Abacus manuals, schools and urban readers in early modern Venice and Milan

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The teaching of practical mathematics was established in Italy long before the development of printing.[1] Beginning in the thirteenth century, Italian merchants created an ever-growing knowledge in accounting and finance, geography and technical specialties in various fields (hydraulics, architecture, manufacturing, etc.) that was naturally transmitted principally by apprenticeship and practice. The mathematics of the merchants was very different from classical and philosophical mathematics taught at the university, which never had the goal of solving problems posed by the management of economic and financial activities. Merchants resorted, therefore, to a new mathematics, called *abaco*, created by Leonardo Fibonacci in the thirteenth century.[2] Since that time, abacus schools began to appear in various Italian cities, beginning in Tuscany.[3] It was an education that developed not only in formal school settings, as occurred in Latin schools, but also in private settings, often with merchant families who required highly specialized personnel.

The need for cultural knowledge, that is, knowing how to read, write and count, emerged forcefully throughout the West beginning in the late Middle Ages. The abacus school was oriented toward the intermediate cultural stratum that was both producer and user of abacus mathematics.[4] In this group were those who did not aspire to the liberal professions, who did not study university subjects (law, medicine, philosophy) and who were predominately strangers to the culture that used Latin in all forms of communication. They were merchants, artists, technicians, administrators, men at arms and also to some extent members of the aristocracy. The basic education of new generations was warranted by the development of central-northern Italian cities, which needed an experienced merchant class and an ever-increasing number of public officials, like secretaries, notaries and clerks in general. For this purpose, Italian communes began to equip themselves with abacus masters who often arrived from other territories, like Tuscany, which was at the forefront of this type of training. With the dissemination of these teachings, the manuscript production of textbooks increased in order to

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[1] Some basic references: Armando Sapori, 'La cultura del mercante medievale italiano', in Id., *Studi di storia economica* (Florence, Sansoni, 1946), pp. 285–325; Richard Goldthwaite, 'Schools and teachers of commercial mathematics in Renaissance Florence', *Journal of European Economic History*, 1 (1972), pp. 418–433; Paul F. Grendler, *Schooling in Renaissance Italy: Literacy and learning, 1300–1600* (Baltimore/London, The Johns Hopkins University Press, 1989), pp. 306–329; Paul F. Gehl, *Humanism for sale. Making and marketing schoolbooks in Italy, 1450–1650* (Chicago, Newberry Library, 2008), especially chap. 6, https://www.humanismforsale.org/. For a broader framework of topics discussed here, see Giuseppe De Luca, Angela Nuovo & Federico Piseri, *La formazione del mercante: scuola, libri e cultura economica a Milano nel Rinascimento* (Milan, Ed. Delfino, 2021).

[2] See the recent critical edition of Fibonacci's *Liber Abbaci*, (eds.) E. Giusti & P. D'Alessandro (Florence, Olschki, 2020).

[3] Elisabetta Ulivi, 'Scuole d'abaco e insegnamento della matematica', *Le scienze*, (eds.) A. Clericuzio and G. Ernst, vol. 5 of *Il Rinascimento italiano e l'Europa*, (dir.) G.L. Fontana & L. Molà (6 vols., Treviso, Fondazione Cassamarca – Angelo Colla, 2008), 5, pp. 403–420; Raffaele Danna, 'Una scienza per la Rinascita. Note su Paolo dell'Abaco e la matematica abacistica fiorentina', *Rinascimento*, 59 (2019), pp. 245–269.

[4] Carlo Maccagni, 'Leggere, scrivere e disegnare la "scienza volgare" nel Rinascimento', *Annali della Scuola Normale Superiore di Pisa. Classe di Lettere e Filosofia*, 23, no. 2 (1993), pp. 631–675; Egle Becchi, 'Professionalizzare precocemente: l'acculturazione del mercante in epoca rinascimentale', and Federico Piseri, 'Il 'corpo mercantesco' tra tardo Medioevo e Rinascimento: formazione e professionalizzazione', in M. Morandi (ed.), *Formare alle professioni. Commercianti e contabili dalle scuole d'abaco ad oggi*, (Milan, Franco Angeli, 2013), pp. 183–191 and 25–43.

impart such knowledge as well as related exercise notebooks to practice computation and apply the rules.

From teaching to printing

Publishing for schools was faced with the needs of a particular market. Each city had its Latin schools, which offered instruction that gave access to the most prestigious professions. Many Italian cities also had schools taught in the vernacular. Once printing was introduced, Latin grammars represented the typical production with steady sales within reach of even the smaller printing firms. The Italian editions of Latin grammars, beginning with those of Antonio Mancinelli, Donatus and Alexander de Villa Dei, were prodigious, all the more so considering that the majority of these school-book copies have not survived.[5] However, the passage from manuscript to printed manuals of practical mathematics was a process that began with much greater difficulty.[6] Relatively new subjects and teaching methodology, which were without precedents in the classical age, written in the vernacular for a fragmented, unequal and semi-private school market, attended by a small number of students, made printers cautious in their decision to produce texts that continued to circulate in manuscript. Precisely because the school texts in Italian did not follow a pre-set and uniform school course, it would take several decades following the invention of printing for books designed for these contexts to be published. The function of a book as a cultural instrument in the service of various communities of readers reveals in this case a complex process because this community – students of abacus – was not yet perceived as engaged in a formal curriculum of study.

There was another difficulty that printers had to face for the publication of these types of textbooks. In this period, in fact, the majority of authors were abandoning traditional Roman numerals in favour of Hindu-Arabic ones. The positional numeral system presented several advantages over the Roman one because it made it possible to handle large numbers, proportions, multiplications and divisions effectively, but it complicated the graphic representation.[7] For this reason, the technical obstacles in producing abacus books probably made it less or not at all convenient to print editions of such texts for a long time.

The turning point came when some of the brightest and most enterprising abacus and mathematics masters began to make use of printing not only to profit in a different way on the basis of their own skills but also to win personal notoriety. Although separate from traditional pedagogy, the abacus masters could not forget a fundamental principle, however: whatever the path of learning, it had to include education in moral virtues. Such virtues were necessary to gain the necessary *fides* to exercise the mercantile profession at a high level, and especially, that of banking.[8] The edifying subjects were thus well in evidence even in secular education, which was oriented, moreover, toward a wide range of learners, including women.

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[5] USTC provides a series of more than 1,790 editions in the search, Educational Books in Latin printed in Italy in 1470–1600.

[6] The same search mentioned in the preceding note but for the Italian language provides 667 editions in the USTC, but those texts are much more disparate, and many are very far from abacus schools.

[7] Raffaele Danna, 'Figuring out. The spread of Hindu-Arabic numerals in the European tradition of practical mathematics (13th–16th centuries)', *Nuncius*, 36 (2021) pp. 5–48; John W. Durham, 'The introduction of 'Arabic' numerals in European accounting', *The Accounting Historians Journal*, 19, no. 2 (1992) pp. 25–55.

[8] Giacomo Todeschini, 'Carità profitto nella dottrina economica francescana da Bonaventura all'Olivi', *Franciscan Studies*, 60 (2002), pp. 325–339; Federico Piseri, ' "Vol più ponti a fare uno mercatante che un dottore de leggi": la professionalizzazione del mercante-*rationator* nel Rinascimento italiano', *La scuola classica di Cremona. Annuario dell'Associazione ex alunni del Liceo-Ginnasio Daniele Manin*, 20 (2012), pp. 213–233.

