaulche.
Pied en l'air droict.
Pied en l'air gaulche.
Sault moyen.
Posture droicte.

Comme au commencement.

Pied en l'air gaulche.
Pied en l'air droict.
Pied en l'air gaulche.
Pied en l'air droict.
Sault moyen.
Posture gaulce.

N^e iij

Figure 3.3. Music turned sideways corresponds to the dance steps printed in text to the right.

Thoinot Arbeau. *Orchesographie* (Lengres, France: Ichan des preyz: 1589), 51.
Library of Congress, Music Division. Public domain.

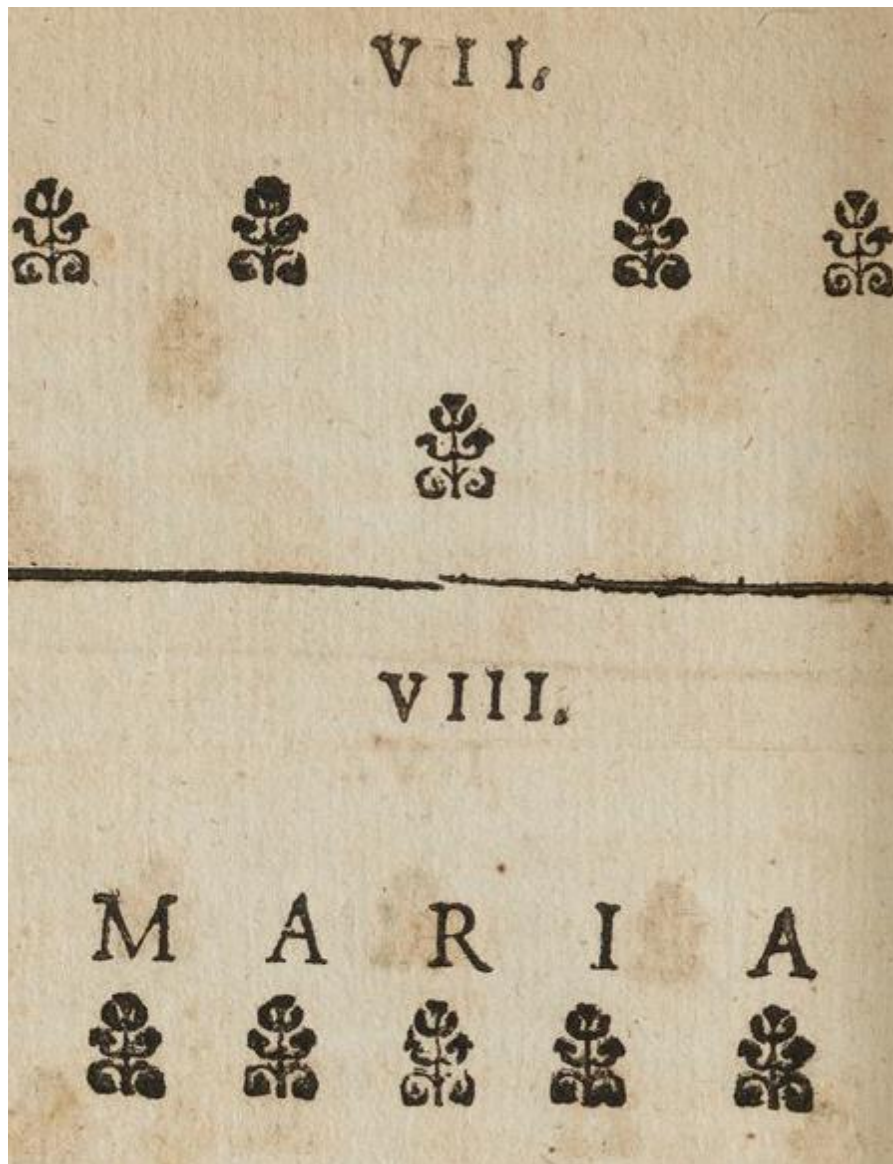


Figure 3.4. Symbols for five dancers spell out the name of Princess Maria.

Claude-François Menestrier, *Des ballets anciens et modernes selon les règles du theatre* (Paris: Guignard, 1682). Source: gallica.bnf.fr / BnF. Public domain.

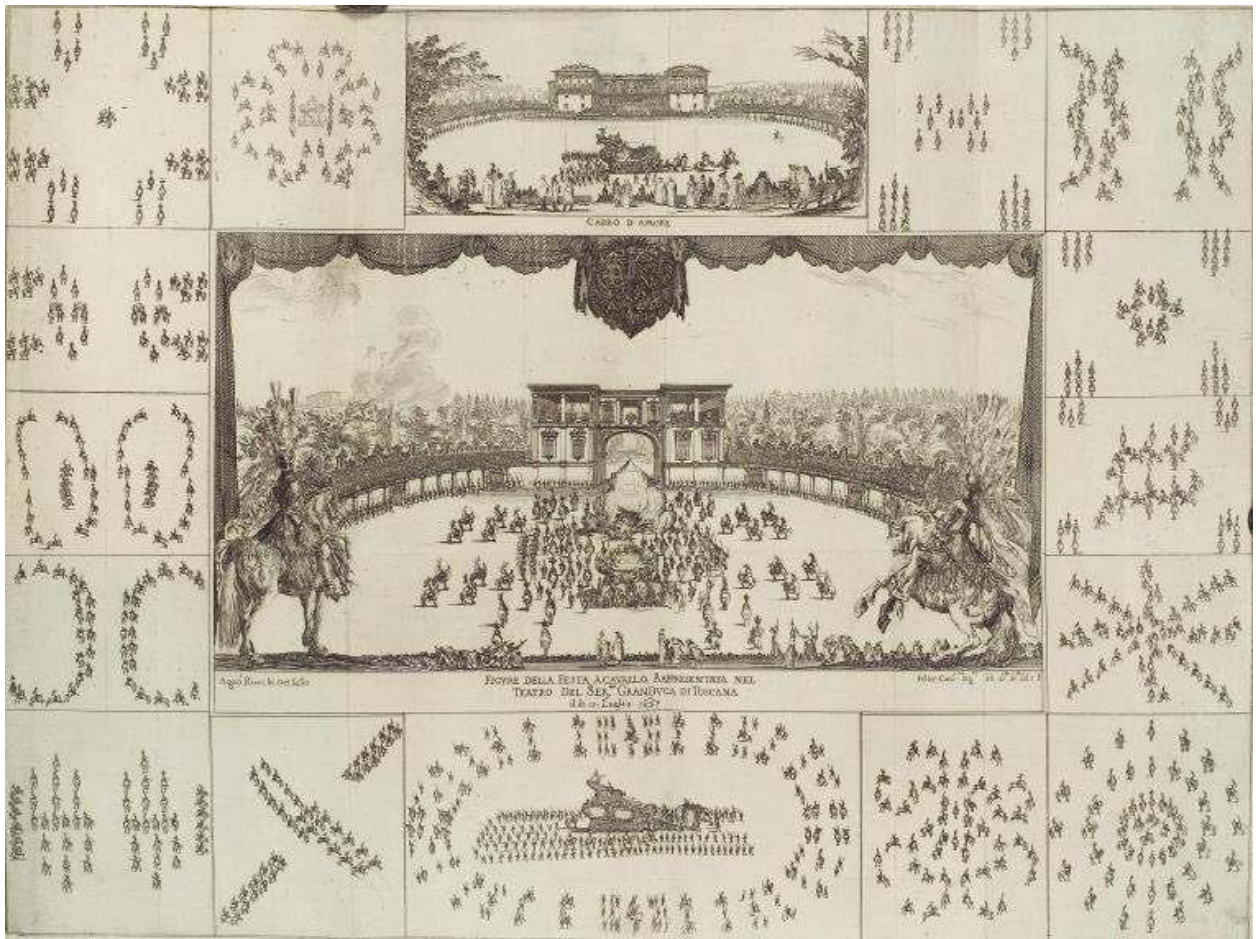


Figure 3.5. Horse ballet in picture and diagrammatic figures.

Stefano Della Bella, Giovanni de Bardi, Agniolo Ricci, *Horse Ballet* (Florence: Zanobi Pignoni, 1637). *Descrizione delle feste fatte in Firenze*. New York Public Library, Spencer Collection. Public domain.

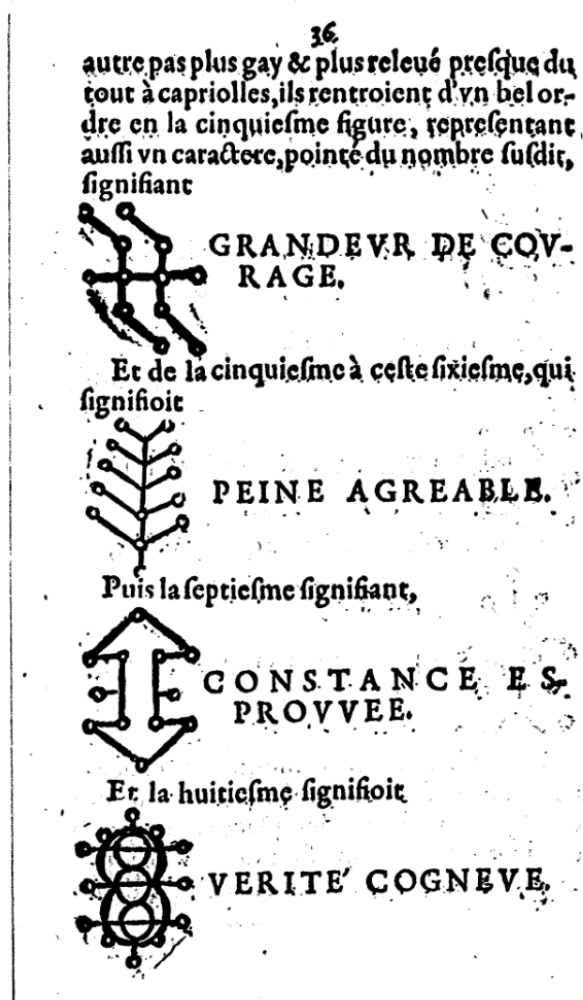


Figure 3.6. Dance patterns form symbols for virtues.

Ballet de Monseigneur le duc de Vendôme, dansé lui douzième en la ville de Paris, dans la grande salle de la maison royale du Louvre. Puis en celle de l'Arsenac, le 17 et 18^e jour de janvier 1610 [*Ballet of the Duke of Vendome*, danced by him as the twelfth dancer in the city of Paris in the great hall of the royal house of the Louvre. Then in that of the Arsenac, on the 17th and 18th day of January 1610] (Paris: J. de Heuqueville, 1610), 36.

Source: gallica.bnf.fr / BnF. Public domain.

Contredanse du R. oy.

Le Cavalier 1. et la Dame 2. se tournent un peu l'un devant l'autre, ils partent tous deux du pied droit pour faire un tour ensemble suivant la demonstration cy dessous, lequel tour est composé de trois pas de bourree, et d'un couppe assemble. A la premiere mesure de l'air ils se presentent la main droite par une petite Inclination, A la 2.^e ils se baissent, Et a la fin de la 3.^e ils se baissent pour retourner a leur place apres quoy le Cavalier 1. fait un petit saut devant la Dame 1. Et la Dame 2. ne saute pas.

The page features a musical staff at the top with a key signature of one sharp (F#) and a common time signature (C). The melody is written for a single line. Below the staff, there are four sets of diagrams illustrating the dance steps, numbered 1 through 4. Each diagram shows a male figure (Cavalier) and a female figure (Dame) in 17th-century attire. Diagram 1 shows the initial position. Diagram 2 shows the first step, a small hop for the Cavalier. Diagram 3 shows the second step, a bow. Diagram 4 shows the third step, a small hop for the Cavalier. The diagrams are arranged in a circular pattern, indicating a continuous dance.

La Dame 1. qui a demeure posée le visage en dedans sans rien faire pendant que les autres ont dance, fait aussi un petit saut dans le même temps que son cavalier, ce qui se rencontre justement au milieu de la 4.^e mesure de l'air.

Le Cavalier 2. reste posé le visage en dedans sans rien faire.

1	2	3	4
---	---	---	---

Figure 3.7. Contredanse notation using small pictures and diagrammatic notations.

Andre Lorin, *Livre de la contredanse du roy*, présenté à Louis XIV (1688) et retranscrit pour Louis XV (1721) [Book of the king's contredanse, presented to Louis XIV (1688) and retranscribed for Louis XV (1721)], vue 46. Source: gallica.bnf.fr / BnF. Public domain.



Figure 3.8. Portrait of dancing master and dance composer Guillaume-Louis Pécour (1653-1729) proudly gesturing toward one of his compositions in Beauchamp/Feuillet notation.

“Pécour: Master of Ballets of the royal Academy and Dancing Master to the Duchess of Bourgogne.” Drawn with a page of a male solo in Beauchamp/Feuillet choreography, c. 1699-1712 (approximate date of print is derived from dates of Pécour’s employment with Duchess of Bourgogne). Robert Tournier (1676-1752), drawing; François Chéreau (1680-1729), engraving. Source: gallica.bnf.fr / BnF. Public domain.



Figure 3.9. Notation for “Pas glissé,” also called a glissade, or jumping step (circles are bleed-through from the other side of the page).

Raoul Auger Feuillet, *Chorégraphie* (Paris: Michel Brunet, 1700), 11.

Source: gallica.bnf.fr / BnF. Public domain.

LA DANCE.
*Table de la mutation
des bonnes positions.*

27

de la 1. ^{re} à la 2. ^{me}	de la 1. ^{re} à la 3. ^{me}	de la 1. ^{re} à la 4. ^{me}	de la 1. ^{re} à la 5. ^{me}
de la 2. ^e à la 1. ^{er}	de la 2. ^e à la 3. ^{me}	de la 2. ^e à la 4. ^{me}	de la 2. ^e à la 5. ^{me}
de la 3. ^e à la 1. ^{er}	de la 3. ^e à la 2. ^{me}	de la 3. ^e à la 4. ^{me}	de la 3. ^e à la 5. ^{me}
de la 4. ^e à la 1. ^{er}	de la 4. ^e à la 2. ^{me}	de la 4. ^e à la 3. ^{me}	de la 4. ^e à la 5. ^{me}
de la 5. ^e à la 1. ^{er}	de la 5. ^e à la 2. ^{me}	de la 5. ^e à la 3. ^{me}	de la 5. ^e à la 4. ^{me}
	de la 3. ^e à la 3. ^{me}	de la 4. ^e à la 4. ^{me}	de la 5. ^e à la 5. ^{me}

Figure 3.10. *Table de la mutation des bonnes positions* [Table of the transfer movement in good positions, i.e. positions of the feet in which the toes are turned out]. The table on the next page in the book is of all of these moves performed with the feet turned *in* (i.e. “false” positions).

Each square demonstrates notation for a jump. The beginning position in each square is marked with a bend and jump signs (small lines across the main foot line – one line on a diagonal is a bend, two lines crossing the foot line designates a jump). For example, the upper right corner demonstrates a jump from first position with heels together to fifth position with the feet crossed and the right foot in front.

Raoul-Augur Feuillet, *Chorégraphie* (Paris: Michel Brunet, 1701), 27.
Source: gallica.bnf.fr / BnF. Public domain.

