MATHEMATICAL PERSPECTIVES

ABOUT THE COVER:
SOME MATHEMATICAL ENCYCLOPEDIAS

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Long before Wikipedia and Wolfram there were mathematical dictionaries and encyclopedias that allowed a reader to check quickly on what was known at the time. Many of the topics seem rather quaint by today's definition of mathematics. Some were lists of arithmetical facts, either for students or for use in commercial enterprises; others were collections of what was then known about specific fields. Even Euclid's geometry could be viewed as a collection of facts about a subject. The genre thrived in the 17th century with the appearance of Claude Dechales's *Cursus seu mundus mathematicus complectens Euclidis* (Lyons, 1674); Jean Prestet's *Élémens mathématiques* (Paris, 1675); Gaspard Schott's *Cursus mathematicis* (Bamberg, 1677); Jacques Ozanam's *Dictionaire* [sic] *mathématique* (Amsterdam, 1691); and Burckhardt von Pürckenstein's *Mathematischen Wisssenchaften* (Augsburg, 1713). Along similar lines in more recent times we have seen the widely used Japanese volumes *Encyclopedic Dictionary of Mathematics* (Cambridge, MA, 1993) and finally Timothy Gowers's brilliant and satisfying volume, *The Princeton Companion to Mathematics* (Princeton, 2008). Many such worthy volumes appeared between the late 17th century and the present.

In an article in 2012 a colleague and I wrote a description of the title page of the massive 1570 first edition of Euclid in the English language [1] citing fairly recent scholarship on that famous page. For us it had always been something of a mystery because it was lavishly illustrated with what seemed to be a combination of mythological and historical figures—one set of images showing representatives of the quadrivium of the seven traditional liberal arts in the Middle Ages (those relating to mathematics: arithmetic, astronomy, geometry, and music). The whole piece, however, did not connect very well with the works of Euclid. But there it was, a gloriously decorative title page.