The primary public of this school consisted of aspiring merchants, often members of merchant families or their employees. To learn abacus and mercantile writing was in fact fundamental to such workers. It concerned two essential techniques for professionals who based all their business on calculation, the attribution of value to commercial goods and on money exchange. Knowledge of theoretical geometry was also fundamental: it served to measure circumferences, diameters and areas. It served above all to calculate the area of fields and agricultural lands.

Business management and transnational trade required continual epistolary exchange within merchant networks for the circulation of information that could help overcome decision-making uncertainties and manage business in the most profitable way. A specific professional handwriting script was developed, the *mercantesca* cursive, as the most adapted to rapid, unofficial communication. Businessmen had a growing need for knowledge: arithmetic and law, money exchange and politics, navigation and geography, metallurgy and architecture; it was thanks to all of this knowledge that their business could succeed or else fail. The merchant class was thus a social class profoundly linked to the practice of reading and writing that, in order to practice one's profession and not a theoretical venture, deepened and developed extensive scientific knowledge.

Venetian publishing and books for merchants

It has been calculated that between 1490 and 1600 no fewer than 140 publications were published in Venice related to *ars mercatoria*, among which were books on abacus and accounting, manuals and dictionaries of foreign languages, rates of weights and measures, rates of exchange, pilot books (*portolani*) and tools to learn various handwriting scripts (including the *mercantesca*). In the same period, 103 editions of the same kind were produced in Antwerp, nearly all after 1540, that is, when the city had become one of the economic capitals of Europe. Well in the distance followed approximately 76 similar publications printed in Frankfurt.[9] In reality, if, on the one hand, the Venetian data seems underestimated, on the other, it cannot be forgotten that many other Italian cities contributed a substantial share to the same publishing sector.[10]

In his fundamental bibliography, Van Egmond, while limiting the field only to practical mathematics, counts ninety Venetian editions prior to 1600, but he also lists many editions produced in other cities, such as Naples, Brescia, Ferrara, Florence, Milan, Turin, Verona, Padua, Messina and even Tosolano (the small town on Lake Garda).[11] If we exclude the example of Venice, which on account of its product quality and distribution capacity rises in all publishing sectors as the *de facto* capital of Italian printing, the localisation of books for merchants seems to

[9] Dave De ruysscher, 'How normative were merchant guidebooks? Of customs, practices and … gold advice (Antwerp, sixteenth century)', in H. Pihlajamäki [et al.] (eds.), *Understanding the sources of early modern and modern commercial law: courts, statutes, contracts, and legal scholarship* (Leiden, Brill/Nijhoff, 2016), pp. 144–165.

[10] A different sort of quantitative analysis, combining manuscripts and prints, has been recently carried out by R. Danna, 'Figuring out', cit.

[11] Warren Van Egmond, *Practical mathematics in the Italian Renaissance: a catalog of Italian abbacus manuscripts and printed books to 1600* (Florence, Istituto di storia della scienza, 1980). Another vast and still useful bibliography: Pietro Riccardi, *Biblioteca matematica italiana dalla origine della stampa ai primi anni del secolo XIX* (2 vols., Modena, Società tipografica modenese, 1870–76). For the European context, see Jochen Hoock, Pierre Jeannin & Wolfgang Kaiser, *Ars mercatoria: Handbücher und Traktate für den Gebrauch des Kaufmanns. Eine analytische Bibliographie in 6 Bänden,* vol. 1: *1470–1600, mit einer Einleitung in deutscher und französischer Sprache* (Paderborn/Munich, Schöningh, 1991); vol. 3, *Analysen (1470–1700)*, (Paderborn/Munich, Schöningh, 2001).

relate most of all to the development of the abacus school in the area and then to the talent and initiative of a few local masters.[12]

Although most abacus manuscripts were Florentine in origin, Venice exerted a pronounced dominion in printing production. The phenomenon was naturally connected with the most brilliant development in printing in Venice rather than in Florence, such as to assure a prominent position of the Serenissima in any book sector, thus breaking the link, typical of the manuscript, between geography of cultural phenomena and book production. As a consequence, what has been defined as Venetian accounting culture prevailed during the first phase of the circulation of print of mercantile mathematics and its teaching not only at the Italian but also at the European level.[13] The trend in the production of manuals for merchants reflects the state of the economic situation on a European level: the position of Venice and Italy in general, dominant in the fifteenth and early sixteenth centuries, plummeted to a market share of about 5% in the seventeenth century.[14]

Examining printed books for the training of merchants poses a series of preliminary problems. Notwithstanding the numerous studies on these texts and the bibliographies dedicated to them, their survival is extremely sporadic so that an overall vision cannot but be incomplete. A further difficulty rests in the analysis of the contents. Only with difficulty can these editions be distinguished from each other because they have different titles: the titles can vary, and indeed, they vary even if the contents remained the same, perhaps assembled and reassembled several times. Despite the large digitisation projects in progress, the analysis of the contents proves particularly difficult for editions from which sometimes remain only one or two copies in the world, survivors of a large shipwreck that may have stolen from us a considerable amount of information.

Incunables of practical mathematics

The brief journey among books for merchants proposed over the next pages begins with the first treatise of commercial mathematics whose author is known, Pietro Borghi,[15] published 2 August 1484 in Venice by Erhard Ratdolt, a printer from Augsburg of exceptional technical talent.[16] FIG. 1 Ratdolt's innovation was connected to his ingenuity. In this period, trailblazing printers experimented with effective ways to reproduce mechanically the textual and visual design of handwriting. Copyists were free to create fluid and complex layout, non-horizonal sequences of signs, combinations among words, numbers and images, colour juxtapositions, and so on, an expressive freedom arduous to impose in a printing forme. The Euclid edition and other works

[12] On the contrary, this affirmation does not exclude that the abacus and accounting books printed in Venice also had their origin in didactic practice and in professional work.

[13] Massimo Sargiacomo [et al.] (eds.), *The origins of accounting culture: the Venetian connection* (New York, Routledge, 2018).

[14] Bernard Lepetit & Jochen Hoock (eds.), *La ville et l'innovation: relais et réseaux de diffusion en Europe 14e-19e siècles* (Paris, Éditions de l'École des hautes études en sciences sociales, 1987).

[15] Pietro Borghi, *Aritmetica mercantile* (*Qui comenza la nobel opera de artihmetica na la qual se tracta tute cosse a mercantia pertinente facta et compilata per Pietro Borgi da Venetia*) (Venice, E. Ratdolt, 1484). GW 4936, ISTC ib01034000.

[16] Luca Rivali, 'Ratdolt, Erhard', in *D.B.I*, vol. 86 (2016) summarizes what is known about his activity in Venice. More information about his biography and his activity in Augsburg in Paul Geissler, 'Erhard Ratdolt', in *Lebensbilder aus dem Bayerischen Schwaben* (Munich, Konrad, 1966), vol. 9, pp. 97–153; Günter Hägele & Melanie Theirbach (eds.), *Augsburg macht Druck: die Anfänge des Buchdrucks in einer Metropole des 15. Jahrhunderts* (Augsburg, Diözesanmuseum St. Afra, 2017).

of the new astronomical science printed by Ratdolt were so successful as to establish new standards in the market. [17]

Aritmetica mercantile by Pietro Borghi was thus published by the firm of Ratdolt, who surely had established a significant relationship with Venetian aristocracy and had printed for a cultured public with large spending power. For this edition, Ratdolt had to resolve intrinsic difficulties in the complex layout of mathematical functions printed in the margins. The text had a profound influence in subsequent decades, so much so that at least fourteen re-editions are known. Borghi presented it as a valuable text for merchants and novices in which everything that could be useful for their activity was synthetically summarized. Although Borghi acknowledged that his work was not an original creation but rather an assemblage of different materials from a number of manuscript manuals, he put an effort into framing mercantile practice within a much larger study of arithmetic. Borghi's *Aritmetica* is an example of a work of reorganisation and systemization of existing material that had already proven its validity and therefore had expanded to respond to an actual demand for training and instruction over these years. This approach, which was a long-time characteristic of abacus manuals, had some limits. Textbooks oriented toward practice, like Borghi's work, simplified definitions or omitted them altogether; they offered fewer problems; the calculations were not more complex than those normally encountered in business. But the emergence of complex elaborations was crucial to the sector's development so as to provide a framework for the entire sector and to stimulate a deep interest among various categories of readers.