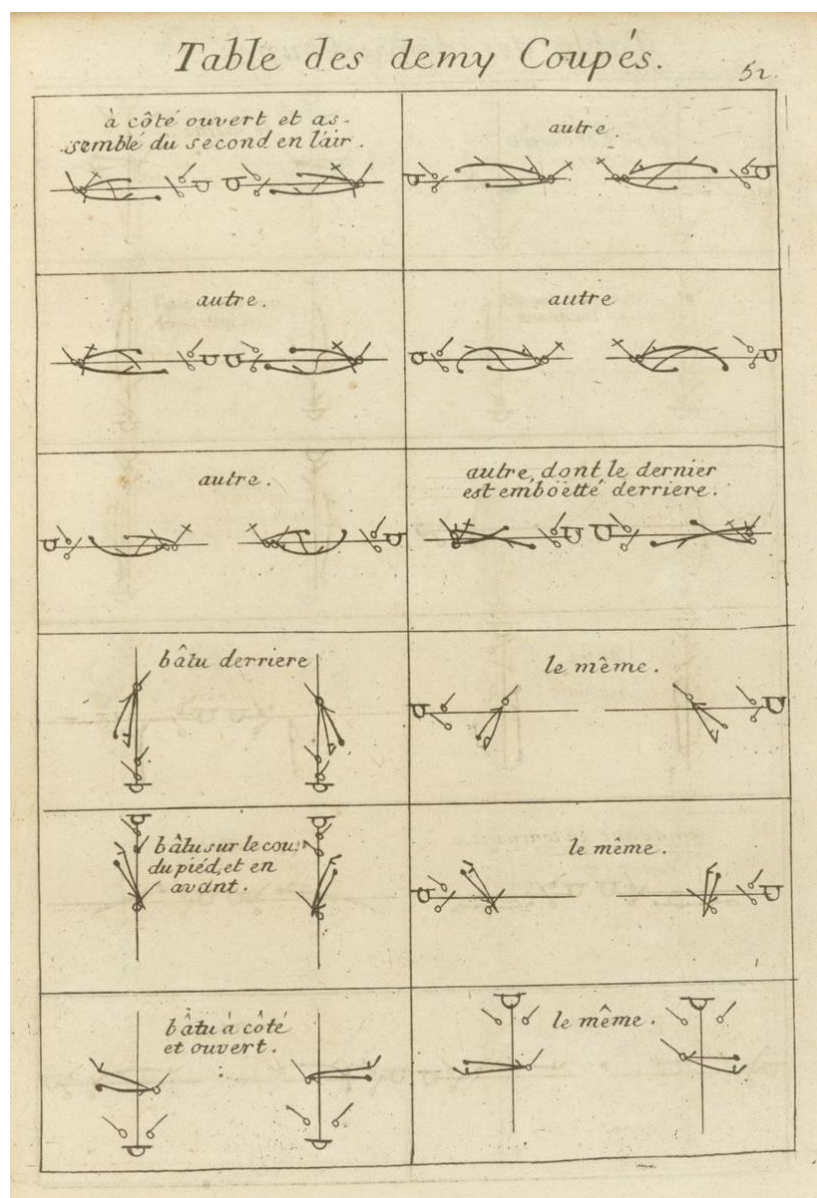


Figure 3.11. Table of demi-coupés. The third square down on the right shows the notation for “another, in which the 1st foot is boxed in (*embœttée*) behind.

Raoul-Auger Feuillet, *Choregraphie* (Paris: Michel Brunet, 1701), 52.
Source: gallica.bnf.fr / BnF. Public domain.

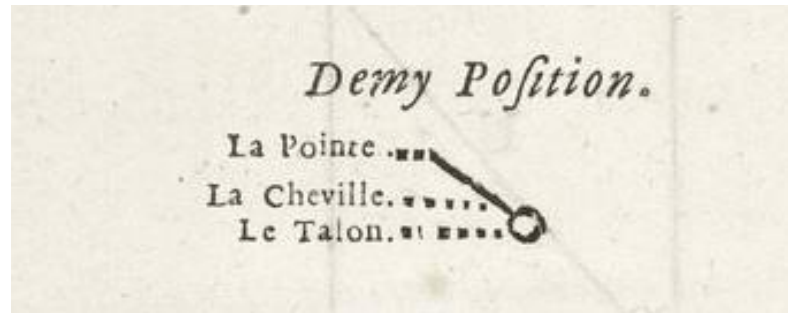


Figure 3.12. Close up of Foot, diagrammed in Beauchamp/Feuillet notation (La Pointe/the Point, La Cheville/the Ankle, and Le Talon/the Heel).

Raoul Auger Feuillet, *Chorégraphie*, (Paris: Auteur, 1700), 6.
Source gallica.bnf.fr / BnF. Public domain.

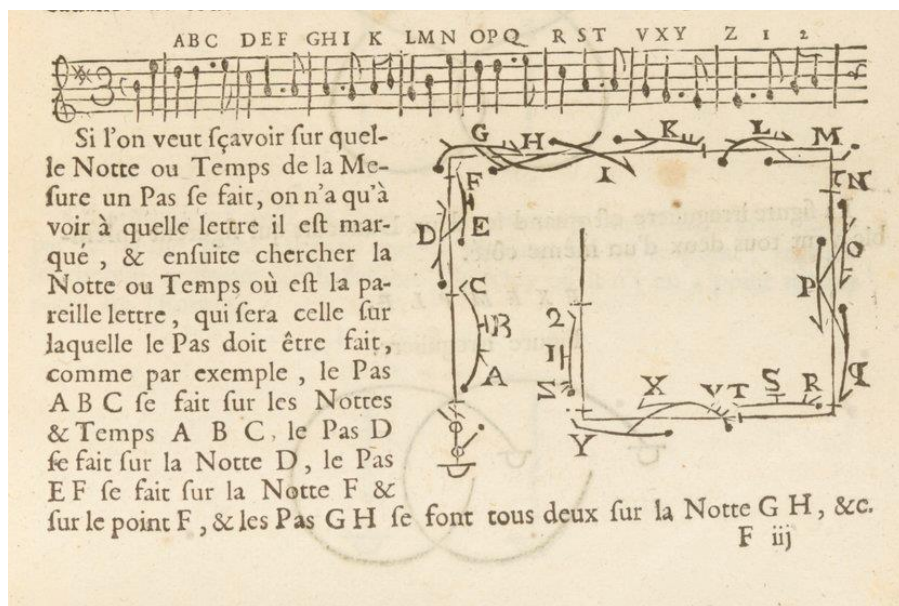


Figure 3.13. Diagram correlating dance notation with mensural musical notation.

If one wants to know on which Note or Beat of the Measure on which one makes a Step, one has but to look at which letter it is marked, & then look for the Note or Beat where the parallel letter [is located], which will be where the Step should be made, as in for example, the Step A B C is performed over the Notes & Beats A B C, the Step D is made on the Note D, the Step E F is made on the Note F & on the point F, & the Step G H is made the two together [in double time] on the Note G H, &c.

Raoul Auger Feuillet, *Chorégraphie* (Paris: Michel Brunet, 1701), 91.
Source: gallica.bnf.fr / BnF. Public domain.

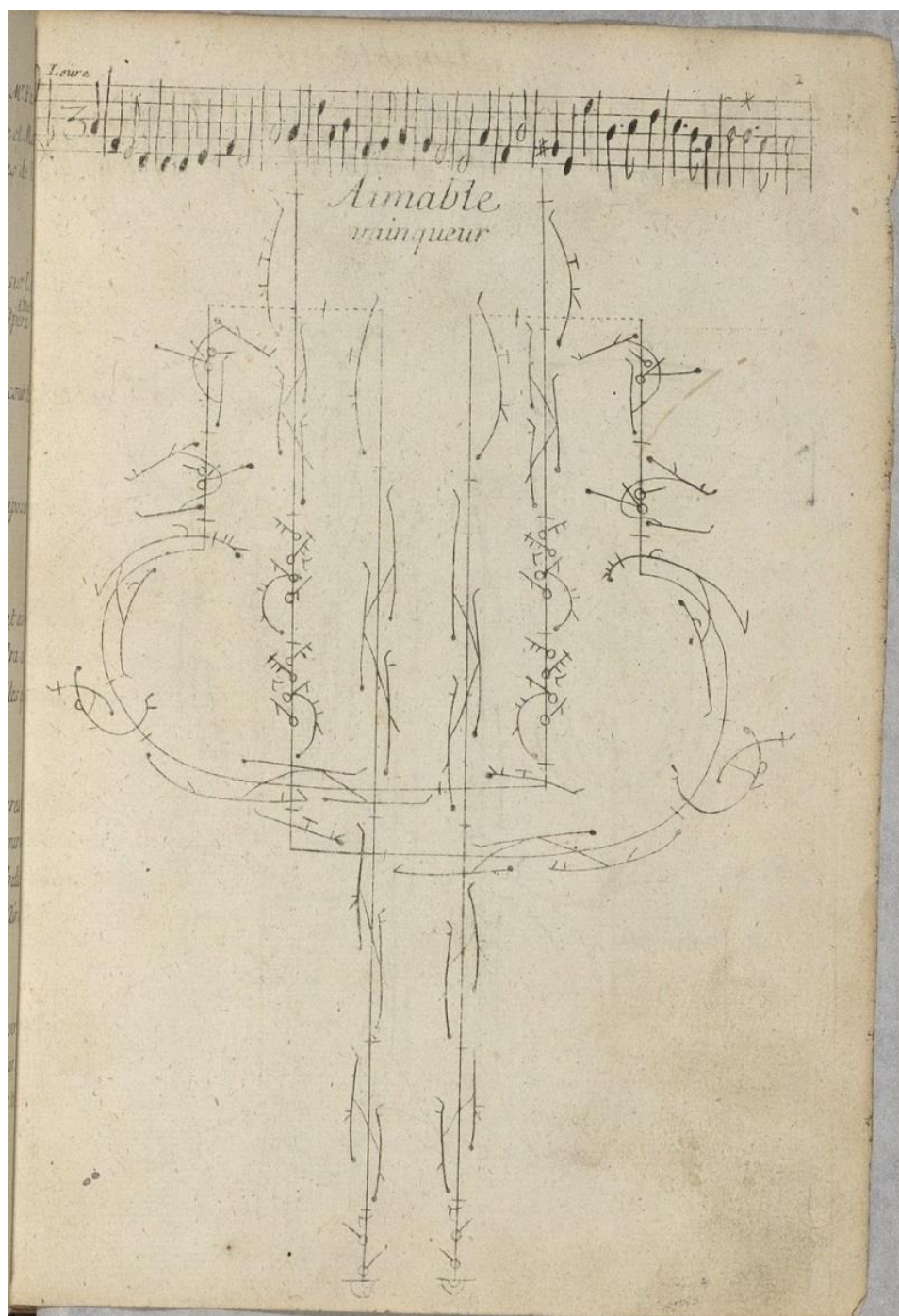


Figure 3.14. Beauchamp/Feuillet notation for the dance *Aimable Vainqueur* [Loving Conqueror].

Guillaume-Louis Pécour, composer, and Raoul Feuillet, notator, *Aimable Vainqueur* (Paris: R. A. Feuillet or Michel Brunet, 1701), plate 1 of 6 plates of dance notation (the publication also included a Title page and Notes to the Reader). Source: gallica.bnf.fr / BnF. Public domain.

Source: gallica.bnf.fr / BnF.



Figure 3.15. *L'Aimable Vainqueur* music is being held by the woman musician on the right (top image); it is being danced by the couple in the middle (bottom image).

Biombo [Painted Screen], attributed to Miguel Cabrera (1695-1768), c. 1760. Public domain.

Exhibited at the Los Angeles County Museum of Art, "Painted in Mexico, 1700–1790: Pinxit Mexici," Nov. 19, 2017 – Mar. 18, 2018. See Ilona Katzew, ed., *Painted in Mexico, 1700-1790: Pinxit Mexici* (Los Angeles: Prestel, 2017).



Figure 3.16. Formal bow to the king before dancing.

This illustration depicts the same couple, making their bows in the middle of the floor and then returning to the bottom of the image to begin their dance while the court looks on. Note the risers giving those in the back row a good view of the patterns traced by the dancers on the floor.

Pierre Rameau, *Le Maître à danser* [The Master of dancing] (Paris: J. Villette, 1725), 1.
Source: gallica.bnf.fr / BnF.

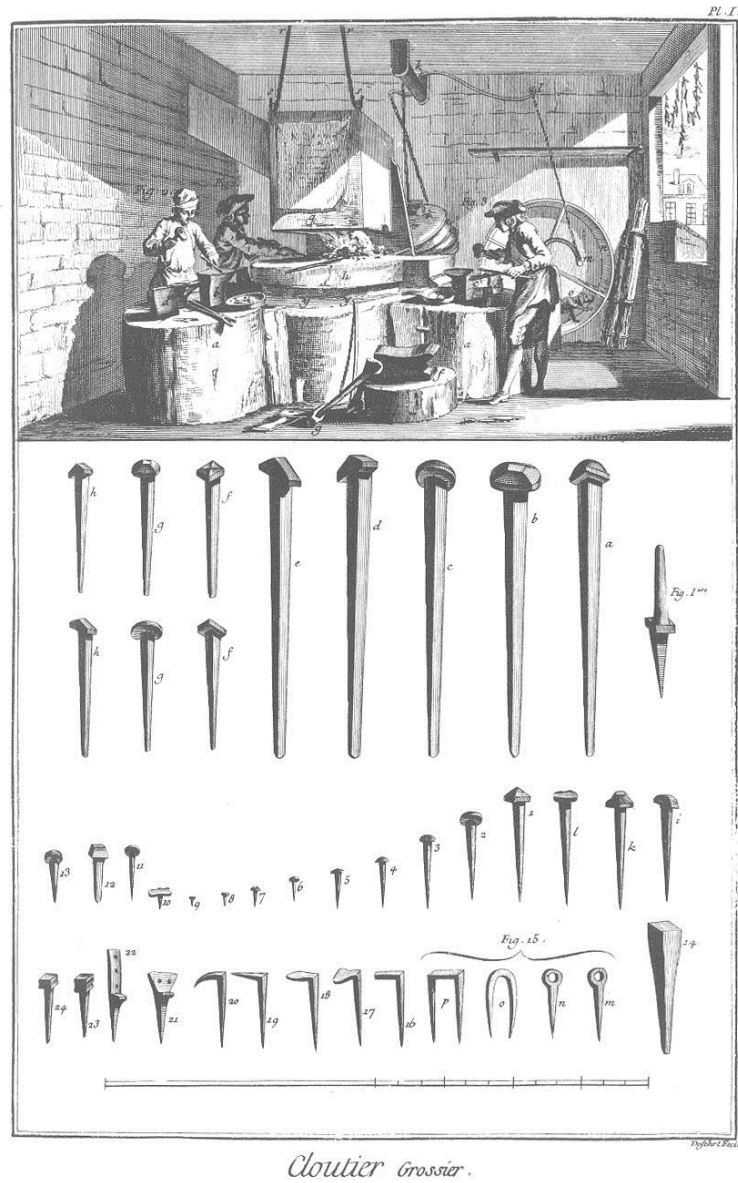


Figure 3.17. Blacksmith shop making heavy nails.

Louis-Jacques Goussier, s.v. "Cloutier," *Encyclopédie*. Source: gallica.bnf.fr / BnF.

L'F.^{te}

LES PLAISIRS

DE

L'ARQUEBUSE

Contredanse Allemande

PAR M^{re} DUSUEL

M^{re} de Danse

P. 4. 1^{re} la Veille

A PARIS

Chez M^{re} Bouin M^{re} de Musique
et Cordes d'Instrumenterie
8^{me} honore au Cagne Petit pressé
Roch
M^{re} de Castagnery Rue des Eaux
vives a la Musique Royale

LES PLAISIRS CAS

DESCRIPTION

Des Figures de la Contredanse.

1. Le Rond ordinaire.
2. Tous se tiennent les mains croisées & vont en avant les 4. m. et se tiennent d'une place tous font piroetter les Dames : les 4. premiers reculent a leurs pl. et les autres avancent en vers d'une pl. tous font enrou piro. les D.
3. Contrepartie
4. Les Cavaliers donnent main gau. a main gau. a leurs Dames. les font tourner derrière eux en se plant. le bras gauche derrière le dos.
5. Alors passant le bras droit derrière le dos de leurs D. ils tournent un tour sur place avec elles.
6. La chaîne des Dams. a par 2. sur les côtés.
7. Les Caval. tenant leurs Dams. les mains croisées, la droite dessus, balancent en se joignant d'une l'autre dans le bras droit sans quitter les mains.
8. Dans cette position ils avancent d'une place sur leur droite.
9. Ils développent leurs D. en les faisant passer à leur gau. et en leur plant. le bras gauche derrière le dos.
10. Par cette position ils avancent d'une place.
11. Lachant le bras droit de leurs D. ils se présentent en moulinet, en leur plant. le bras gauche derrière le dos. ils se placent derrière elles.
12. Alors les D. se donnent la main droite en moulinet les Caval. a par 2. se donnent aussi la main droite par dessus les bras de leurs Dams. demi tour de moulinet.
13. Chaque Caval. tenant toujours sa D. main gau. à main gauche, la fait tourner derrière lui pour la mettre à sa place et lui même se met en moulinet. les Dams. a par 2. se donnent les mains comme les Caval. dans la fig. précédente.
14. Un demi tour de moulinet, jusqu'à ses places.
15. La Main.

DE L'ARQUEBUSE.

DE DAN

Des Figures de la Contredanse.

LES PLAISIRS DE L'ARQUEBUSE.

Contredanse Allemande

Figure 3.18. “Les Plaisirs de L’Arquebuse” [The pleasures of the Arquebuse/Musket]. Contredanse publications were standardized, usually consisting of four pages: 1. a title page, 2. the directions for the dance in text, 3. a page of small diagrams demonstrating the patterns the dancers made, and 4. the tune for the dance, usually a single line of music.