It turns out that it was originally designed for a somewhat earlier book on geography. And with that discovery, the appearance of many other figures on the page became entirely clear. It recalled to mind, however, a practice of a
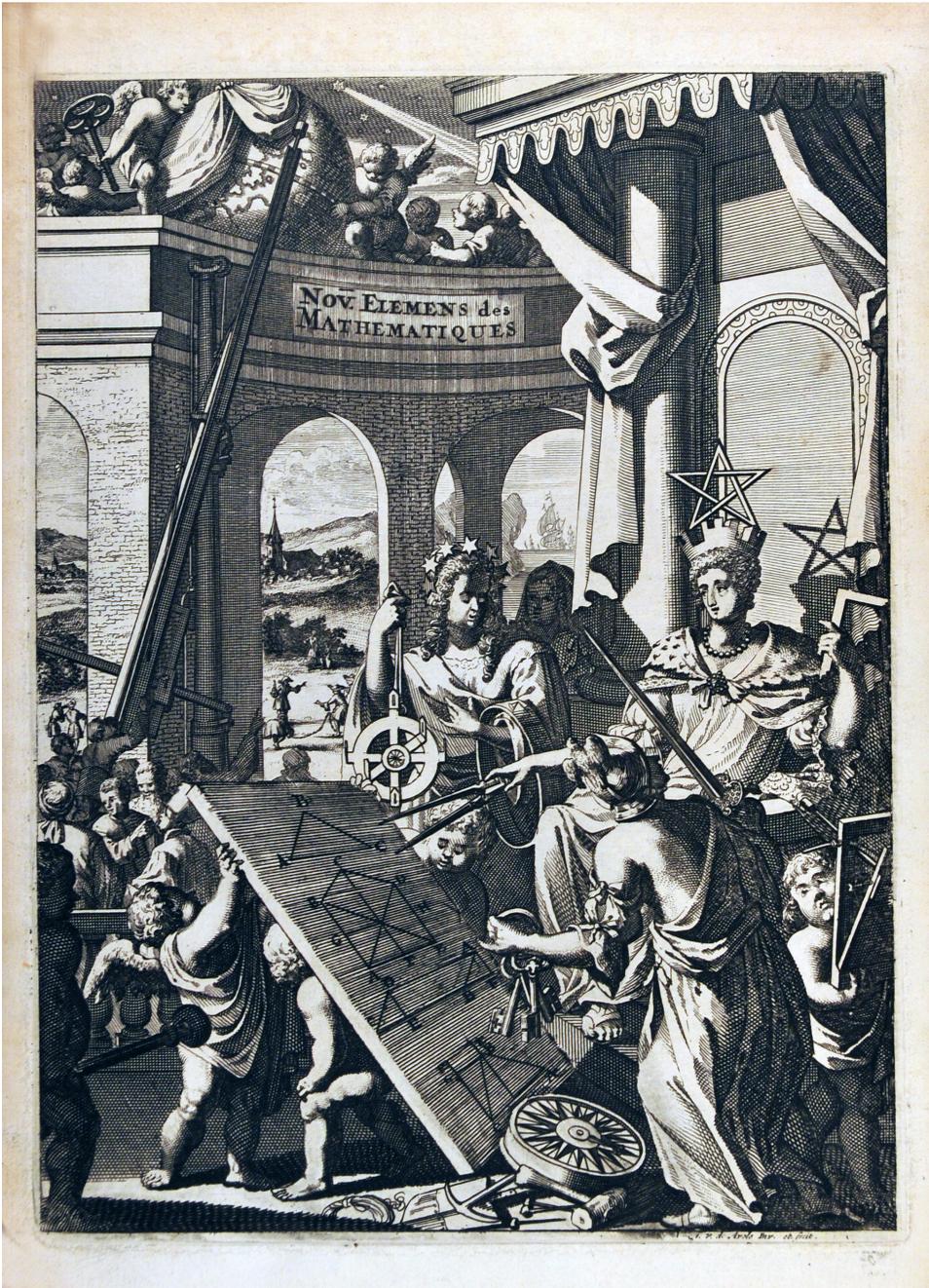
FIGURE 1. The frontispiece for Jean Prestet's *Nouveaux Elémens des Mathématiques*, Paris, 1694

FIGURE 2. The frontispiece for Jacques Ozanam's *Dictionaire Mathématique*, Amsterdam, 1691

century earlier, much closer to the advent of printing with movable type: the use of many woodcuts that decorated one of the earliest "picture books", a history of the world. The printer Anton Koberger published in 1493 his *Nuremberg Chronicle*, more precisely Hartmann Schedel's *Liber Chronicarum*. It was reprinted in Augsburg a few years later in a smaller format. Publishers are often thrifty, and in this case to cut expenses Koberger used the same woodcuts again and again. For example he used exactly the same woodcut to depict Naples, Lyon, Bologna, and an unspecified city in the German-Austrian provinces. It shows a city with a body of water in the foreground, with many barrels on the wharf—appropriate, perhaps for Lyon, where they might have been filled with wine from Rhone Valley vineyards, but, according to one expert, when depicting Naples those barrels could have been filled with books, a standard means of transporting books at the time. The woodcut makes the water look more like the Bay of Naples than the placid meandering Rhone River. Bologna, however, is a fair distance from the Po, and it is not clear what the water there could have represented. One woodcut of a church-monastery is used nine times with different captions identifying it as a different church each time. Anyone using the *Nuremberg Chronicle* to get an impression of the great sights of the world could be consistently misled. There are occasional attempts at accuracy: minarets and mosques in Constantinople and the Doge's palace in Venice. But windmills do not identify a Dutch city; it's Rhodes.