Luca Pacioli's *Summa de arithmetica*, printed by Paganino Paganini in 1494, represents a watershed for the strengthening and the dissemination of mathematical knowledge of the time.[18] FIG. 2 It is an impressive compilation, an encyclopaedia of the varieties of mathematics. It provided the foundation for many advancements in mathematics, especially in algebra, of the sixteenth century. The adoption of the Hindu-Arabic numeral system and the wealth of theoretical explanations of mathematical functions, among other achievements, made this large treatise of about six hundred densely printed pages an avantgarde text, aimed primarily at mathematicians by profession and able to exert a long-lasting influence. For Pacioli, mathematics was philosophy in itself, a fundamental key in constructing all further knowledge. He succeeded in outlining a programme of the mathematization of knowledge, which he would develop with even greater success in *Divina proportione*, published in Venice fifteen years later, in 1509, once again by the printer Paganino Paganini and his son Alessandro; to express his utmost satisfaction of his prior work, Pacioli had himself portrayed with a copy of his *Summa*.[19]

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[17] Renzo Baldasso, 'La stampa dell'*editio princeps* degli Elementi di Euclide (Venezia, Erhard Ratdolt, 1482)', in C. Kallendorf & L. Pon (eds.), *The books of Venice/Il libro veneziano* (Venice, La musa Talia; New Castle (DE), Oak Knoll Press, 2009), pp. 61–100; Id., 'Printing for the Doge: on the first quire of the first edition of the *Liber Elementorum Euclidis*', *La Bibliofilia*, 115 (2013), pp. 525–552; B. Wardhaugh [et al.], *Euclid in print, 1482-1703. A catalogue of the editions of the Elements and other Euclidean works* (London, The Bibliographical Society, 2020), http://www.bibsoc.org.uk/sites/bibsoc.org.uk/files/Euclid_v1.pdf, p. 24; E. R. Anderson, 'Printing the bespoke book. Euclid's Elements in early modern visual culture', *Nuncius*, 35 (2020), pp. 536–560.

[18] Luca Pacioli, *Summa de arithmetica geometria proportioni et proportionalita* (Venice, P. Paganini, 1494). GW M18913, ISTC il00315000. About the printer, see Angela Nuovo, 'Paganini, Paganino', in *D.B.I,* vol. 80 (2014).

[19] Luca Pacioli, *Divina proportione. Opera a tutti gli ingegni perspicaci e curiosi necessaria ove ciascun studioso di philosophia: prospectiva pictura sculptura, architectura, musica, e altre mathematice, suavissima, sottile, e admirabile doctrina consequira e delectarassi con varie questione de secretissima scientia* (Venice, Paganino and Alessandro Paganini, 1509). EDIT16 CNCE 28200, USTC 846001. This edition, which included tables extracted from drawings of Leonardo da Vinci, was preceded by a few weeks by the edition of *Elementi* by Euclid, edited by the same Pacioli. For both editions, see Angela Nuovo,

Luca Pacioli played a role of absolute pre-eminence as well in economic history, given that in the *Summa* he supplied the first printed detailed technical-practical treatise on double-entry bookkeeping.[20] The work's strong innovative nature is also represented from the not so obvious choice of the Italian language instead of Latin, a choice that probably reduced the work's international impact in the short term but permitted its use by groups of readers excluded from learned culture.[21] Indeed, the broad appeal to abacus sources, together with the intention of creating a didactic text, led to the vernacular as the single language being adopted by merchants and by the middle classes of society. This allowed the typographic standardisation of terms and formulas used first-hand in practice. Its encyclopaedic and all-encompassing size made Pacioli's work desirable for a large number of buyers, active in various professions, but it is probable that the world of wealthy merchants was its first intended public.[22] FIG. 3

As a printed product, the *Summa* of 1494 was a great success. The printer was able to repurpose the layout of geometric figures and mathematical calculations in the side margins with similar mastery that Ratdolt had developed some ten years earlier. The printing case created for its publication was quite vast: not only letters, abbreviations, numbers and mathematical signs created by Pacioli himself but also in particular fractions with large denominators (called *esimi*). It is, therefore, not surprising to read in the *colophon* of the author's claim of having worked tireless, day and night, to monitor the printing operations and to correct the text.

Pacioli had obtained a privilege for the *Summa*, whose contents and duration (ten years of exclusivity) were printed in the 1494 edition's colophon. The application was based on Pacioli's well-known competence in the field of mathematics, science being indispensable to state government and business; and it was primarily founded on his great fame as a teacher, celebrated throughout Italy and particularly among the 'gentlemen' of Venice, that is, the nobles and rich merchants. In asking to become legal proprietor of his own works for ten years, Pacioli showed awareness of their market prospects. Nevertheless, the voluminous *Summa* would only have a second edition posthumously (Toscolano: Alessandro Paganino, 1523).

Pacioli's *Summa* had a profound impact on his readers and a determining influence on the development of mathematics in the Renaissance. He created the epistemological foundations indispensable to subsequent developments, combining, in an innovative synthesis, numerous elements present also in Pacioli's other works, such as the study of Euclidian geometry, the

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Alessandro Paganino (1509–1538) (Padua, Antenore, 1990), pp. 15–21 and 141–143. For the author's biography, see Francesco Paolo Di Teodoro, 'Pacioli, Luca', in *D.B.I.* (*Dizionario Biografico degli Italiani*, Rome, Istituto della Enciclopedia Italiana Giovanni Treccani, 1960- , http://www.treccani.it/Portale/ricerche/searchBiografie.html) vol. 80 (2014). For the portrait of Jacopo de Barbari, see Paolo Portoghesi, 'Luca Pacioli e la *Divina Proportione*', *Civiltà delle Macchine*, 5 (1957), pp. 21–28; Renzo Baldasso, 'Portrait of Luca Pacioli and disciple, a new mathematical look', *The Art Bulletin*, 92 (2010), pp. 83–102; Renzo Baldasso & John Logan, 'Between the golden ratio and a semiperfect solid: Fra Luca Pacioli and the portrayal of mathematical humanism', in I. Alexander-Skipnes (ed.), *Visual culture and mathematics in the early modern period* (New York, Routledge, 2017), pp. 130–149.