M. Dusuel, “Les Plaisirs de L’Arquebuse” [The pleasures of the Arquebuse/Musket], *Recueil de Danses* (Paris: Bouin & Castagnery, n.d.), images 5-8. Library of Congress, Music Division. Public domain.

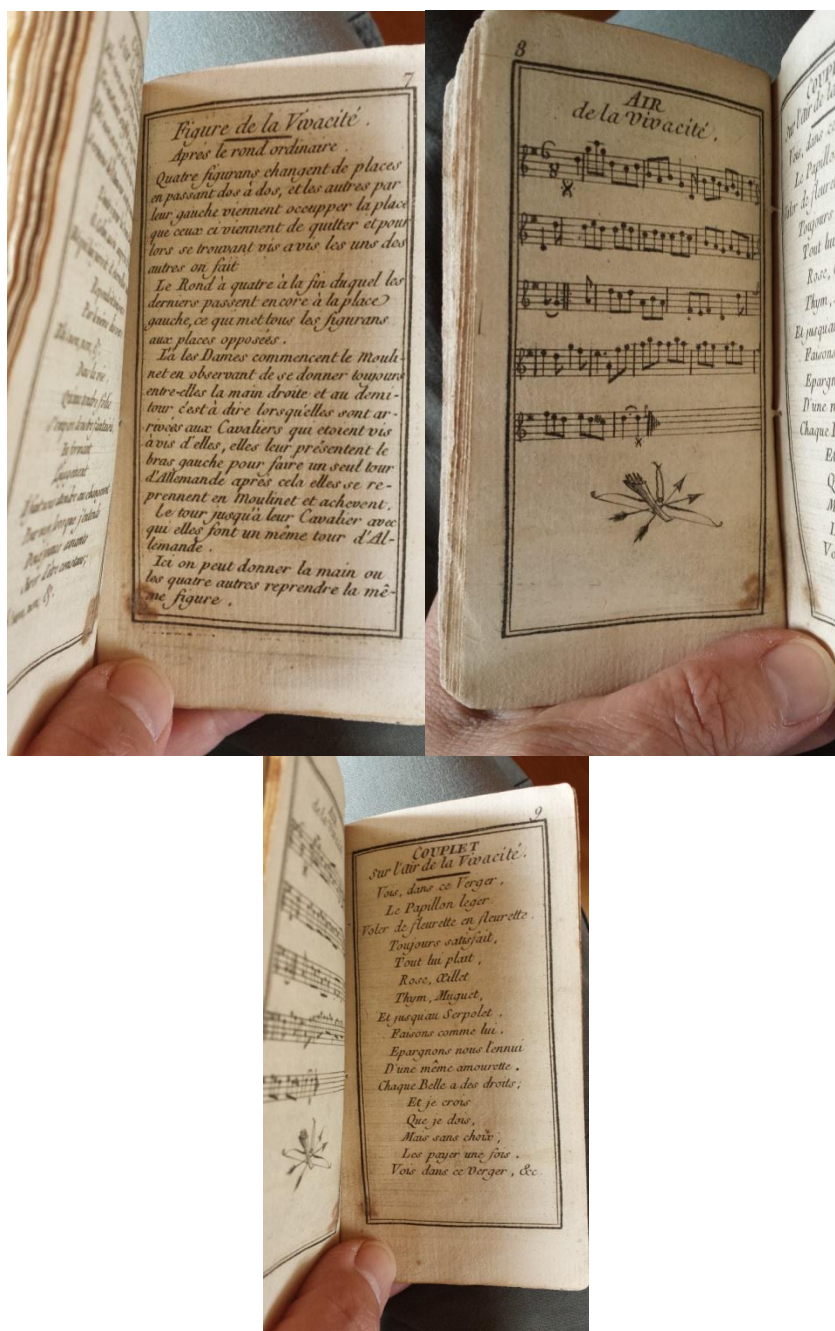


Figure 3.19. A dance called “de la Vivacité” (of Vivacity) in three pages: 1. the “Figure” or instructions, 2. the “Air” (tune), 3. “Couplet” words that could be sung to the tune. This booklet was little bigger than a 3” x 5” index card and on lightweight paper.

“De la Vivacité,” in *de la Cuisse, Entrennes Dansantes Ou Recueil Des Aires et Descriptions Des Figures Des Meilleures et plus Jolies Contredanses Avec Des Couplets Sur Chaque Air* (Paris: Cailleau; Castagnery, 1758), 6-8. Photos by Tamara Caulkins.

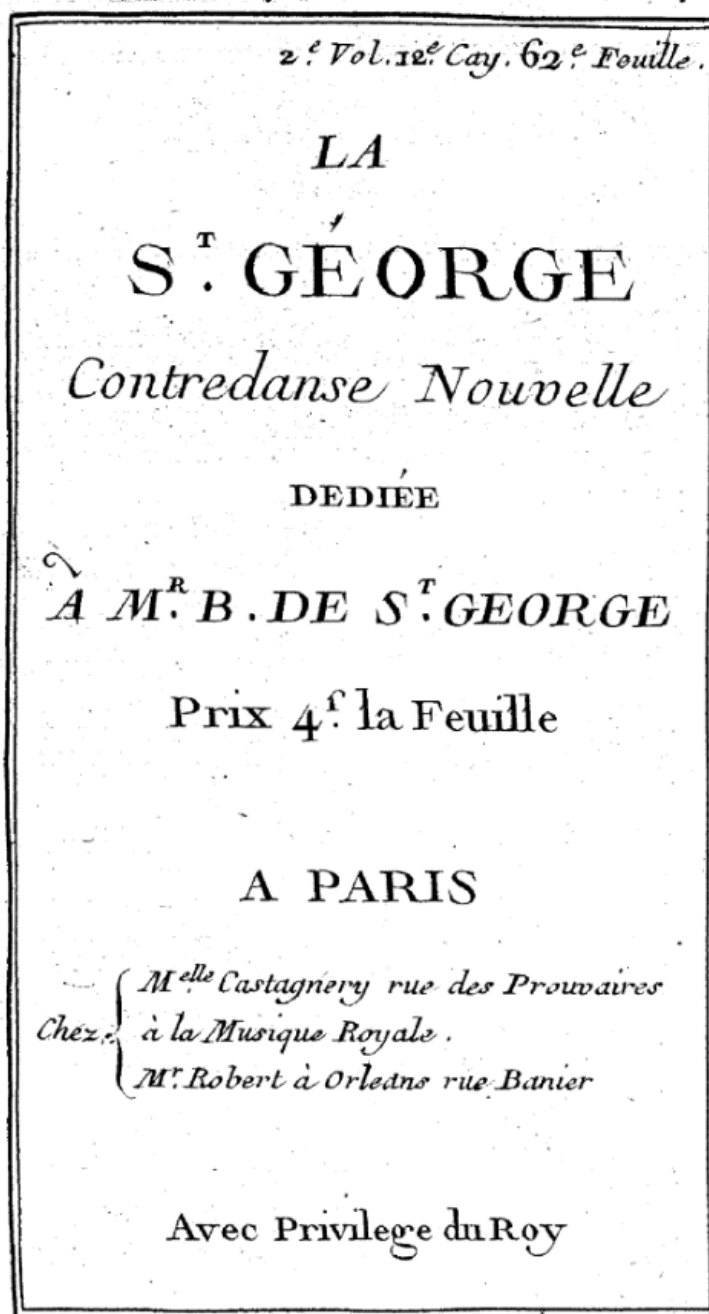


Figure 3.20.1. "La St. George" Contredanse. Title page.

De La Cuisse, *Le Repertoire des Bals* (Paris: Cailleau, 1762), vol. 2, (not paginated), vue 280-283 of digital version. Library of Congress, Music Division. Public domain.

LA S^T. GEORGEDESCRIPTION
des Figures de la Contredanse

- L'air de cette Contredanse est de M^r. Petit et la figure de M^r. De la Hante M^{re} de Danse, la Basse de M^r. Hanau. elle se figure ainsi, après le Grand rond ordinaire l'on se deploye sur deux lignes puis*
- 1^e. Chaque Cavalier menant sa Dame et Chassant par sa gauche change de Coin en allant former la ligne vis-à-vis*
 - 2^e. et continuant de tenir les Dames, tous Balancent puis les font Pirouetter sous le Bras.*
 - 3^e. Les deux lignes s'approchant et chaque Cavalier prenant les Mains de la Dame qu'il a devant luy, fait une Poussette d'un tour entier.*
 - 4^e. Alors les deux bandes se donnant les Mains et chaque bande Chassant par leur droite vont former 2. lignes dans le sens contraire.*
 - 5^e. Continuant de se tenir les Mains tous vont en avant et en arriere.*
 - 6^e. Les 4. Figurans de chaque ligne s'approchant Balancent et Rigaudon et de suite*
 - 7^e. les Dames se donnant les deux Mains et les Cavaliers la Main droite en Moulinet par dessus font un tour et se deployent comme ils étoient auparavant.*
 - 8^e. Chaque Cavalier tenant sa Figurante va en avant et deux Chassant à droite et les autres à gauche forme*
 - 9^e. deux Ronds qui passant dos-à-dos autour l'un de l'autre sans tourner, se divisent, et vont former deux Lignes semblables aux premières et deux Figurans de l'un des Ronds se trouvant vis-à-vis deux de*
 - 10^e. l'autre se prennent en Moulinet dont ils font un demi tour*
 - 11^e. Alors les Cavaliers presentant la Main droite à la Dame qu'ils ont vis-à-vis passent à leur places*
 - 12^e. et recourent de la Main gauche leur Figurante avec qui il fait un demi tour qui les remet à leur places*

La Main

Figure 3.20.2. Instructions in text. "La St. George" Contredanse.

De La Cuisse, *Le Repertoire des Bals* (Paris: Caileau, 1762), vol. 2, (not paginated), vue 280-283 of digital version. Library of Congress, Music Division. Public domain.

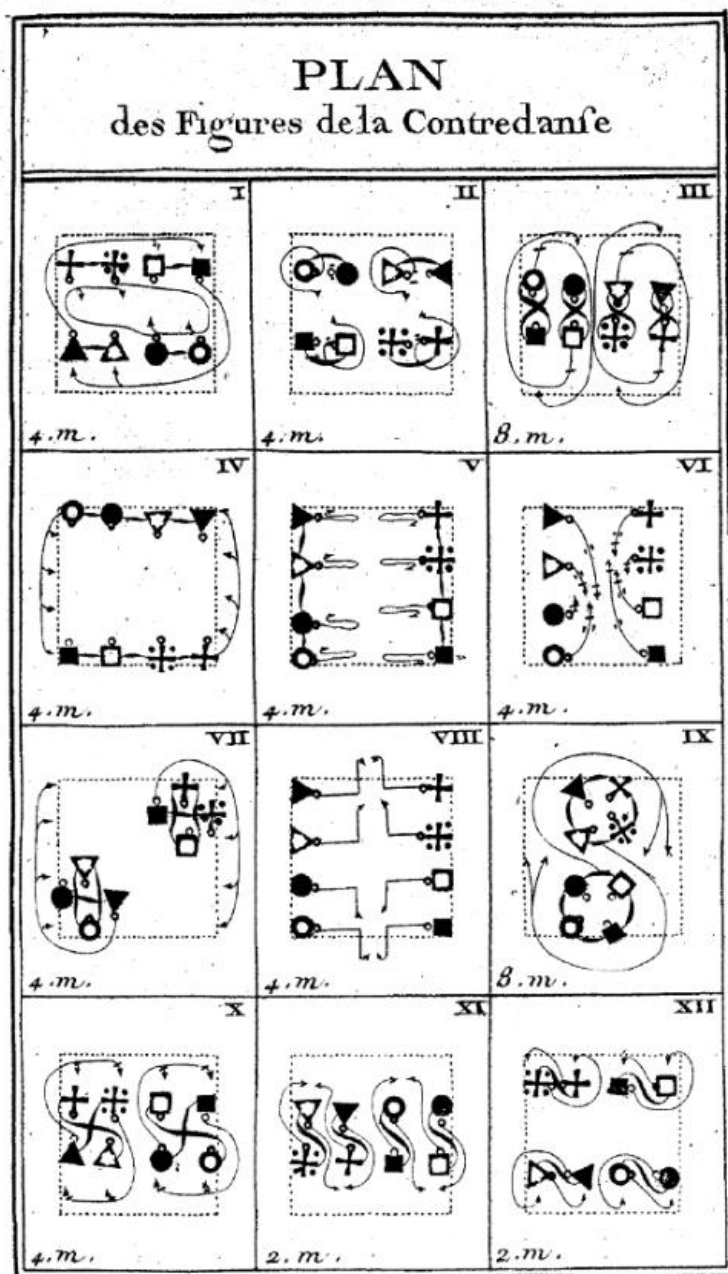


Figure 3.20.3. “La St. George” Contredanse. Diagrams for floor patterns.

De La Cuisse, *Le Repertoire des Bals* (Paris: Cailleau, 1762), vol. 2, (not paginated), vue 280-283 of digital version. Library of Congress, Music Division. Public domain.

LA S^T. GEORGE
Contredanse .

1. fois la 1^{re} Reprise et le Rond. Encore la premiere
Reprise et le Rondeau, le Minour et le Rondeau .

Figure 3.20.4. “La St. George” Contredanse. Music.

De La Cuisse, *Le Repertoire des Bals* (Paris: Caileau, 1762), vol. 2, (not paginated), vue 280-283 of digital version. Library of Congress, Music Division. Public domain.

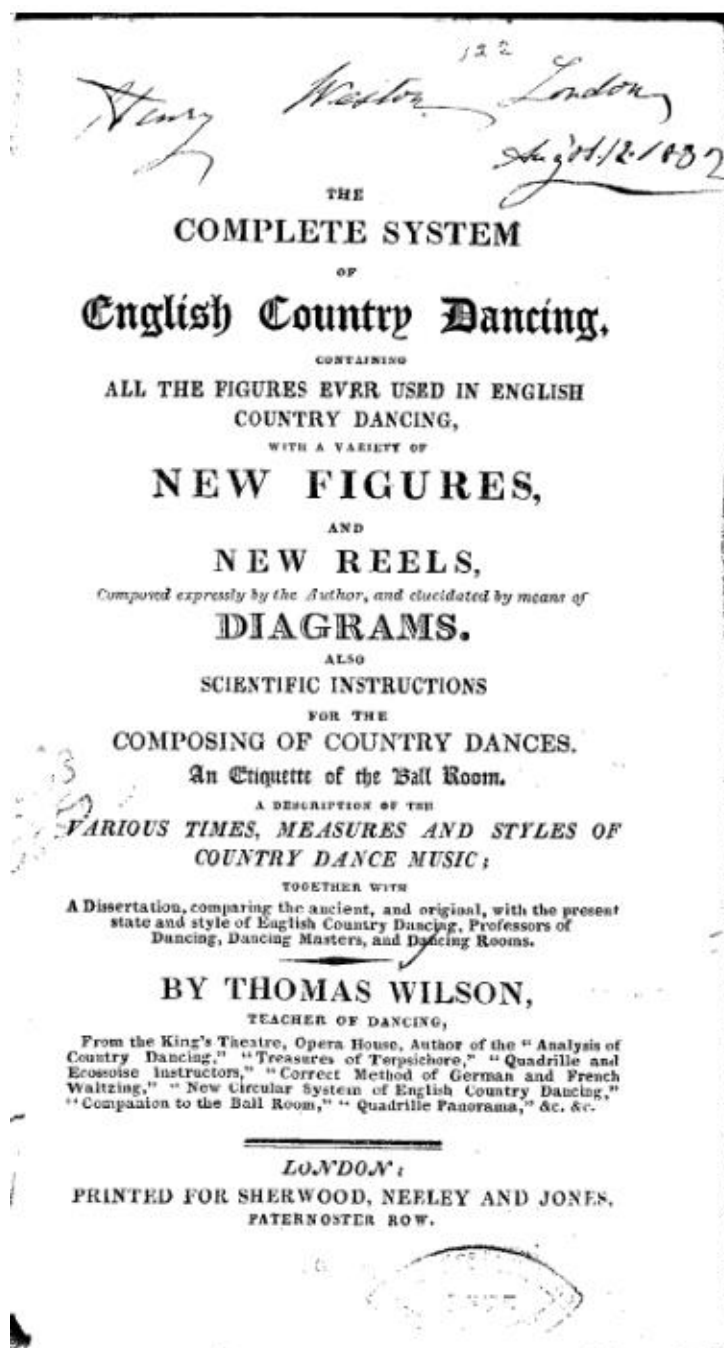


Figure 3.21. Thomas Wilson, Complete System of English Country Dancing, (London: Sherwood, Neeley and Jones, 1815).