In later centuries the thrift of publishers is still evident, however. Many frontispieces are portraits of the authors, usually assumed to be fairly accurate, at least in the 17th century and later. Of course, we cannot be really sure because it is sometimes all we have to go by, unless the author was sufficiently rich, like Newton, whose likeness can be recalled by portraits in oil by Kneller or a life-size likeness in marble by Roubiliac at the Trinity College chapel. Publishers were not deterred, however, from commissioning or otherwise acquiring a suitable engraving to serve as a frontispiece and modifying it minimally to suit the contents. An example of such is the cover of this issue. Here we see a quite elaborate frontispiece for a set of volumes by Jean Prestet [3], in an edition of 1694 (though a somewhat different version was published as early as 1675). On an entablature above the portico we see the title of the book with, below, various figures holding geometric tools, some putti constructing figures on a sheepskin, perhaps, stretched over an easel. The book was published in Paris. But an almost identical frontispiece had been used by a printer in Amsterdam in 1691 in a mathematical encyclopedia by Jacques Ozanam [2]. The entablature had been altered to fit the title of this book and there are a few other differences. One quickly observes that there are different and less interesting scenes appearing through two of the portals in the background. and the work on the easel has been changed to a plan for fortifications, a topic then commonly included in collections of mathematical results and a favorite topic of Ozanam.

In this period elaborate engravings need not be relevant to the content of a book. The collected papers of Simon Stevin (1634) and François Viète (1646) have title pages both with a prominent 3-by-3 inch engraving. It is tempting to look for mathematical significance, but none will be found. The engraving shows a hermit (*un Solitaire*) picking grapes from a vine entwined about the trunk of a many-leaved elm tree, with a banner reading "Non solus". It has no relevance to the content of either book; it is the printer's device of the large and prominent Elzevir

family of publishers and printers active in Leiden for many years following the firm's founding in 1583. We do note, however, that Stevin's papers include much work on fortifications.

A look at some of the books listed above turn up a variety of topics we would not see in a mathematical reference book today: more military architecture, for example, or hydraulics to assist in designing projects for irrigation or, probably more often, decorative fountains, or the theory of music. There are other surprising entries, like a section on wind flow (followed quickly by the design of sailing ships) and catoptrics (the mathematics of mirrors), all of which are included in Ozanam's book. Dechales included fireworks and stone cutting. Schott's massive volume contains sections on astrology, geography, horography, polemics—both offensive and defensive—and tactics, hydrography as well as hydrostatics and hydrotechnics. A folio size engraving in Schott shows fountains of many kinds, including those with descending pools, one adorned with a formidable two-headed eagle, another with a bird and snake, and one in the form of a shell. No expense was spared when illustrative engravings were called for. Of course, they may have been used, like the frontispiece, in more than one book. Prestet's two volumes were confined more narrowly to algebra and equations, with tributes to Diophantus of Alexandria, Viète, and Descartes. They also contain an early version of the fundamental theorem of arithmetic.

Bound in vellum or calf and printed on high rag-content paper, these volumes are nearly as fresh and crisp as they were when published. A prominent San Francisco bibliophile recently asserted that an advance greater than Gutenberg's invention of movable type was made some centuries earlier with the abandoning of the scroll in favor of the codex format of book-pages assembled and sewn together along an edge. His concern is that we are now abandoning the "book" and returning to the scroll in the form of a computer screen. Is this progress?

Acknowledgment

References

[1] Gerald L. Alexanderson and William S. Greenwalt, *About the cover: Billingsley's Euclid in English*, Bull. Amer. Math. Soc. (N.S.) **49** (2012), no. 1, 163–167, DOI 10.1090/S0273-0979-2011-01365-9. MR2869011

[2] Jacques Ozanam, *Dictionaire* [sic] *Mathématique; ou, Idée Générale des Mathématiques*, Huguetan, Amsterdam, 1691.

[3] Jean Prestet, *Nouveaux Élémens des Mathématiques*, 2 vol., Third Edition, André Pralard, Paris, 1694.

[4] Gaspard Schott, *Cursus mathematicus; sive Absoluta omnium mathematicarum disciplinarum encyclopædia*, Schönwetter, Bamberg, 1677.

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