[20] A basic bibliography includes Federigo Melis, *Storia della ragioneria. Contributo alla conoscenza e interpretazione delle fonti più significative della storia economica* (Bologna, Zuffi, 1950), pp. 620–638; Enrico Giusti & Carlo Maccagni (eds.), *Luca Pacioli e la matematica del Rinascimento* (Florence, Giunti, 1994); Argante Ciocci, *Luca Pacioli e la matematizzazione del sapere nel Rinascimento* (Bari, Cacucci, 2003); Enrico Giusti & Matteo Martelli (eds.), *Pacioli 500 anni dopo: atti convegno di studi Sansepolcro, 22–23 maggio 2009* (Sansepolcro, Centro studi Mario Pancrazi, 2010). Recently, the double-entry treatise has been critically republished: Luca Pacioli, *Trattato di partita doppia: Venezia 1494*. Edizione critica a cura di Annalisa Conterio; introduzione e commento di Basil Yamey; nota filologica di Gino Belloni (Venice, Albrizzi, 1994).

[21] Roman Sosnowkis, 'Il latino e il volgare della *Summa* di Pacioli', in *Maestro e Amico. Miscellanea in onore di Stanisław Widłak* (Krakow, Wydawnictwo Uniwersytewtu Jagiellońskiego, 2004), pp. 339–342.

[22] Alan Sangster, Gregory N. Stoner & Patricia McCarthy, 'The market for Luca Pacioli's *Summa Arithmetica*', *The Accounting Historians Journal*, 35, 1 (2008), pp. 111–134.

geometrical construction of letters, the application of the golden ratio in art and architecture and the professionalization of writing, not only in the field of economics, which would go on to construct a large expertise of knowledge as the basis of new professions. Pacioli merged, gathering together the greatest results, the century-old development of practical mathematics with academic and speculative mathematics founded on rediscovered Greek classics that were at this point largely available. We can describe the *Summa* as a 'classic', to use a current term, that was deemed indispensable for the private libraries of scholars, even more than a century after its publication.[23]

The Tagliente editions

Between the 1490s and the 1520s, books destined for the new audience of the mercantile classes began to be published. The publishing industry, constantly in search of subjects that could attract new buyers, explored new types of products. Books began to be proposed that served to acquire specific skills, even as self-taught. Taking into consideration the extensive scope of merchants' knowledge, we see the first writing manuals appear, beginning with the works of Sigismondo Fanti, which, in exemplifying the various handwriting scripts that the professionals had to master, dealt also with the merchants' script, *lettera mercantesca*.[24]

A significant stage in the printing tradition of abacus books is represented by the activity of Giovanni Antonio Tagliente. Calligrapher and woodcutter, author of several of the early printed textbooks in the field of abacus and double-entry bookkeeping, handwriting techniques and vernacular reading, his broad initiative opened a new phase with the production of books for merchants, and even more broadly, for the urban classes of artisans and shopkeepers.[25] FIG. 4 His action in this sector was innovative, carried forward with organisation, awareness and a strong aesthetic taste that resulted in the creation of a specific, very attractive typographic layout. The majority of his texts were re-elaborated and revised during his lifetime, beginning with *Libro d'Abaco* (or *Tesoro universale*, or *Componimento di arithmetica*, according to the various published titles), which was reprinted some thirty times in Venice over the course of the century and another ten times in Milan, where the last known edition was published by Valerio Meda in 1586. Editions by Tagliente were books 'that teach' as promised by nearly all his titles. Nevertheless, as Tagliente himself affirms in his dedication, he was neither a mathematician nor a bookkeeper, and for this reason, his work was more that of an entrepreneur than a true author. The mathematic textbooks were in fact written by Girolamo Tagliente, his relative. The abacus

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[23] An example is the private library of Gian Vincenzo Pinelli (1535–1601), a true prince of the Republic of Letters and promoter of Galilei's teaching in Padua, where both Euclid's editions by Pacioli and his *Summa de arithmetica* (1494) were found. For this collection, see Anna Maria Raugei, *Gian Vincenzo Pinelli e la sua biblioteca* (Geneva, Droz, 2018).

[24] *Thesauro de scrittori opera artificiosa la quale con grandissima arte, si per pratica come per geometria insegna a scrivere diverse sorte littere, cioe cancellarescha, merchantesca, formata, cursiva, antiqua, moderna, et bastarda*… (Rome, Antonio Blado, 1525). EDIT16 CNCE 23990, USTC 802418. This edition also contains tables of Hindu-Arabic numerals and examples of commercial operations; all the handwriting specimens were reproduced with woodcuts. Regarding the manner in which mercantile scripts were described in printed treatises, see Irene Ceccherini, 'La "lettera merchantesca" nei trattati di scrittura del Cinquecento', *Gazette du livre médiéval*, 59, 2 (2012), pp. 1–20.

[25] A few biographical notices on Tagliente, with special reference to embroidery books and to handwriting manuals that he published are in Carmen Bambach Cappel, 'Leonardo, Tagliente and Dürer: La scienza del far di groppi', *Achademia Leonardi Vinci: journal of Leonardo studies & bibliography of Vinciana*, 4 (1991), pp. 72–98. See also Armando Petrucci, 'Per una strategia della mediazione grafica nel Cinquecento italiano', *Archivio storico italiano*, 144, 1 (1986), pp. 97–112.

teacher Alvise Fontana wrote *Luminario de arithmetica* with Giovanni Antonio. These works are typical of the new basic instructional genre, and thus not at all advanced, considered instead as supports for the traditional lesson by the abacist. In these works, the realisation of numerous illustrations also had the purpose of proposing a spatial organisation of information, a typical expedient of mnemonic practices at the time.

Notwithstanding the difficulty in reconstructing the sequence of the dozen editions of Tagliente's works due to the low rate of survival, it would appear that the first edition of *Libro di abaco* by Girolamo Tagliente was published in Venice in February 1515.[26] It is not clear to what extent Giovanni Antonio had contributed to shape this textbook, but he is generally considered its co-author. The book concerns several fundamental notions in a very simplified form: simple arithmetic functions, monetary systems, interest calculations, practical plane geometry and international rates of exchange. The text systematically avoids theory in favour of a problem-solving approach. Tables for memorisation and visual reference filled a large portion of it. The treatment of multiplication 'by column', for example, furnished various diagrams, including figures in the shape of a chalice and a host, though not explaining the method. It was thus difficult for a beginner truly to deal with the subject with only the small manual as escort. The textbook offered little more than an outline for learners to follow and to integrate with the master's oral lesson, a matter of course because the Tagliente's objective was not so much to create self-learners but rather students registered in their school.

The same booklet shows the first elements of publicity and marketing. To begin with, recipients of the *Libro de abacho* were surely not school students only. As Girolamo Tagliente wrote in the preface, his objective was to teach how to do accounts and to keep the economic operations under control for 'friars, priests, students, doctors, gentlemen, artisans' and especially sons of the latter. The mention of men of the Church as first among the recipients was not accidental. Friars (like Pacioli himself) and priests were very active agents in the economic scene and had used accounting tools for some time to organise information in each parish with the objective of promoting the bishop's control.[27]

The success achieved with this first publishing venture of the *Libro de abacho* opened a sort of second stage in Giovanni Antonio Tagliente's career, which resulted in a much broader and more orchestrated enterprise, designed to monopolise the sector and become the reference point for a new public in an expanding market. The enterprise had a precise starting point with the application of a privilege by Giovanni Antonio Tagliente on 15 November 1524.[28] From this, it can be inferred that, because Giovanni Antonio Tagliente had worked at the Republic's Chancellery from 1492, he was, therefore, elderly in 1524 and wished to spread his knowledge and derive some earnings from it. The privilege of 1524 gave rise to some publications for which

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[26] Girolamo Tagliente, *Libro de abaco che insegnia a fare ogni raxone marcadantile & apertegare le terre con larte di la giometria ... El qual libro se chiama Texauro uniuersale. Concesso per lo Serenissimo Dominio Venetiano per anni diexe* (Venice, s.n., 1515). EDIT16 CNCE 67544, USTC 857960. The volume's contents are described in Marino Zorzi (ed.), *La vita nei libri. Edizioni illustrate a stampa del Quattro e Cinquecento dalla Fondazione Giorgio Cini* (Venice, Edizioni della Laguna, 2003), pp. 205–206. This edition was reprinted, nearly identical in 1520, according to Giancarlo Petrella, 'Il Tesauro Universale di Girolamo Tagliente: quando i mercanti imparavano a far di conto', *La biblioteca di Via Senato Milano*, 12 (2020), 4, pp. 27–32. See also *Luca Pacioli e la matematica*, *cit.*, p. 99 No 83.