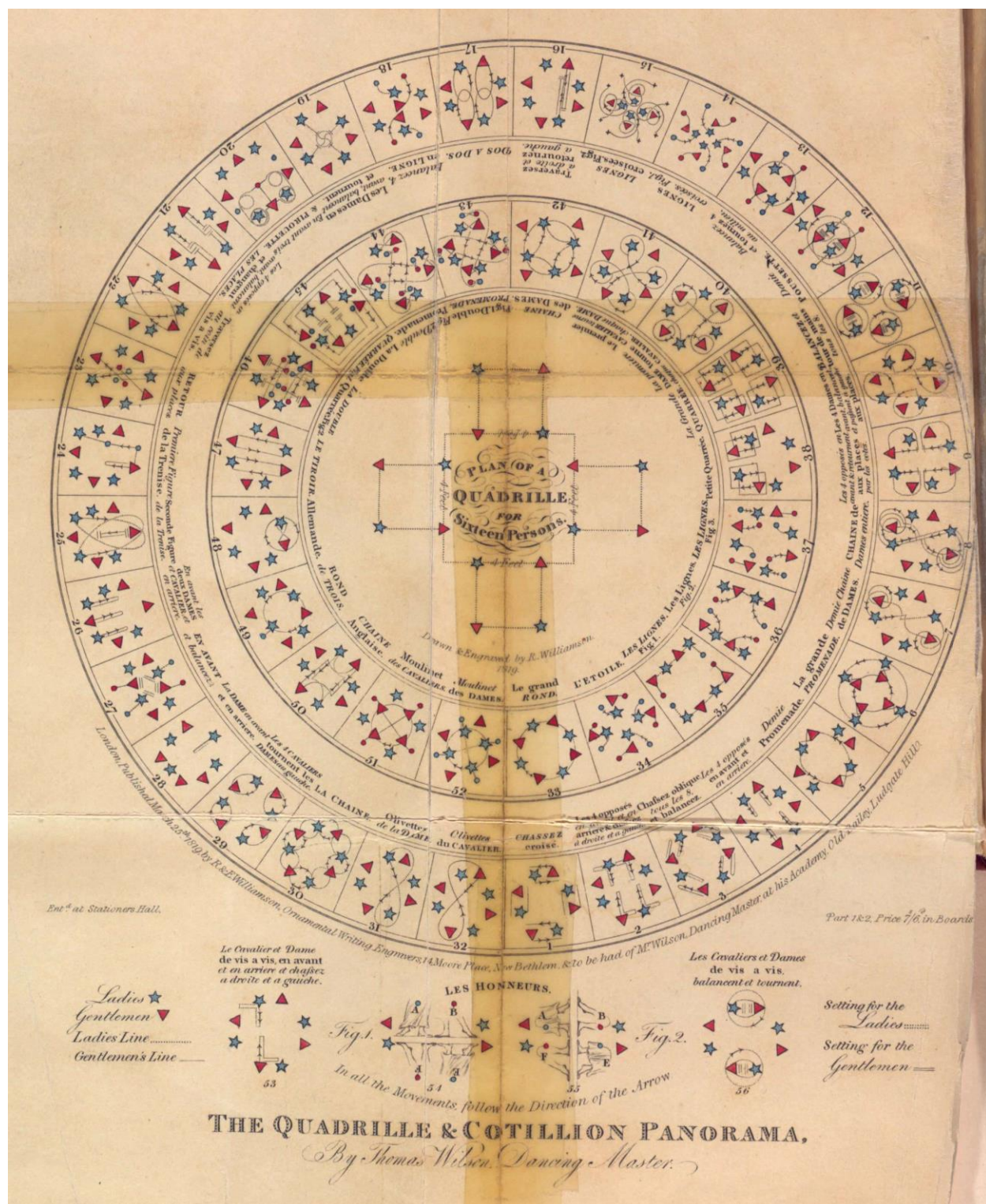


Figure 3.22. Thomas Wilson, *The Quadrille and Cotillion Panorama* (Edinburgh: R. & E. Williamson, 1819), fold out.

Source: Library of Congress. Public domain.

CHAPTER FOUR DRILL: BODIES ON A MAP



Figure 4.1. Diagrams in a c.1330 manuscript edition of Aelian, *On Tactical Arrays of the Greeks*. Public domain.

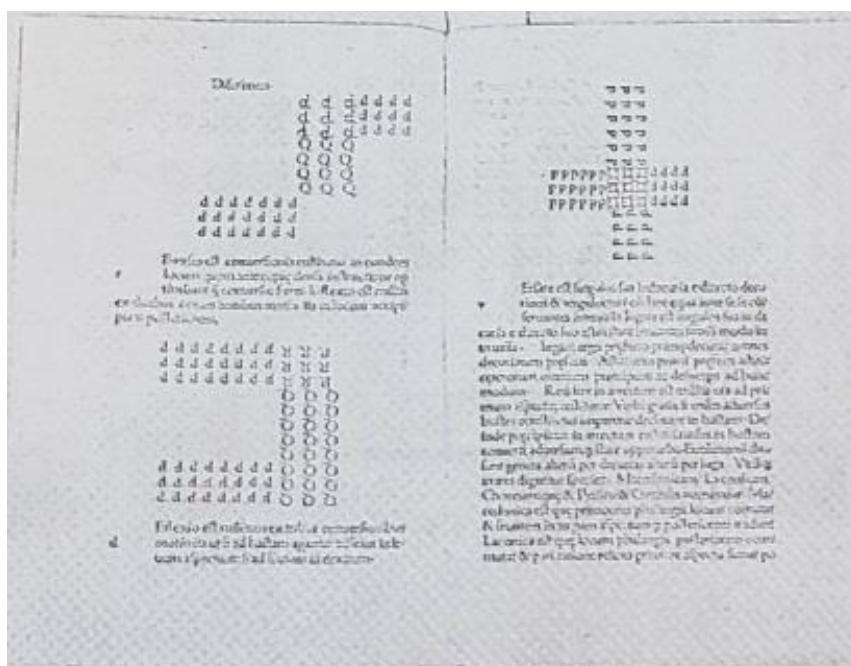


Figure 4.2. A 1496 anonymous Latin edition of Aelian, *On Tactical Arrays of the Greeks*, published in Bologna. The drill diagrams were printed using letter fonts arranged on the page. Public domain.

Sappiate adunque che questa lettera.

O	significa	Fanti con lo scudo
o		Fanti con la picca
X		Capidieri
r		Veliti ordinarij
r		Veliti straordinarij
C		Cennarioni
p		Connestaboli delle battaglie.
φ		Capo del battaglione
ω		Capitano generale.
S		Il fiono
Z		La bandiera
φ		Huonemi d'arme
Y		Canagli leggeri
h		Artiglierie

Figure 4.3a. In Machiavelli's 1521 treatise, *Dell'Arte della guerra* [The Art of War], he included a chart to explain his the symbols in the diagrams to follow. Public domain.

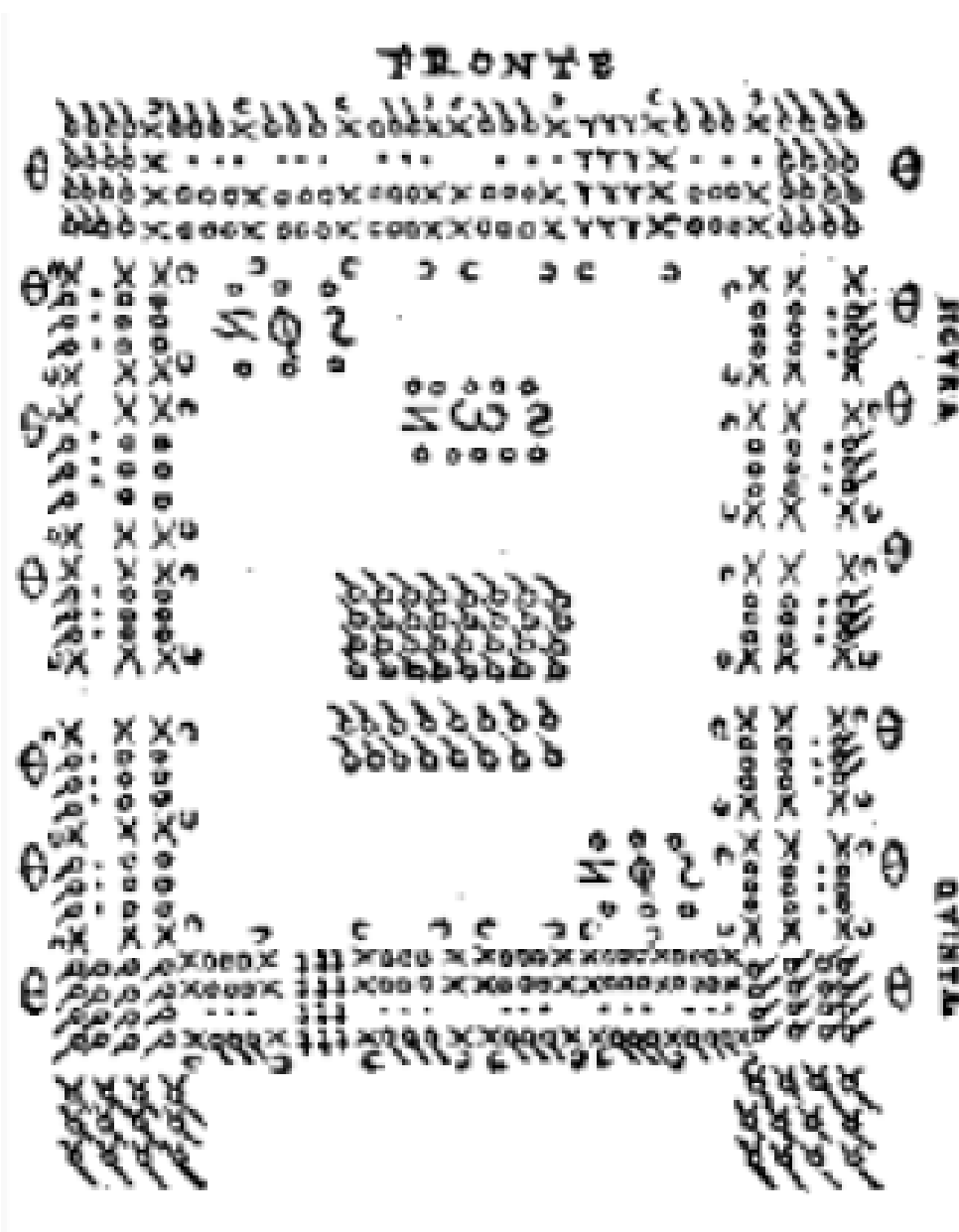


Figure 4.3b. Machiavelli drew on over a dozen different symbols to designate different ranks in the diagrams included in his *Dell'arte della guerra*. The overall open square formation was flexible to ward off attacks. Often noncombatants marched in the middle (this protected food from peasant marauders). Inside the square at the top left, upper center, and bottom right, Z = flag bearer, O with a cross = head of the battalion, and W = General in command. Public domain.

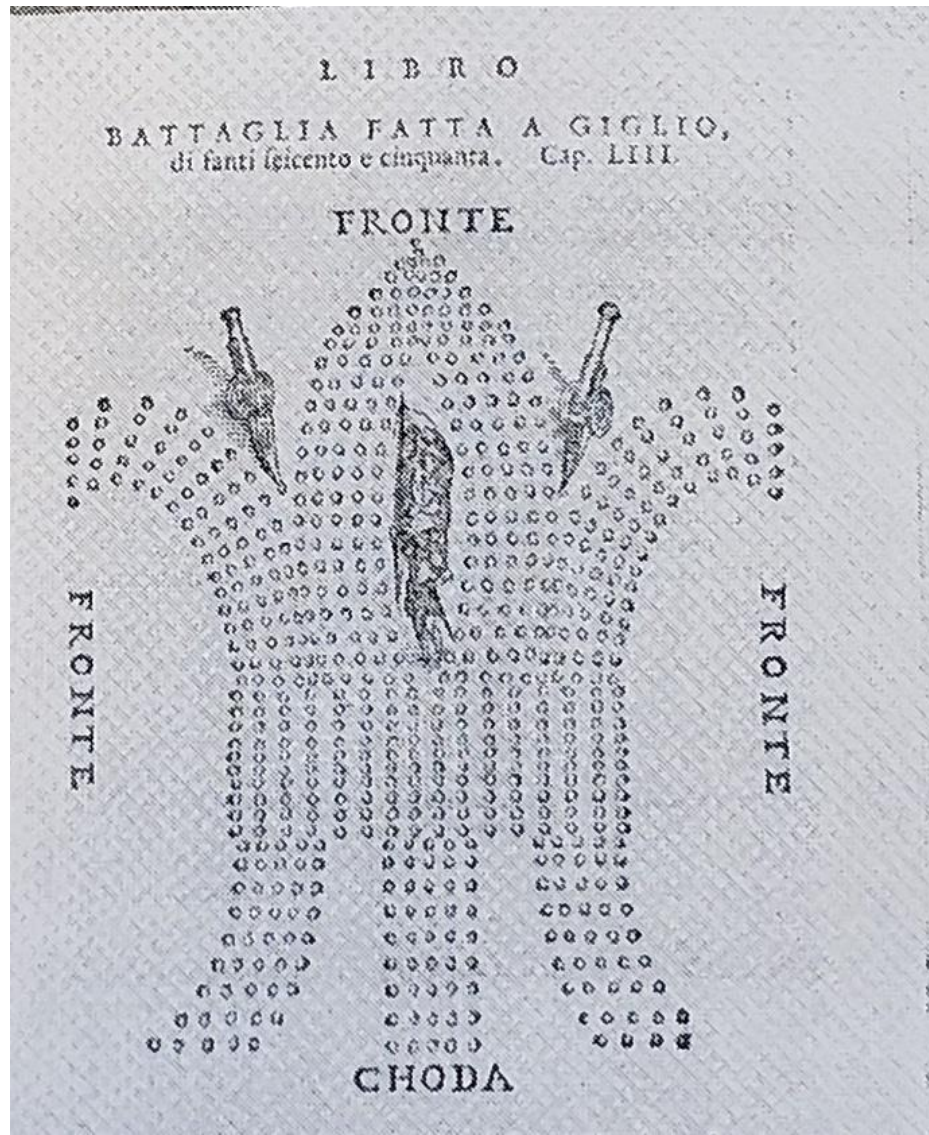


Figure 4.4. A drill diagram in the shape of a fleur de lis [lily] with a picture of a flag bearer in the middle and two cannons on either side at the top. This is one of several pictorial designs mentioned in classical sources. Public domain.



Figure 4.6a. A 1624 depiction of the telescope in the Netherlands. Anon.
Source: https://en.wikipedia.org/wiki/History_of_the_telescope. Public domain.



Figure 4.6b. 1625 In this Velázquez painting, “The Surrender of Breda (1625),” the victorious Ambrosio Spinola (commanding the Spanish troops) is holding a spyglass/telescope.

Source: www.museodelprado.es. Public domain.



Figure 4.7. Demonstrating a delicate operation on an Arquebuse: one blows gently on the wick and carefully places it on the holder. The trigger then pulls the ember toward the gun powder already poured into the opening. See Giffart's version of the same movement in Figure 4. .

Jacques Gheyn, *Maniement d'armes d'arquebuses, Mousquetz, et Piques...Representé Par Figures* (Amsterdam: Robert de Baudous, 1608), 39. Source: gallica.bnf.fr / BnF. Public domain.

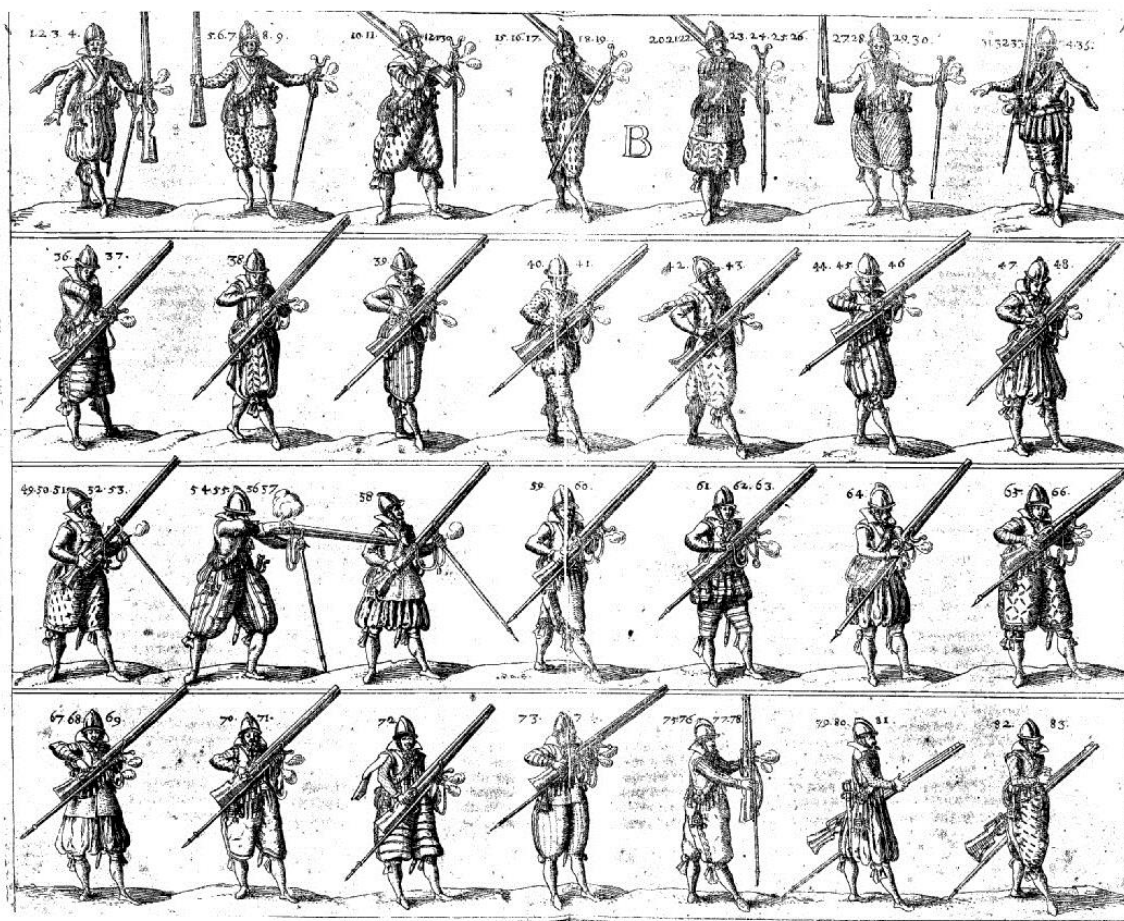


Figure 4.8. Johann Jacobi (aka Jean Jaques) von Wallhausen copied Gheyn's concept and drawings. Placing the figures all on one page may have been merely a way to save money, however, the effect was to make the movements apparent in a glance.

Jean Jaques de Wallhausen, *L'Art Militaire Pour l'infanterie*, trans. Anonymous (s.l.: s.n., 1615). Source: gallica.bnf.fr / BnF. Public domain.

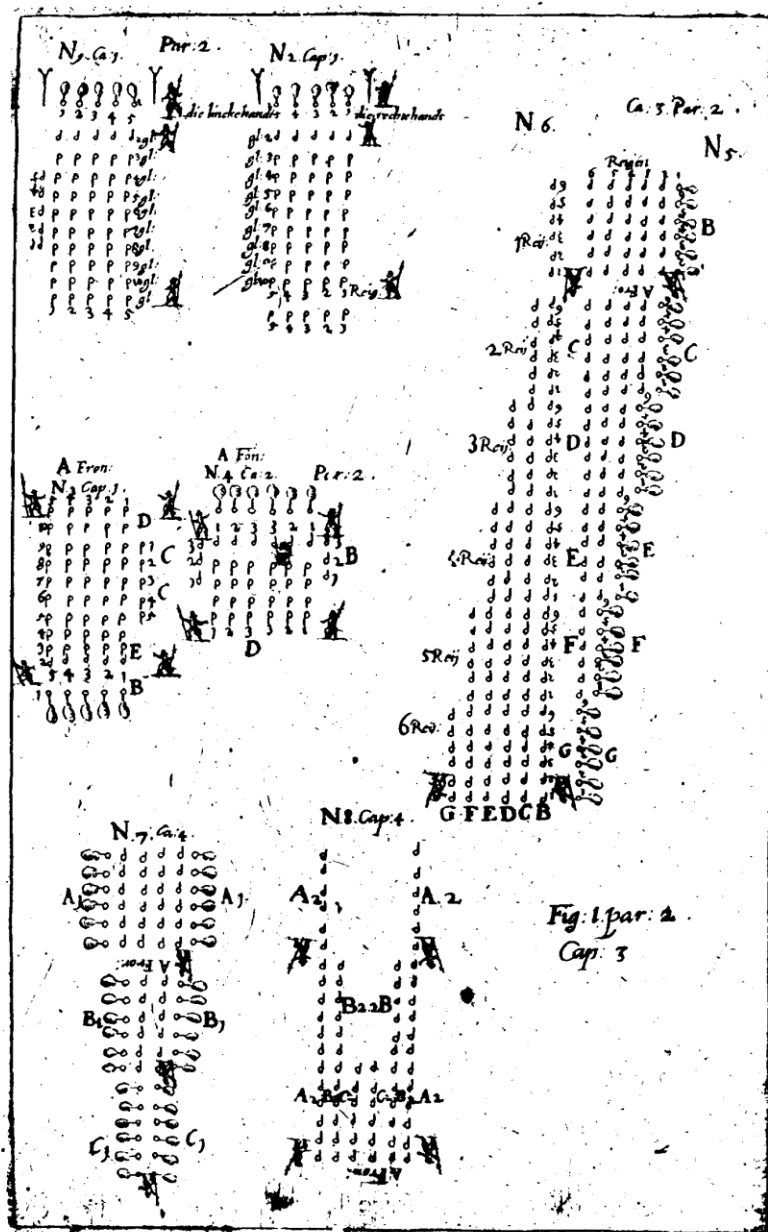


Figure 4.9. A combination of pictorial figures (presumably officers) and dots for infantry and cavalry. On the upper right, a line of infantry performs a volley drill flanked by a line of cavalry. The front line shoots then retreats to reload (from top to bottom, six rounds are pictured).

Jean Jaques de Wallhausen, *L'Art Militaire Pour l'infanterie*, trans. Anonymous (s.l.: s.n., 1615), 56. Source: gallica.bnf.fr / BnF. Public domain.

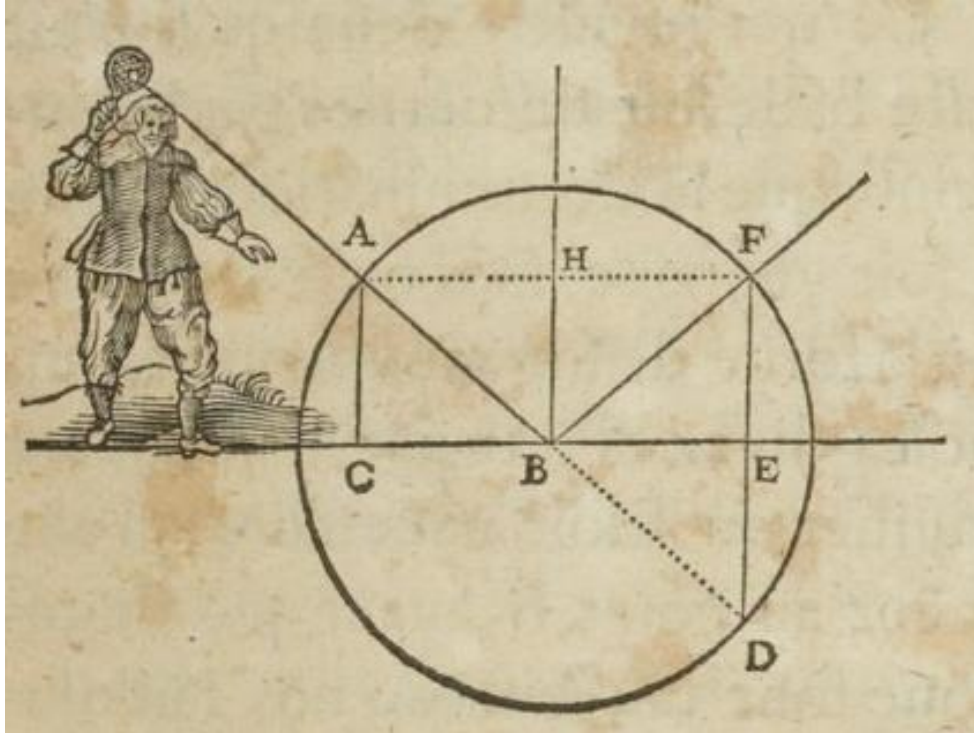


Figure 4.10. 1637 The path of a moving tennis ball shown with (imagined) geometric lines.

René Descartes, *Discours de la méthode pour bien conduire sa raison et chercher la vérité dans les sciences* (Leiden: Jan Maire, 1637), 13. Source: gallica.bnf.fr / BnF. Public domain.

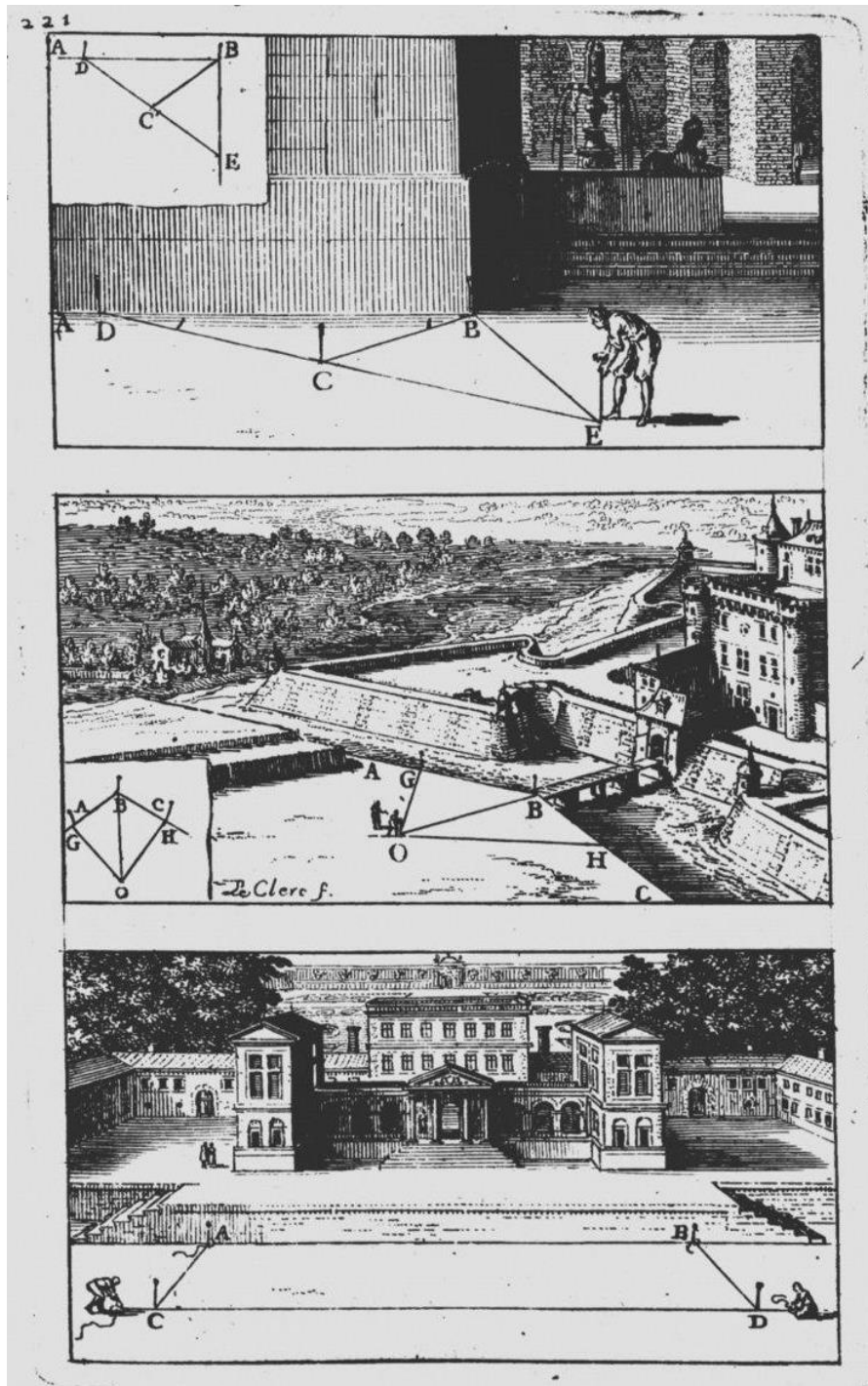


Figure 4.11. 1690 Geometric lines and labels superimposed on outdoor scenes connected the lessons from geometry to real-life problems in Leclerc's treatise on geometry.

Sébastien Leclerc, *Traité de geometrie* (Paris: Jean Jombert, 1690), 221. Source: gallica.bnf.fr / BnF. Public domain.

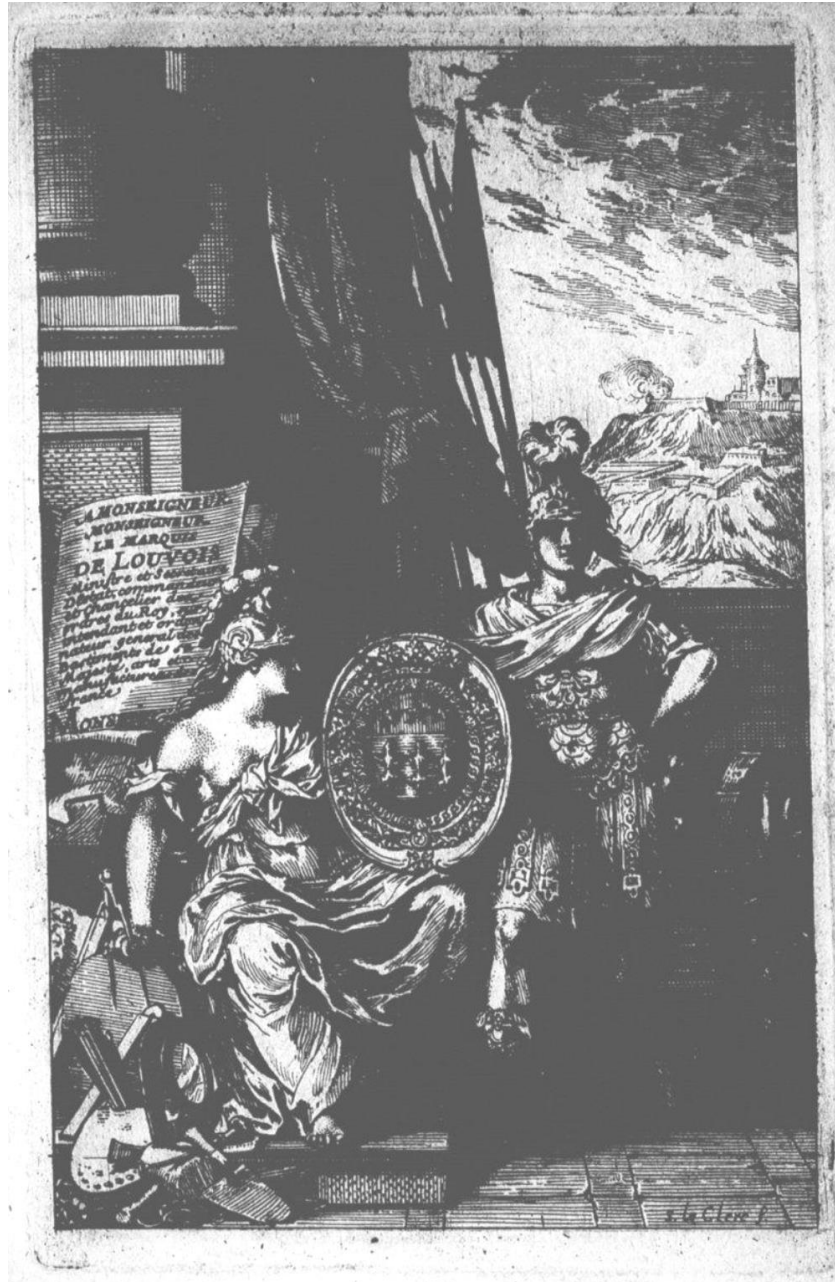


Figure 4.12. The practical value of geometry for the conduct of war is clear in Leclerc's dedication to François-Michel le Tellier, Marquis de Louvois, Secretary of State for War.

Sébastien Leclerc, *Traité de geometrie* (Paris: Jean Jombert, 1690), Frontispiece. Source: gallica.bnf.fr / BnF. Public domain.