[27] Michele Bigoni, Enrico Deidda Gagliardo & Warwick Funnel, 'Rethinking the sacred and secular divide: Accounting and accountability practices in the diocese of Ferrara (1431–1457)', *Accounting, Auditing & Accountability Journal*, 26 (2013), 4, pp. 567–594.

[28] Venice, Archivio di Stato, Senato Terra 23, ff. 164r–v, transcription in the database, *Early Modern Book Privileges in Venice*, http://emobooktrade.unimi.it/db/public/frontend, ID 873.

Giovanni Antonio continued to act more than as an author or entrepreneur but rather as an organiser of a vast publishing operation, with whom various individuals collaborated, as in a small family business, the son Pietro, the relative Girolamo and the associate Alvise Fontana.

The four texts protected by the privilege were published quickly thereafter. The first one was a writing manual, a book to learn how to write in all major scripts.[29] The second was a work to learn how to read in the vernacular and to improve in a couple of months the competence of those who read with difficulty, including women.[30] The third, *Componimento di parlamenti*, was a manual that taught how to write letters in Tuscan, an anthology of texts that exemplified the changes in tone and contents, depending on the recipients.[31] Here, examples of conversations were also found correlated to the interlocutor's *status*.[32] Finally, the privilege was granted for the work, *Luminario di Arithmetica*, which would be published in the following year, in 1525.[33]

Of all these works, the writing manual belonged to a new genre, and perhaps on account of Tagliente's fame as chancellor of the Republic, it was republished many times, at least until 1565. Among the other works, the most interesting is *Luminario*, written in collaboration with Alvise Fontana. It is a small work on how to keep double-entry accounts, based on the instructions given in the *Summa de arithmetica* by Luca Pacioli. In their work, Fontana and Tagliente simplified Pacioli's long theoretical discourse, extracting only some practical exercises of bookkeeping with examples of business problems drawn from real life. The title, *Luminario*, shows that they intended to propose a book of examples, illustrated with the local system of bookkeeping for those who did not have the time or the ability to follow Pacioli's complex explanations that were mostly devoid of examples. For example, the *Luminario* included several real Venetian double-entry registers so that its correctness was not due to Tagliente, but rather it was a demonstration of the bookkeeping precision of contemporary merchants.[34] FIG. 5

This quickly published series of titles emerged in the editorial assembly of these small textbooks in aggregate collections beginning in the mid-1520s under Tagliente's name, at this

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[29] Giovanni Antonio Tagliente, *Lo presente libro insegna la vera arte delo excellente scrivere de diverse varie sorti de litere le quali se fano per geometrica ragione …Opera del Tagliente novamente composta cum gratia nel anno di nostra salute 1524*, s.n.t. [Venice, s.n., 1524?]. EDIT16 CNCE 67576, USTC 857981.

[30] *Libro maistrevole. Opera nuovamente stampata del MDXXIIII, in Venetia, la quale insegna maistrevolmente con nuovo modo & arte a legere a li grandi & piccoli & alle Donne che niente sanno in termine de mesi doi et piu & manco, secondo l'ingegno de cui cercha imparare. El qual libro sara anchora di molta utilita a quelli che sanno poco leggere & come seguendo vederai*. EDIT16 CNCE 79068. See Anne Jacobson Schutte, 'Teaching adults to read in sixteenth-century Venice: Giovanni Antonio Tagliente's *Libro Maistrevole*', The *Sixteenth Century Journal*, 17 (1986), pp. 3–16. Whereas this book is addressed *also* to women, later on Tagliente would publish a text *exclusively* for women to learn how to sew and embroider, basic skills in the education of women, see Alessandra Mottola Molfino, 'Nobili, sagge e virtuose donne: libri di modelli per merletti e organizzazione del lavoro femminile tra Cinquecento e Seicento', in *La famiglia e la vita quotidiana in Europa dal '400 al '600: fonti e problemi. Atti del Convegno internazionale, Milano, 1-4 dicembre 1983* (Rome, Ministero per i beni culturali e ambientali, 1986), pp. 277–293.

[31] Giovanni Antonio Tagliente, *Componimento di parlamenti. Libbro utile & commodissimo in lingua tosca, il qual apertamente, & con facilita insegna ogni qualita di persone a dittar lettre di varia & diversa materia* (Venice, G.A. and brothers da Sabbio, 1531). EDIT16 CNCE 76865, USTC 764520. It included examples of commercial letters that curiously all dealt with the same arguments (evidently a *topos* at the time): the decline of Italians in international commerce, then compelled to withdraw in the face of the growing competition from other communities and consequent choice to return to the uneventful life of rural economy and land administration.

[32] Even this small work had a notable fate, so much so that 14 different editions to 1586 survive; lost, however, is the *princeps*, given that the oldest known today dates from 1531.

[33] *Considerando io Ioanni Antonio Taiente quanto e necessaria cosa a li nostri magnifici gentilhomeni & ad altri mercatanti el laudabile modo de tenere conto de libro dopio cioe, el Zornale, el Libro con l'alphabetto secondo el consueto de questa inclita citta di Venetia …*, [1525?]. EDIT16 CNCE 47961, USTC 857982.

[34] F. Melis, *Storia della ragioneria*, *cit.*, pp. 640–41.

point a recognized authorial brand.[35] The entire operation was thus a demonstration of Tagliente's talent, a true forerunner of manuals for everyone, and of his clear vision of market niches. In fact, although the contents were at a mere introductory level, the popularization of this type of knowledge and its extension to a broad audience, realised thanks to printing, constituted a great step forward in the dissemination of practical mathematics and double-entry accounting techniques.

Tagliente's products found a ready market and a sustained demand. Tagliente succeeded in dominating this market sector, stimulating and satisfying at the same time the reading and instruction needs of a growing public that could sustain the production of his books. The presence of Tagliente's abacus manuals was ever more widespread in commercial documents of the period, a success shared by the preceding standard, namely, the manual by Borghi. Toward the middle of the sixteenth century, both books were on sale in shops at the very low price of 3 Venetian soldi. The comparison with Latin grammars printed in Venice at the same time is significant, for which the average price was much higher at its peak at about 1 lira and 2 soldi on average.[36] The success of the intermediate urban classes, such as tradesmen and craftsmen, in practising commercial arithmetic and practical geometry is also due to a greater accessibility of basic tools.

The Verini in Milan

A similar trajectory to the Tagliente's can be reconstructed for another family group, the Verini, in Milan between the 1530s and the 1550s. They were led by the prolific Giovanni Battista Verini, an author still famous today for literary works in popular verse. His collections, *Ardor d'amore* and *Crudeltà d'amore*, repertories of verses useful to lovers short on inspiration, were reprinted innumerable times until the nineteenth century.[37] Little is known of his biography, but it is certain that he was a native of Florence. Verini constantly played the trump card of his Florentine identity as added value to his many and varied skills. In those years, in Italy, to be a native of Florence implied mastery as a native speaker of the language that had established itself as literary Italian, marginalising all other regional parlances to the rank of dialect.

Verini's first publication was among the earliest handwriting manuals of the period, *Liber elementorum litterarum* or *Luminario* (ca. 1527).[38] It was his most successful work, subject of many reprints and remakes, which also contributed to the spread of geometric construction of letters, deduced from *Divina proportione* by Luca Pacioli, from the work by Sigismondo Fanti and others.

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[35] There has been recently remarkable research about the concept of authors' branding, starting with Andrew Pettegree's *Brand Luther: 1517, printing and the making of Reformation* (New York, Penguin Press, 2015). See for instance Lieke van Deinsen & Nina Geerdink, 'Cultural branding in the early modern period. The literary author', in Helleke van den Braber, Jeroen Dera, Jos Joosten, & Maarten Steenmeijer (eds.), *Branding books across the ages: Strategies and key concepts in literary branding* (Amsterdam, Amsterdam University Press, 2021), pp. 31–60. Authors' branding as a successful way to promote commercially printed works is a typical process in the world of publishing and bookselling, and it can be detected quite early in Venice.

[36] These prices can be obtained in the database, *Early Modern Book Prices*, http://emobooktrade.unimi.it/db/public/prices.

[37] Alessandro D'Ancona, *La poesia popolare italiana. Studi* (Livorno, Vigo, 1878), pp. 414–416.

[38] Stanley Morison, 'Some new light on Verini', *The Newberry Library Bulletin*, 3 (1953), pp. 41–45. There are two modern editions of this text, the first one with an introduction by Stanley Morison (Cambridge, Harvard College Library; Chicago, The Newberry Library, 1947) and the second one with a note by Emanuele Casamassima (Florence, Olschki, 1966). See also Paul F. Gehl, 'The "maiuschule moderne" of Giovambaptista Verini: From music texts to calligraphic musicality', in D. Shemek & M. Wyatt (eds.), *Writing relations: American scholars in Italian archives. Essays for Franca Petrucci Nardelli and Armando Petrucci* (Florence, Olschki, 2008), pp. 41–70.

It does not appear coincidental that Verini entrusted his text to the same printer of Pacioli, Alessandro Paganini, active in those years in Toscolano.[39] Verini explained in the preface that he had succeeded in obtaining two privileges for his work: the 'general excommunication', that is, the papal privilege, as well as the privilege of the Signoria in Florence, where he was a citizen. The two privileges demonstrated recognition of his ability and proof of the fact that the *Luminario* project was anything but impromptu. It is, therefore, a debut parallel to that of Giovanni Antonio Tagliente in Venice a few years earlier, and just like his destiny that began with a handwriting manual, it opened a publishing career with a range of actions, similarly broad and diversified. Like Tagliente, Verini set all his writing examples in woodcut tables, a system that allowed reiterative reuses of the same material, as in fact occurred in his subsequent publications.

It is unknown whether Giovanni Battista Verini thought of residing in Milan or even in Lombardy until 1527. Certainly, conditions made it very difficult. While Venice was in the process of responding successfully to the disastrous events of the War of the League of Cambrai, Milan in the 1520s was experiencing its worst crisis in the whole century. Following a series of military conflicts, the imperial troops moved into Milan in 1525; widespread pillaging would endure at least until 1528, with violence by the occupiers and revolts by the population. Plague epidemics occurred in 1522, 1524, and in a most devasting way in 1528, causing the highest number of victims. The city's long recovery was set in motion in the 1530s, and productive activities resumed in parallel, among which were printing firms that had nearly all closed in the previous decade. Even educational systems encountered a profound pause: only in 1533 were there initiatives, aimed at re-establishing regular classes at the University of Pavia. It certainly could not be said to be a favourable period to set up an abacus school in Milan. Nevertheless, this was apparently the intention of Giovanni Battista Verini.

With respect to Tagliente and the other Venetian authors of abacus books, Verini had the advantage on account of his Florentine identity, a guarantee of his particular qualification in the knowledge of abacus and commercial mathematics as well as in the native domain of the Tuscan language. Tuscanisation, in fact, had by this point affected all written texts, including practical professional ones, where the original Venetian terms used in the treatise on double-entry and bookkeeping registers began to sound like dialects. Therefore, it was strategic for Verini to let it be known that he was able at the same time to teach the subjects of vernacular schools, that is, merchant skills and the good Tuscan language, such that the first work he chose to publish in Milan was a type of dictionary of the Tuscan language (1532).[40] FIG. 6 It was a lexicon designed for beginners to learn how to read and write in the vernacular: it opened with an alphabet and a primer, and then presented lists of terms grouped by particular categories. The small volume

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[39] *Incipit liber primus [-quartus] elementorum litterarum, Ioannis Baptistae de Verinis Florentini noviter impressus. Con gratia et priviulegio per anni x.* [Toscolano, A. Paganini, ca. 1527], text in vernacular, notwithstanding the Latin title. EDIT16 CNCE 55830, USTC 862918. Regarding the printer, see A. Nuovo, *Alessandro Paganino* …, in particular, pp. 130 and 186.

[40] Giovanni Battista Verini, *Dictionario opera di Giovambattista Verini fiorentino in la quale si contiene tutti li nomi masculini & feminini di tutte quante le cose del mondo vive & morte in lingua thosca* (Milan, Gottardo da Ponte, 1532). EDIT16 CNCE 57711, USTC 862912. The only surviving copy, held today at the Biblioteca Trivulziana di Milano, was the object of a facsimile reprint with introduction by Giovanni Presa (Milan, Le stelle, 1966). See also Teresa Poggi Salani, 'Venticinque anni di lessicografia italiana delle origini (leggere, scrivere e "politamente parlare"): note sull'idea di lingua', in P. Ramat, H.J- Niederehe & E.F.K. Koener (eds.), *The history of linguistics in Italy* (Amsterdam/Philadelphia, J. Benjamins Publishing Company, 1986), pp. 51–86.

included a woodcut showing the teacher at his desk writing (or perhaps correcting) while two youths offer their exercise sheets to him: a sort of snap-shot of the author in action, like others that had already appeared in print for some time – portraits of authors intent on doing something, like teaching, preaching, writing – very different from portrait medallions imitative of antique portraits, selected by authors of literary and academic culture in the Renaissance. The image transmitted the volume's purpose (to publicise Verini's efforts) and context (a vernacular school). In the preface to readers, the author in fact guaranteed, as he had already demonstrated a thousand times in his experience as a teacher, that with the help of his dictionary the illiterate would learn to read and write in three months. He offered to teach the poor and the rich, male and female, even 18-year-olds and the total ignorant:[41] in three months they would learn to read printed texts in the vernacular, to write in a handwriting script of their choice, and to learn the first rudiments of mathematics. He was so sure that he wanted to receive his payment only after the results.[42] These fearless affirmations, common likewise with other 'sellers' of knowledge, such as authors of recipes and 'secret' remedies,[43] were signals of change underway in vernacular schools in various cities, of an increasing demand always more focussed on immediate useful results and, simultaneously, of the intensification of the competition among those offering themselves as instructors. It focussed on expertise of basic knowledge, usable in daily practice, as a good (and merchandise) that was offered to the expanding urban classes, without difference of gender among the learners. Printing accelerated this like all other modernising tendencies, showing its power as an ideal vehicle of self-promotion and marketing.