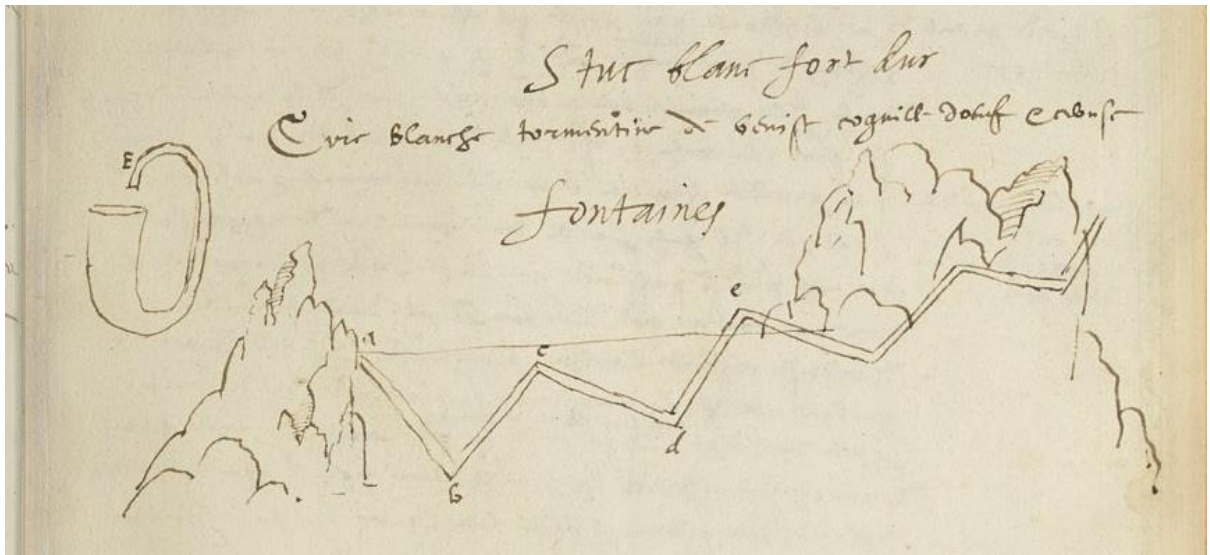


Figure 4.13. A sketch of geometric lines superimposed over a sketch of mountains gives an early example of geometric visualization over a landscape.

Anonymous, “Recueil de recettes et secrets concernant l’art du mouleur, de l’artificier et du peintre” (Bound manuscript, Toulouse, c.1580), BnF Ms. Fr. 640. Source: gallica.bnf.fr / BnF. Public domain.



Figure 4.14. Dance (foreground), fencing (middle ground), and horsemanship (in the distance), were often taught at the same academy.

Anonymous print in Nathalie Lecomte, *Entre cours et jardins d'illusion : le ballet en Europe, 1515-1715* (Pantin, France: Centre national de la danse, 2014), 193. Source: BnF, département des Estampes et de la Photographie. Public domain.



Figure 4.15 . Drawing was often among the subjects studied by future officers.

Crispijn van de Passe, *La prima parte della luce del dipingere et disegnare* (Amsterdam: Ian Iantsz, 1643), s.n. vue 89. Source: Internet Archive. Public domain.

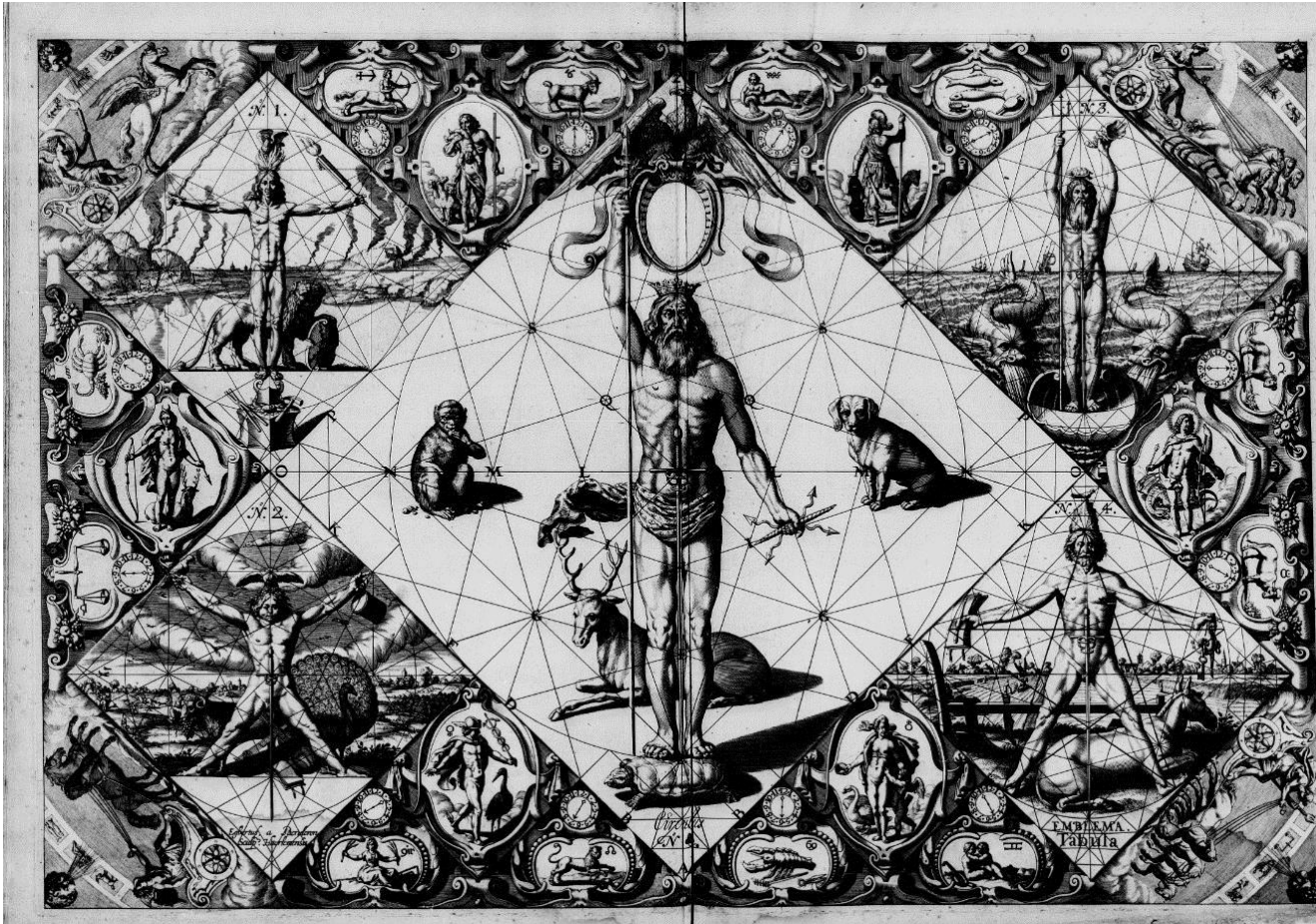


Figure 4.16. This image in Thibault's *Académie de l'espée* includes versions of the measure of man described by the first century architect Vitruvius as well as signs of the zodiac, emblems, various animals and the faces of clocks.

Girard Thibault d'Anvers, *Académie de l'espée* (Leiden: B. & A. Elzevier, 1628).
Source: gallica.bnf.fr / BnF. Public domain.

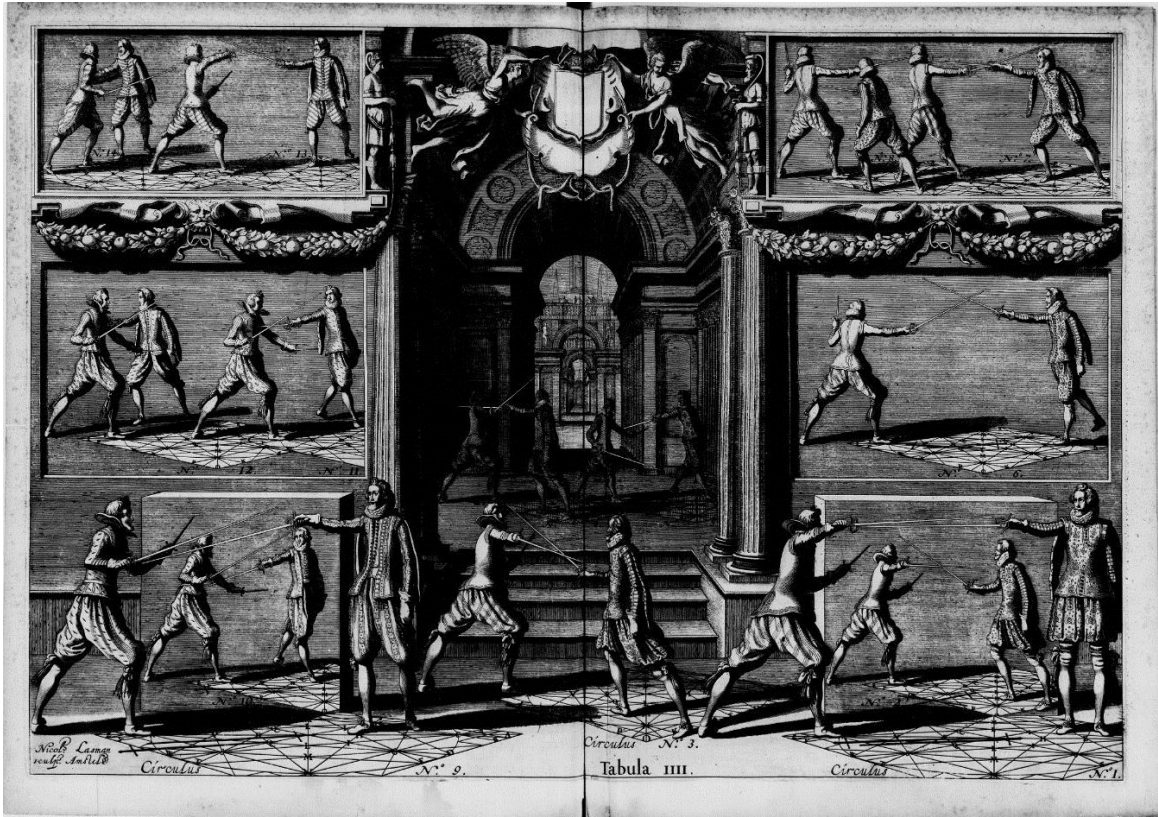


Figure 4.17. Fencing Practice on a geometric grid in Thibault's virtual academy. In this imaginary scene, fencers are drawn on the walls with little regard for realistic perspective.

Girard Thibault d'Anvers, *Académie de l'espée* (Leiden: B. & A. Elzevier, 1628), 26.

Source: gallica.bnf.fr / BnF. Public domain.



Figure 4.18. The Grand Condé's Gallery of Battles painted by Sauveur Le Conte (1659-1694).

Source: Chantilly Chateau, Gallery of Battles. Photo by Tamara Caulkins, 2016.



Figure 4.19. One of eleven large paintings commissioned by Louis, Le Grand Condé as penance for his role in the Fronde.

Le Conte, “Les Actions du Grand Condé” series [The Actions of the Great Condé], “Battle of Rocroi, 1643.” Source: Domaine de Chantilly, Chateau, Gallery of Battles. Public domain. <https://art.rmngp.fr>.



Figure 4.20. Le Conte, "Siege of Mardick," viewed as if through a spyglass. The geometric shape of the *trace Italienne*/star fortress is itself a diagram writ large on the landscape as is evident when seen from a distance.

Source: Domaine de Chantilly, Chateau, Gallery of Battles. Public domain. Licensed under Creative Commons, CC BY-SA 3.0.



Figure 4.21. In this close-up, Le Conte distorts perspective, turning the landscape into a larger-than-life diagram of the battle. *La Bataille de Fribourg en 1644* [Battle of Fribourg in 1644).

Source: Domaine de Chantilly, Chateau, Gallery of Battles, Inv. 355. Public Domain.
Photo by Tamara Caulkins, 2016.



Figure 4.22. 1696. In Giffart's *L'Art Militaire François*, the cultivation of elegant posture in the military draws on postures and positions practiced in dance. Barely visible in the distance of several groups of pike squares drilling in unison.

Pierre Giffart, *L'Art Militaire François Pour l'infanterie Contenant l'exercice et Le Maniement Des Armes... Avec Un Petit Abrégé de l'exercice Comme Il Se Fait Aujourd'huy* (Paris: Chez l'auteur, 1696), frontispiece. Source: gallica.bnf.fr / BnF. Public domain.



Figure 4.23. Demonstrating *Soufflez la méche* [Blowing on the wick] – breathing on the wick to kindle the flame on a musket. In Giffart’s manual, all soldiers lift the wick in the right hand just below the eye brow before blowing to ignite the ember. Compare to Gheyn’s version of the same movement in Figure 4.4.

Pierre Giffart, *L’Art Militaire François Pour l’infanterie* (Paris: Chez l’auteur, 1696), Fig. 24. Source: gallica.bnf.fr / BnF. Public domain.



Figure 4.24. Giffart “Haut la baguette” 1696 A drill modeling the use of “la baguette,” i.e. the ramrod used to load a musket. Note the line of soldiers moving their sticks in unison with the sticks held precisely at 90 degrees to start. Also, a drummer on the left is beating time to coordinate the movements; the man to his left appears to be conducting.

Pierre Giffart, *L'Art Militaire François Pour l'infanterie* (Paris: Chez l'auteur, 1696), Fig. 45. Source: gallica.bnf.fr / BnF. Public domain.



Figure 4.25. Marching in exact unison, i.e. in “cadence.” Note the turned out toes, an influence from dance of the period.

Maurice de Saxe, *Les Rêveries, Ou Mémoires Sur l'art de La Guerre*, vol. 1, ed. M. de Bonneville (La Haye: Pierre Gosse Jr., 1756), 6. Source: gallica.bnf.fr / BnF. Public domain.

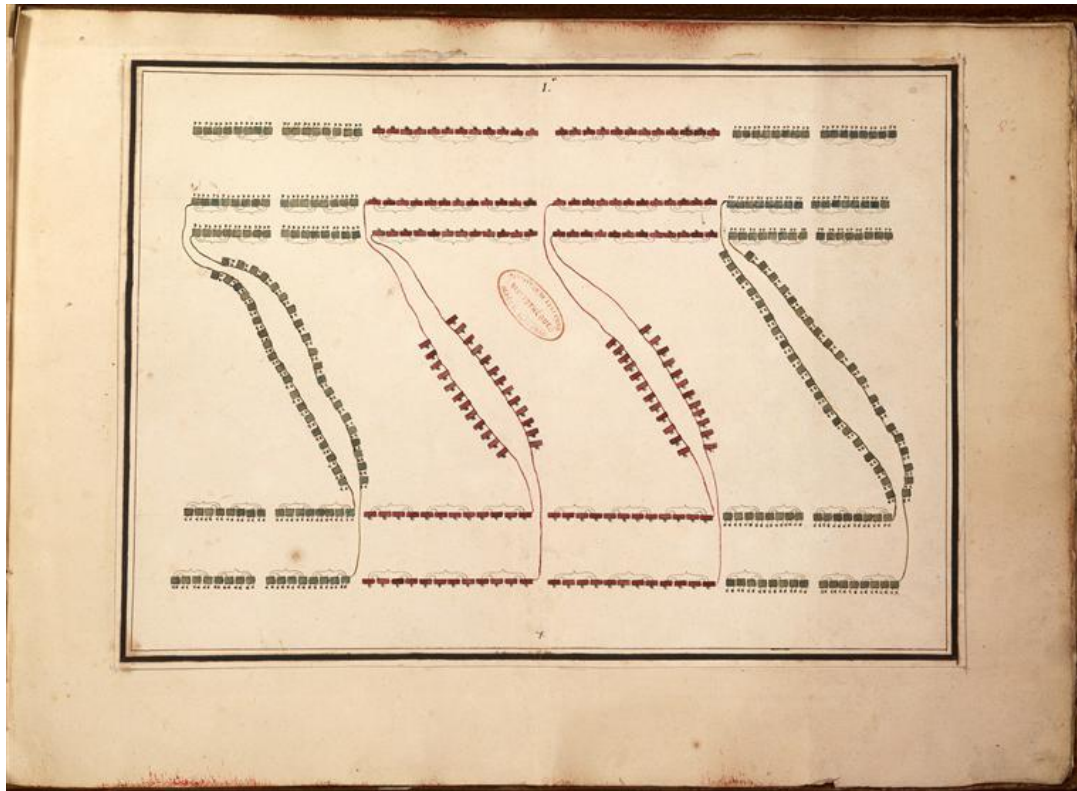


Figure 4.26a. The paths of moving battalions shown with curving lines in a series of engravings made for the young Louis XV in the 1720s. These were part of an eighty volume set (fifteen extant volumes) of drill diagrams and other military images (uniforms, machines, etc.). Louis XV was about eleven years old when he first began to study them.