The privilege that Verini had obtained for his *Dictionario* was printed on the last page, together with the coats of arms of the Medici and Francesco Sforza.[44] The Medici privilege had already been cited in the printing of *Luminario*. With regard to the Sforza privilege, the concession of the book privilege in Milan was not a customary procedure, as in Venice, hence it is a relevant signal of Verini's activism.[45] The privilege was requested not only for the *Dictionario* but also for other works that would be printed in subsequent years, where it is frequently cited. Still more pertinent is the indication of the place, not where the book was sold but where Verini carried out his abacus and writing instruction: at the Dogana, near the Church of St. Satyrus, close to the Porta Romana, where the printer Gottardo da Ponte had located his firm and bookshop at the end of the fifteenth century.[46] The book, therefore, became part of a campaign of public information on the presence and position of the abacus school, presumably opened

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[41] Attendance in abacus schools began around 10-12 years of age, sometimes even earlier, and could last about two years. The 18-year-olds would thus have been very later students.

[42] Giovanni Battista Verini, *Al candido lettore*, in *Dictionario*, *cit*. f. 1v.

[43] William Eamon, *Science and the secrets of nature: Books of secrets in medieval and early modern culture* (Princeton, Princeton University Press, 1994).

[44] 'Nessuno osi stampare la presente opera sotto la pena contenuta nel privilegio del Signor Duca di Milano, e non solo questa mia opera ma ogni altra del detto Giovan Battista Verini fiorentino, che insegna abaco e ogni genere di scrittura a Milano sopra la Dogana, a casa di Gottardo da Ponte stampatore di libri'.

[45] Angela Nuovo & Paola Arrigoni, *Privilegi librari nello Stato di Milano (sec. XV-XVI)*, in Erika Squassina & Andrea Ottone (eds.), *Privilegi librari nell'Italia del Rinascimento* (Milan, Franco Angeli, 2019), pp. 67–101.

[46] The publisher and bookseller, but certainly also a printer on commission and a paper merchant, Gottardo da Ponte (Italianisation of Gothard van der Bruggen) probably born in Bruges in the second half of the fifteenth century; in 1495 his activity began in Milan, that lasted until 1552. An expert to a high degree, he completed the most important illustrated edition of the Milanese Renaissance, that is, the edition of Vitruvius's *Architettura*, translated into Italian and illustrated by Cesare Cesariano (1521). Lorenzo Baldacchini, 'Da Ponte, Gottardo', in *D.B.I.*, vol. 32 (1986); Ennio Sandal, *L'arte della stampa a Milano nell'età di Carlo V. Notizie storiche e annali tipografici (1526–1556)*, (Baden-Baden, V. Koerner, 1987), p. 19

recently. The school's placement near the only (or virtually only) printer and bookseller active in those years in Milan probably also included a form of partnership, in as much other Verini texts were also published by Gottardo da Ponte.

Giovanni Battista was apparently supported by his relative Alessandro Verini, FIG. 7 who authored a series of brief writings related to contemporary events and local reports, in octave verse, conceived for quick consumption and ostensibly dissemination also by street singers and various entertainers.[47] In a few years, therefore, Giovanni Battista and Alessandro Verini had conquered their own space in Milan, not only as founders and teachers of a vernacular school but also as creators of low-cost informational materials (yet always embellished with at least one attractive illustration), able to arouse the curiosity of the large audience of urban classes.[48]

The address of the Verini print shop gradually changed to 'contrada delle bandiere al segno del Ballone' (district of the banners at the sign of the Ballone), whereas the abacus school remained at the Dogana, at the sign of the Ballone. The 'contrada delle Bandiere' was the last stretch of the current via Torino leading toward the Piazza del Duomo, thus a more central location close to the district where most of the Milanese bookshops were located. From 1534–35, the Verini texts were published from this new firm, which was probably managed independently, given that the name of another family member, Pier Paolo Verini, emerged as publisher.[49] Even Pier Paolo, like Alessandro, would not cease to define himself as 'Florentine' in his printings. If Pier Paolo dealt perhaps with the print shop, then Alessandro certainly taught at the abacus school. Indeed, a manuscript is preserved entitled *Il Mercatante* by Alessandro Verini, dated 1555, originating at the same school setting above the Dogana at the address of the abacus and writing school launched by Giovanni Battista more than twenty years earlier. FIG. 8 The manuscript, a remarkable document on the pedagogical method in the classroom, is based on subjects common in various books printed by Giovanni Battista, including drawings often inspired by previously published woodcuts, but above all it attests to the path of student learning through the various abacus operations. In other words, it was a sort of exercise notebook completed by a single student during the course.[50]

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[47] See, for example, a text such as: *La entrata che ha fatta il sacro Carlo quinto imperadore Romano nella inclita città di Milano & la festa fatta: con la dichiaratione di tutti li versi latini che si ferono alle chiese & alle porte. Composta per Lessandro Verini Fiorentino adi X di marzo 1533 a hore ventitre* [Milan, Gottardo da Ponte, 1533]. EDIT16 CNCE 57712, USTC 862908.

[48] For instance, *Il vanto, e lamento della cortigiana ferrarese, per esempio a tutte le donne di mala vita* (the pride and lament of a Ferrarese courtesan, as example to all women of bad life). EDIT16 CNCE 79978.

[49] See, for example, the reprint by G. B. Verini, *Luminario da imparare a scrivere de ogni sorte littera per Giovanbattista Verini fiorentino che insegna abbacho* (Milan, nella contrada delle bandiere al segno del ballone per Pietro Paulo Verini Fiorentino, 1536). EDIT16 CNCE 57891, USTC 862924. Consisting simply of writing essays from woodcut tables, this booklet's title page shows an illustration of Verini teaching a woman to write: this gender choice was probably significant of the success that his work earned in the city. FIG. 14 Partially legible on the folio, on which the master writes to show the student, is the sentence *Avarum neque parcum numquam di amant* (the gods love neither the miserly nor the parsimonious), an apparent demonstration that the teaching of practical skills was never without moral and edifying content.

[50] Milan, Biblioteca Trivulziana di Milano, MS Triv. 185. The Trivulziana holds the majority of the Verini surviving books in single copies. This manuscript comes from well-known merchant families in Milan such as the Barelli and the Perego and carries signs of use through to the mid eighteenth century. See Francesco Piseri, 'Il *Mercatante* di Alessandro Verini: uno strumento didattico per la matematica mercantile' in Giuseppe De Luca, Angela Nuovo & Federico Piseri (eds.), *La formazione del mercante: scuola, libri e cultura economica a Milano nel Rinascimento* (Milan, Ed. Delfino, 2021), pp. 112–219.