Jacques-Antoine Delaistre, *Albums Delaistre* (Paris, 1721), vol. 5, pl. 86. Source: Paris, Musée de l'armée. Public domain.

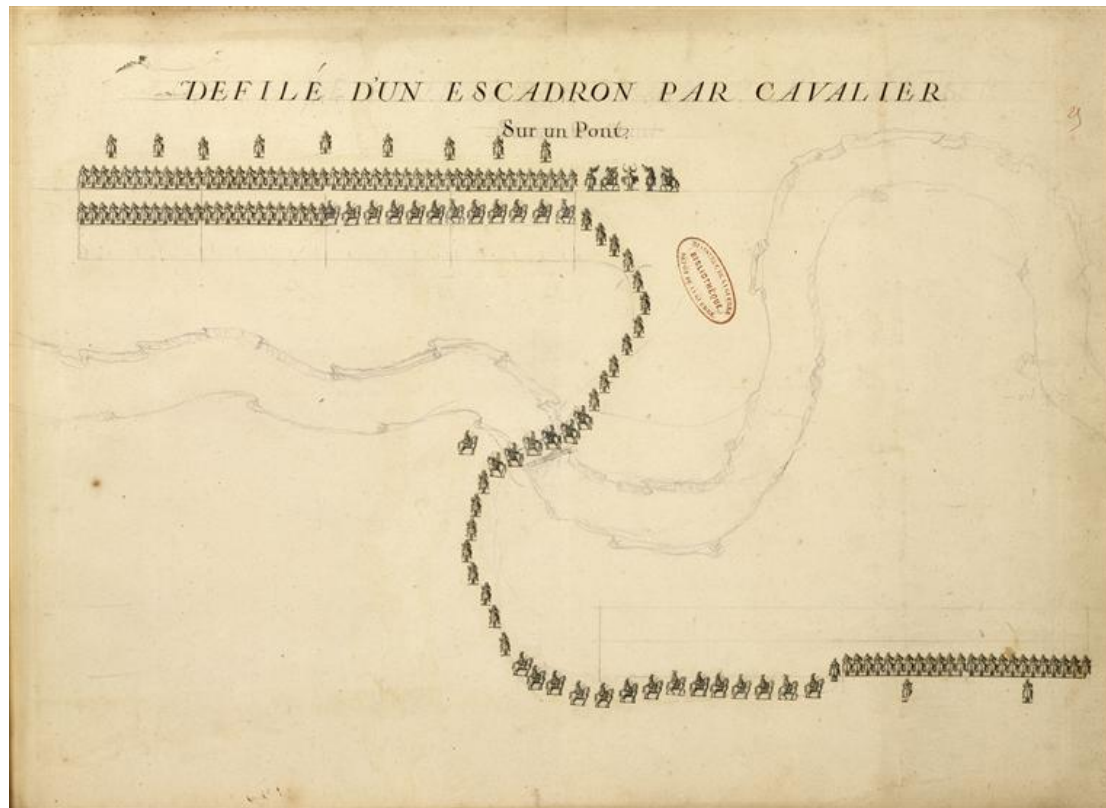


Figure 4.26b. Diagram of Cavalry crossing a bridge created for Louis XV and young Bourbon princes. *Defilé d'un escadron par cavalier, Sur un Pont* [Line of a squadron of cavalry. On a bridge]. Note the uneven line of horsemen crossing the bridge. Only in the beginning and end points is there an effort to smooth out the lines of soldiers.

Jacques-Antoine Delaistre, *Albums Delaistre* (Paris, 1721), s.n. Source: Paris, Musée de l'Armée, Invalides. Public domain.



Figure 4.27. Uniform of a soldier in regiment of Lyon.

Jacques-Antoine Delaistre, *Albums Delaistre* (Paris, 1721), s.n. Source: Paris, Musée de l'Armée, Invalides. Public domain.



Figure 4.28a. Military musicians played to keep drilling infantry marching and moving together, to signal formations, and to convey news of a battle. Each army had a unique set of tunes to convey information. Musicians also might serve as spies, especially if they were familiar with the tunes and signals used by an enemy. The label for this image reads: “Colonel-Général de la Cavalerie Légère: Timballier et Trompette” [Colonel-General of Light Cavalry: Timpanist and Trumpeter].

Jacques-Antoine Delaistre, *Albums Delaistre* (Paris, 1721), vol. 4, plate 6.
Source: Paris, Musée de l’Armée, Invalides. Public domain.

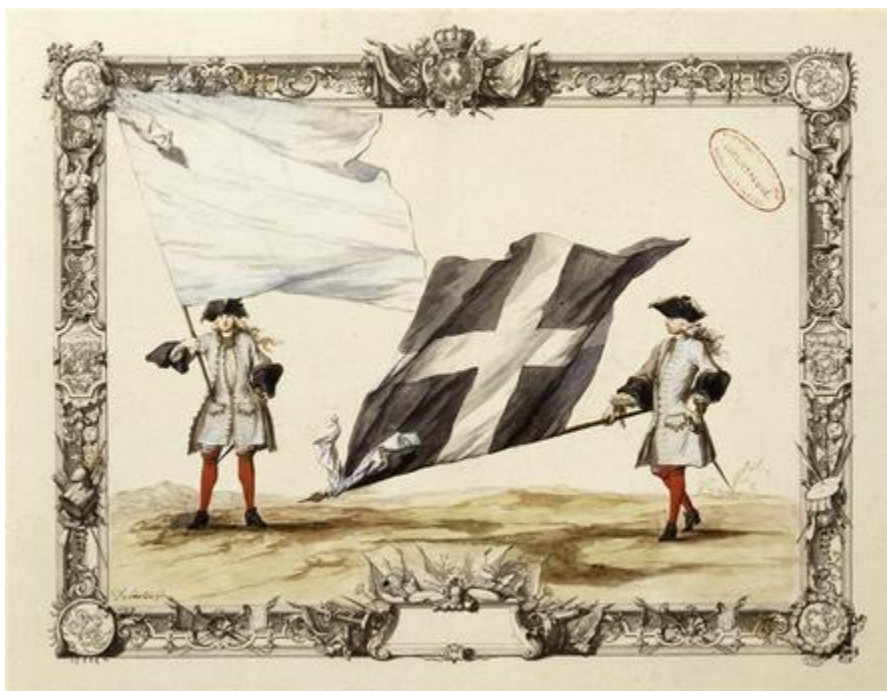


Figure 4.28b. Regiment of Piémont, officers with flags.

Jacques-Antoine Delaistre, *Albums Delaistre* (Paris, 1721), s.n. Source: Paris, Musée de l'Armée, Invalides. Public domain.

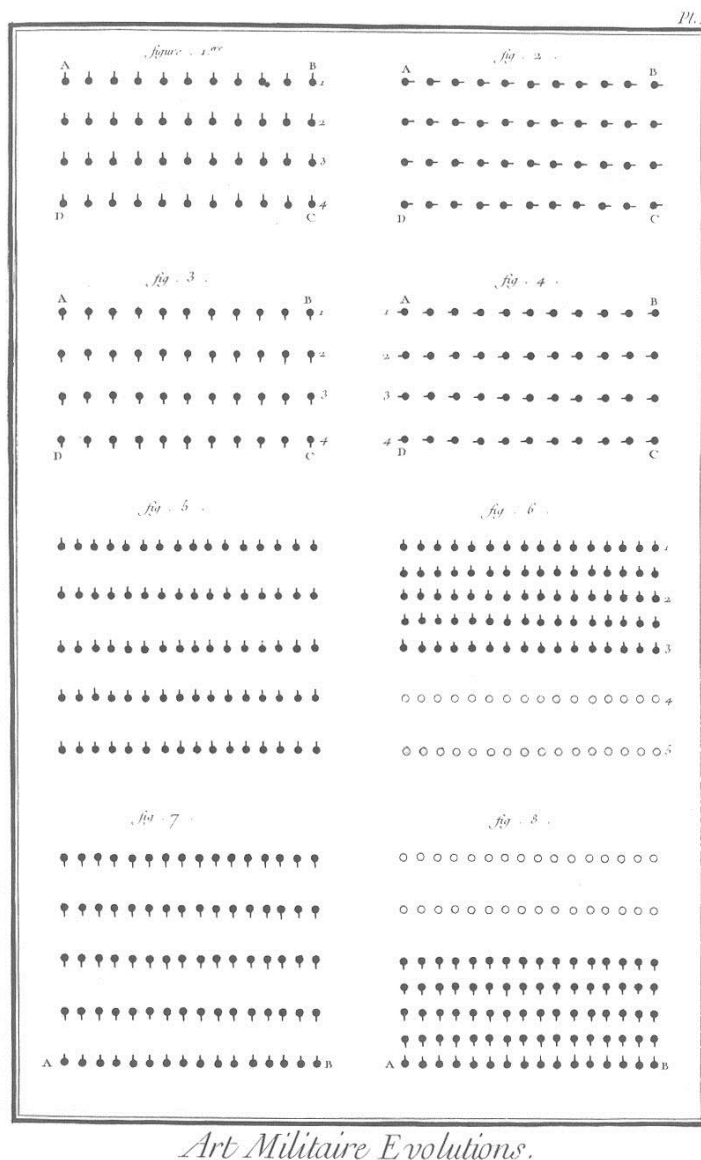
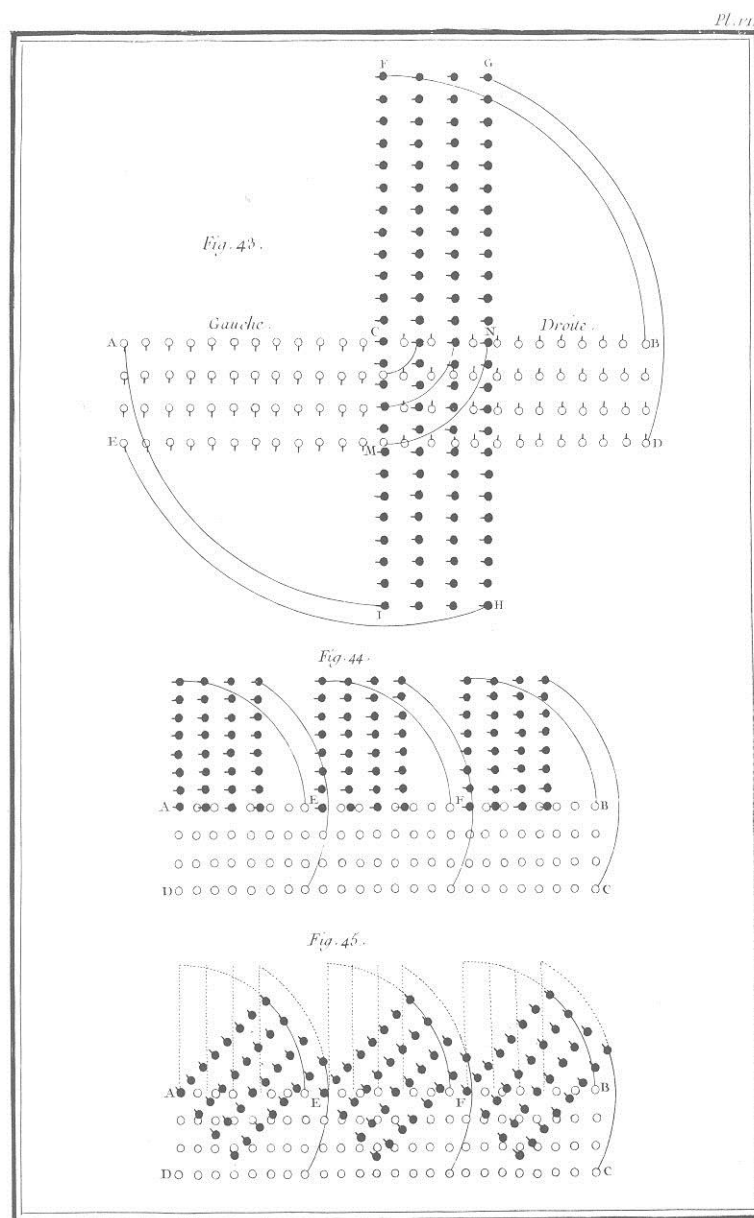


Figure 4.29. Simple movements of infantry formations: in fig. 1 to fig. 2, soldiers turn in place to the right; in fig. 3 to fig. 4, soldiers turn in place to face the bottom of the page and then left; in fig. 5 to fig. 6, soldiers facing the top of the page tight up their ranks (open dots show beginning positions); in fig. 7 to fig. 8, soldiers face the bottom of the page (except the last row which faces up) and tighten up their ranks, moving toward the bottom of the page.

Anonymous, "Art Militaire, Evolutions," in *Encyclopédie, Ou Dictionnaire Raisonné Des Sciences, Des Arts et Des Métiers*, edited by Denis Diderot and Jean le Rond d'Alembert (Paris: Briasson, 1762), vol. 18, pl. I.

Source: The ARTFL Project, University of Chicago. Public Domain.



Art Militaire Evolutions.

Figure 4.30. Open dots are beginning positions; black dots are soldiers' final positions, small line indicates the way each soldier is facing. Dotted lines indicate line of march.

Anonymous, "Art Militaire, Evolutions," in *Encyclopédie, Ou Dictionnaire Raisonné Des Sciences, Des Arts et Des Métiers*, edited by Denis Diderot and Jean le Rond d'Alembert (Paris: Briasson, 1762), vol. 18, pl. I.

Source: The ARTFL Project, University of Chicago. Public Domain.

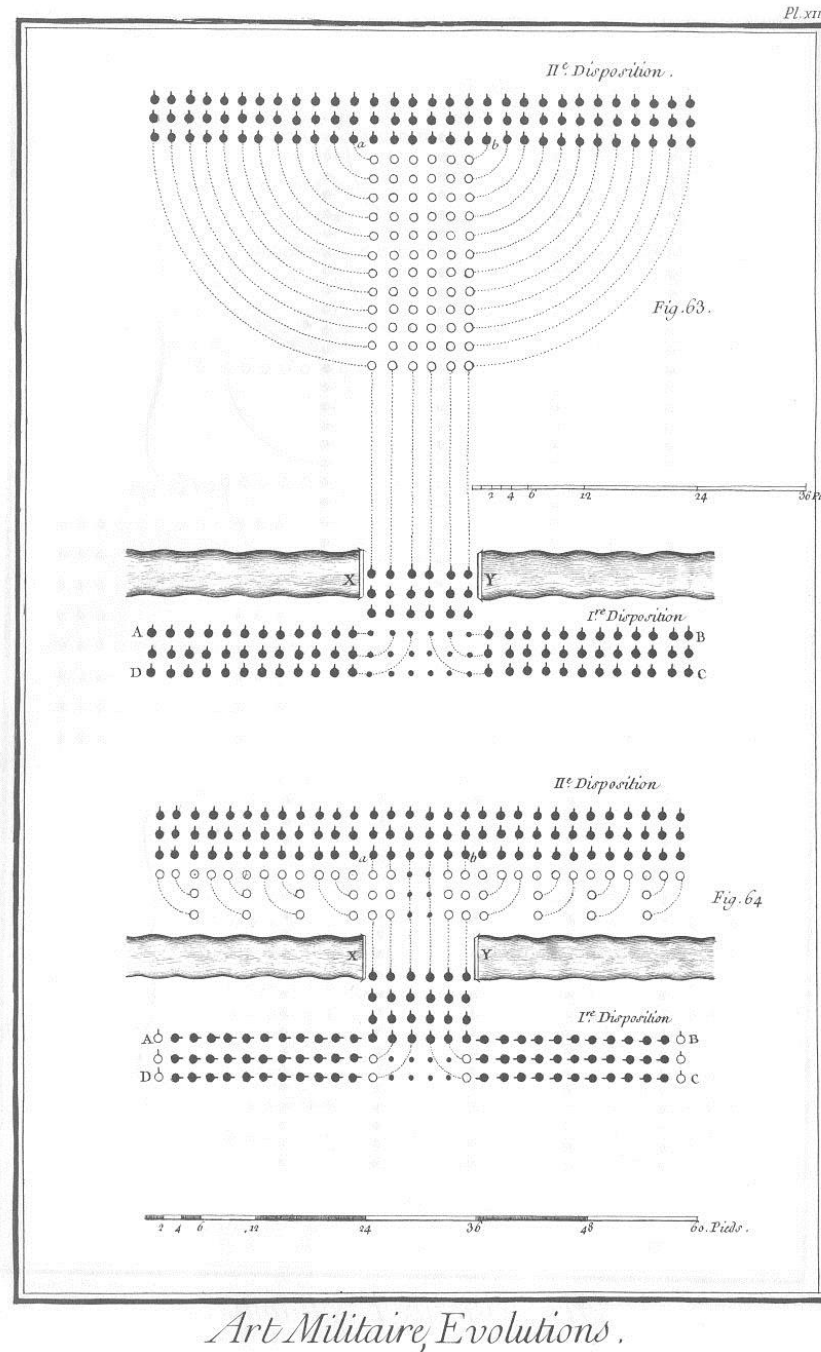


Figure 4.31. A diagram like this one could help an officer think through two different ways for troops to cross a river and consider which might be the best in a particular circumstance.

Anonymous, "Art Militaire, Evolutions," in *Encyclopédie, Ou Dictionnaire Raisonné Des Sciences, Des Arts et Des Métiers*, edited by Denis Diderot and Jean le Rond d'Alembert (Paris: Briasson, 1762), vol. 18, pl. 13.

Source: The ARTFL Project, University of Chicago. Public Domain.

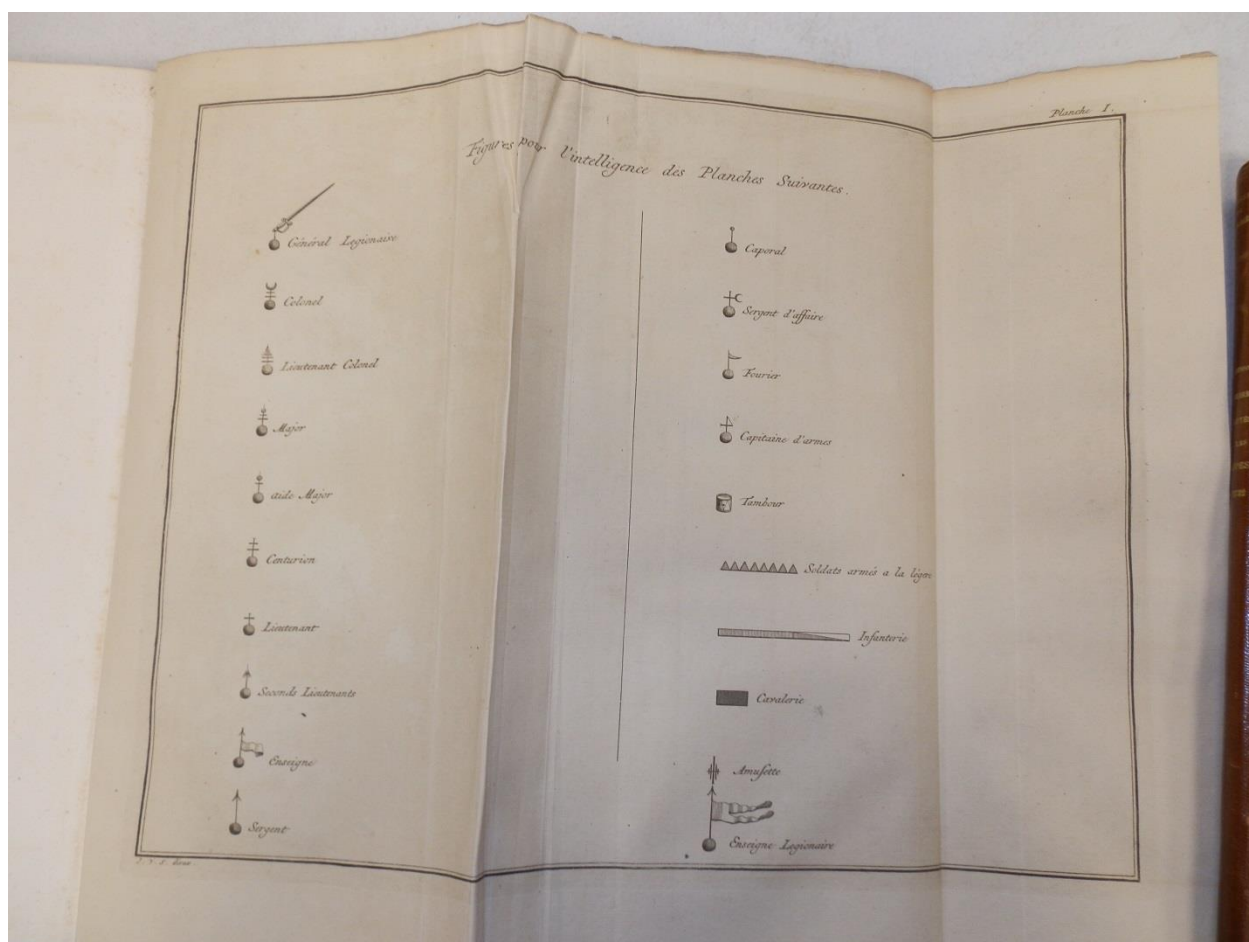


Figure 4.32. de Saxe 1756 Legend for officer ranks and their symbols.

Maurice de Saxe, *Les Rêveries, Ou Mémoires Sur l'art de La Guerre*, vol. 1, ed. M. de Bonneville (La Haye: Pierre Gosse Jr., 1756), Plate 1. Photo: Laëtitia Desserrières, 2016.
Source: Paris, Musée de l'Armée, Invalides. Public domain.

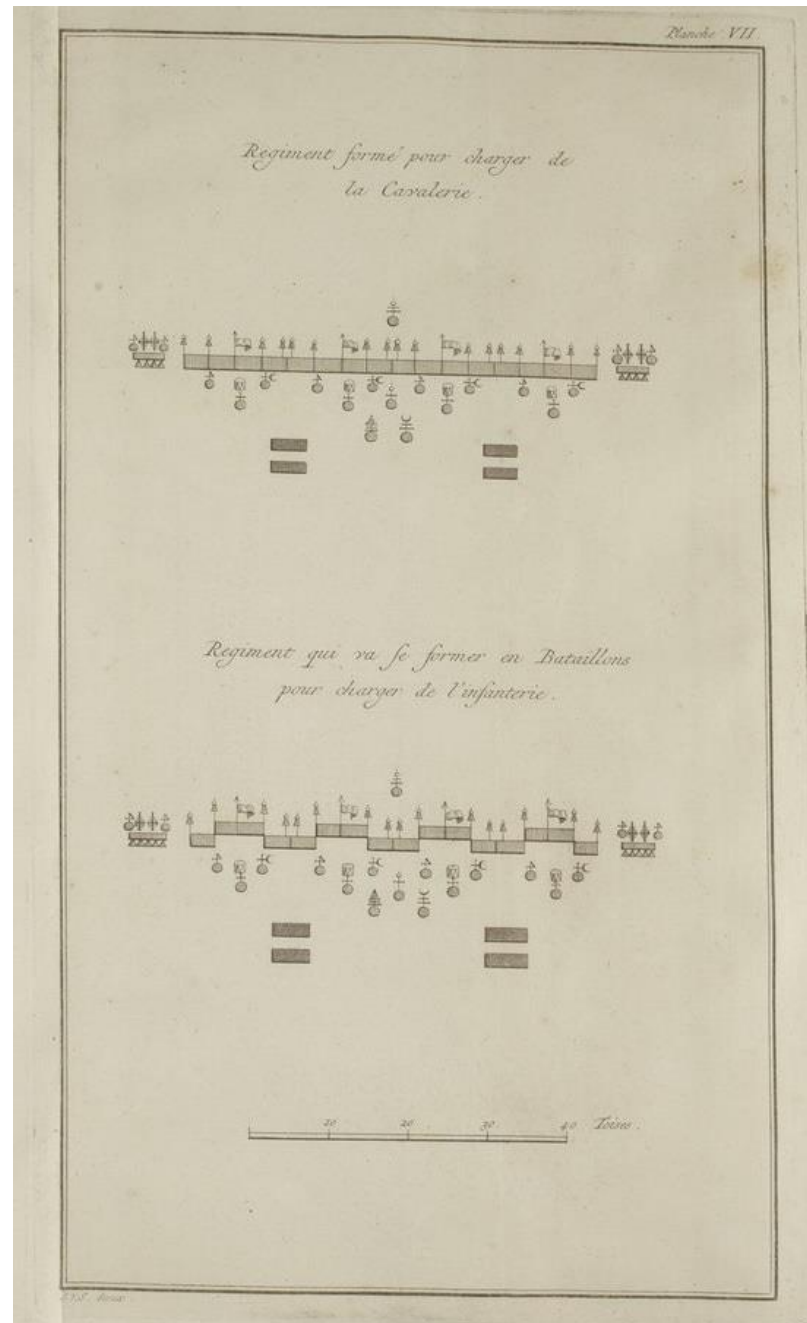


Figure 4.33. Maurice de Saxe positioned small bodies of cavalry in the rear of the infantry, modeling his drill formations of those of ancient Rome: “My second line of cavalry will never fly, so long as they see the square-battalions in their front.”

Maurice de Saxe, *Les Réveries, Ou Mémoires Sur l'art de La Guerre*, vol. 1, ed. M. de Bonneville (La Haye: Pierre Gosse Jr., 1756), plate VII. Source: gallica.bnf.fr / BnF. Public domain.

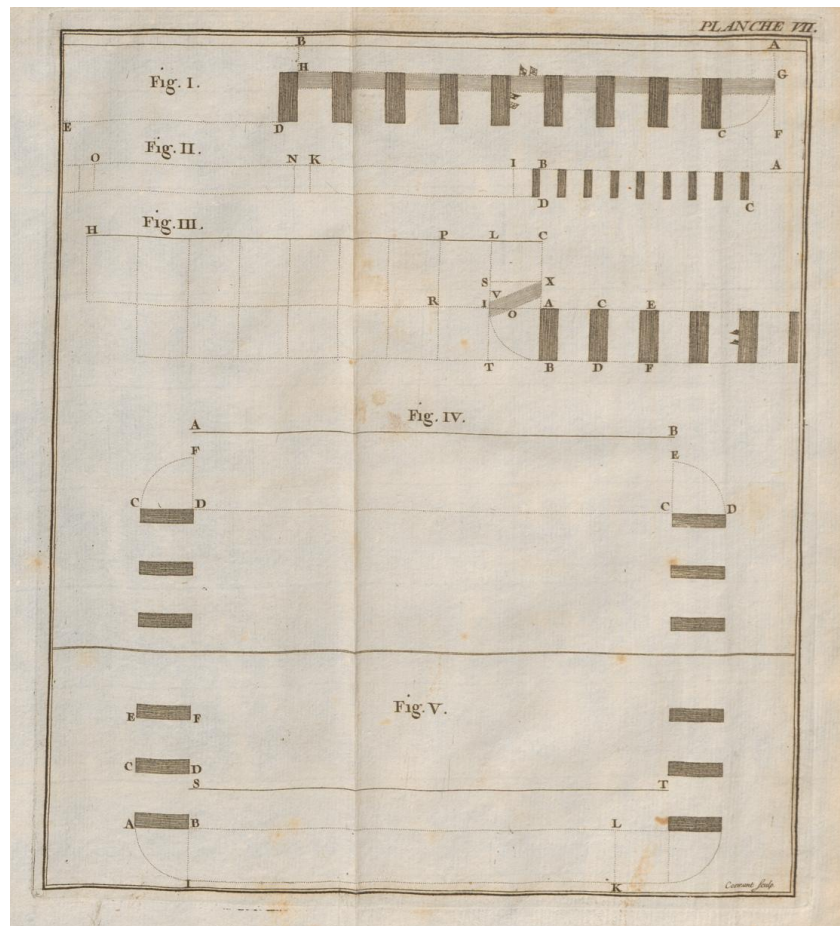


Figure 4.34. Diagrams for maneuvers in Pictet's *Essai Sur La Tactique de l'infanterie* [Essay on the Tactic of Infantry]. The term "Tactic" was often used to refer to the drilling of infantry.

Gabriel Pictet, *Essai Sur La Tactique de l'infanterie* (Geneva: Emmanuel Etienne du Villard, 1761), pl. 7. Source: ETH-Bibliothek Zürich. Public Domain.

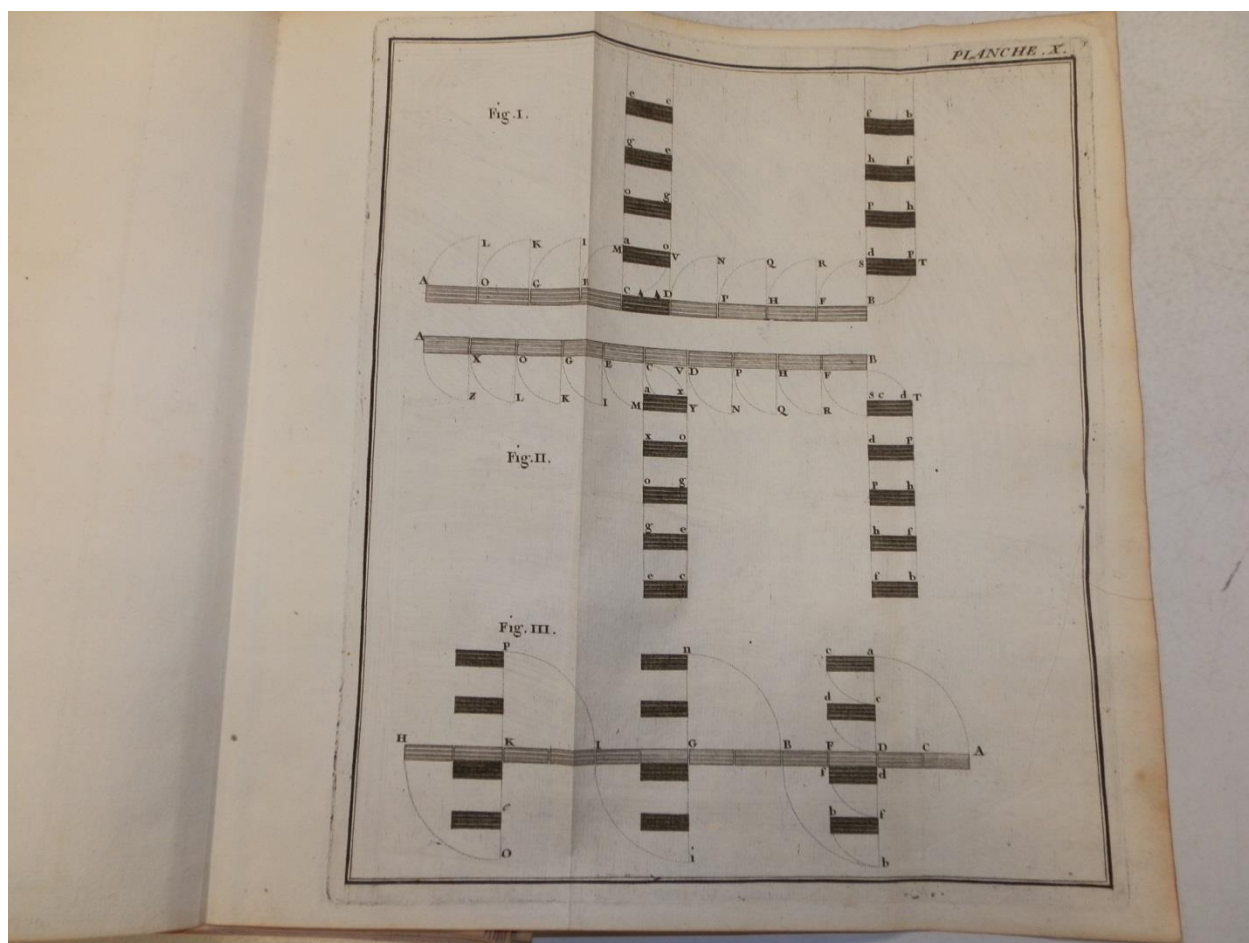


Figure 4.35. Three views of battalions depicted as rectangles shown with dotted lines indicating paths of movement. In Fig. I, two rows of ranks turn into a deep column; in Fig. 2, a deep column transforms into two sets of five ranks; and in Fig. 3, three lines of four ranks each move into a single deep column.

Gabriel Pictet, *Essai Sur La Tactique de l'infanterie* (Geneva: Emmanuel Etienne du Villard, 1761), plate 10. Photo: Laëtitia Desserrieres, 2016.
Source: Paris, Musée de l'Armée, Invalides. Public domain.

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