Giovanni Battista's range of actions, moreover, was not limited to Milan. In 1534, he informed the public in a printed volume of his amorous verses that, as a salaried employee of the duke of Milan, he taught abacus and writing in the second ducal city, Cremona, close to the Spezieria del Gallo (Pharmacy of the Rooster).[51] Thus, it is clear that the Verini had succeeded in creating in Milan a pole of interest for cultural consumption and for the educational needs of the urban classes that could include artisans and shopkeepers, clerks, secretaries and the like, and could be employed in chancelleries, offices and banks. The strong production of cheap print, poetic compositions ready for public performance related to current events or to themes deeply felt by the public, affirms that the workshop at the sign of the Ballone had become the starting point of widely distributed printed materials, accessible even to social classes with less spending capacity. Just as textbooks were used in the related context with the teacher, so also, the verses that recounted war, chronicles and curious facts were mediated by public performance. The interactions between printed texts, oral culture and performance in early modern urban settings created a new multimedia experience, crucial in the formation of an ephemeral form of public sphere.[52]

Spechio del mercatante **(1542)**

The recent discovery of the surviving unicum of Giovanni Battista Verini's abacus book, *Spechio del mercatante* (1542),[53] FIG. 9 permits a more detailed analysis of his pedagogical method. Verini dedicated this work, as shown on its title page, to the illustrious figure Giovanni Marino, one of the most important merchants and financial representatives in Milan in the sixteenth century. Brothers Tommaso and Giovanni Marino moved to Milan from Genoa at the beginning of the century, and Giovanni, in particular, had sojourned in Milan during the entire period of the wars in Italy, ending with the duchy's transfer to Spanish dominion. Giovanni Marino had lived in various residences in the city, but precisely in the 1540s, he moved into the house that represents the prime nucleus of the current Palazzo Marino (seat of the municipality of Milan today). Meanwhile, the part of the family remaining in Genoa initiated a policy of large loans to Emperor Charles V. In the year that Verini's booklet was dedicated, Giovanni Marino's businesses were doing well, both in the sector of merchandise and finance as in the acquisition of agricultural land. When he died in 1546, Giovanni Marino boasted credits of about 800.000 imperial lire from the Chamber of Milan.[54]

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[51] Giovanni Battista Verini, *Ardor d'amor* (Vercelli, G. M. Pellipari, 1534).

[52] S. Dall'Aglio, B. Richardson & M. Rospocher (eds.), *Voices and texts in early modern Italian society* (London/New York, Routledge, 2017); L. Degl'Innocenti, B. Richardson & C. Sbordoni (eds.), *Interactions between orality and writing in early modern Italian culture* (London/New York, Routledge, 2016); M. Rospocher et al. (eds.), *Crossing borders, crossing cultures. Popular print in Europe (1450–1900)*, (Berlin, De Gruyter Oldenburg, 2019); Daniel Bellingradt & Massimo Rospocher (eds.), *A history of early modern communication: German and Italian historiographical perspectives*, Special Issue of *Annali dell'Istituto storico italo-germanico in Trento / Jahrbuch des italienisch-deutschen historischen Instituts in Trient*, 45/ 2 (2019); M. Grenby, E. Marazzi & J. Salman (eds.), *European Dimensions of Popular Print Culture*, Special Issue of *Quaerendo*, 51 (2021).

[53] Giovanni Battista Verini, *Spechio del Mercatante al S. El Signor Zan da Marino* (Milan, al Ballone, 1542). EDIT16 CNCE 58079, USTC 862915. Copy held by the Kunstbibliothek of the Staatliche Museen zu Berlin, prov. Hans Grisenbach (*Katalog der Sammlung des † Architekten Herrn Hans Grisebach in Berlin*, Stuttgart, Guetkunst, 1905). The volume has a parchment binding, recovered from a manuscript, written in twelfth-century Italian Carolingian script and containing *Aurei sermones* by Petrus Chrysologus (c. 380–c.450).

[54] Massimo Giannini, 'Marino, Tommaso', in *D.B.I.* vol. 70 (2008).

There was probably no personal connection between Verini and Marino; as in many other cases, the name of the famous dedicatee helped the author by giving resonance to the publication. Not even the real dedication to Marino, printed on the verso of the title page, provides any clue. Here, Verini spoke of himself and the Christian duty he felt to disseminate his knowledge and not to keep it hidden; he gave no information about his illustrious dedicatee. Marino was in this context the epitome of a successful businessman, an example to strive for as long as (it was understood) one attended Verini's school.

The woodcut illustration on the title page depicts a man, focussed on drawing a route on a globe with a pen; behind him is a nautical compass and a Portuguese caravel in the background. Such an image was created as an author portrait for the first Venetian edition of *Itinerario* in the East by the Bolognese traveller Lodovico de Varthema (1517),[55] a well-received edition that was followed by many reprints. FIG. 10 Immediately thereafter (1518), however, the same image was reused on the title page of the abacus book by the Veronese mathematician Francesco Feliciano De Scolari.[56] Such a rapid passage from one text to another is perhaps explained by the possible shift from traveller-cartographer to abacist-land surveyor, given that Feliciano was particularly interested in land measurement and its practical purposes that served agriculture and land reclamation. The man depicted could thus be adapted to represent the geometer, literally, he who measures the earth and is capable of redrawing the globe, thanks to his calculating ability. Moreover, the merchant was a traveller: the businessman was one of the most powerful agents able to disseminate knowledge of routes and kindle geographic curiosity.

The image that Verini chose for his title page, therefore, comes from Feliciano's editions; nonetheless, it, too, passed through the same path. In 1519, in fact, Varthema's *Itinerario* was republished in Milan, and the title page was decorated with a copy of the same Venetian portrait with some inevitable variations.[57] The cap has a different shape; the bench on which the figure sits is adorned with a classicizing head crowned with laurel; the pose is more rigid compared to the Venetian original, but the result seems better overall. And it is indeed this Milanese version of the image that Verini would reuse after more than twenty years, still in good condition, if some breaks in the outer frame are excluded. The reuse of woodcuts created for previous publications was very common at this time and even more often in small print shops, like Verini's.

The pedagogical planning of *Spechio del mercatante* was not limited to traditional abacus mathematics: Verini's ambition was to teach a merchant to know how to behave like a gentleman and not just a simple practitioner of bookkeeping and monetary exchange. In the long sixteenth century, merchants, who were not infrequently called on for public administration tasks in central and city treasuries, also needed communicative and interpersonal skills, a system of

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[55] Lodovico de Varthema, *Itinerario ne lo Egypto ne la Suria ne la Arabia deserta & felice ne la Persia, ne la India, & ne la Ethiopia* (Venice, Giorgio Rusconi, 1517). EDIT16 CNCE 67803, Essling 1932, Sander 7589, USTC 862068. The image is signed with the initials 'za', that is, the woodcutter Zoan Andrea Vavassore.

[56] Francesco Feliciano, *Libro de abaco el quale insegna a fare molte rasone merchantile & come respondano li preci & monete* (Venice, Niccolò Zoppino & Vincenzo di Paolo, 1518). EDIT16 CNCE 18695, Sander 2684, USTC 828967. Van Egmont, *Practical Mathematics*, cit., pp. 309–10. Feliciano, abacus master in Verona, was a mathematician and engineer of much greater talent than Verini and able to discuss with Niccolò Tartaglia, who recalls his queries in his works. See Gabriella Belloni Speciali, 'De Scolari, Francesco Feliciano', in *D.B.I.* vol. 39 (1991) and Arturo Gallozzi, 'Francesco Feliciano De Scolari (1470–1542), in Michela Cigola (ed.), *Distinguished figures in descriptive geometry and its applications for mechanism science from the Middles Ages to the 17th Century* (Cham, Springer, 2016), pp. 53–75.

[57] Lodovico de Varthema, *Itinerario ne lo Egypto ne la Suria ne la Arabia deserta & felice ne la Persia, ne la India, & ne la Ethiopia* (Milan, Giovanni Angelo Scinzenzeler, 1519 (reprinted in 1523). EDIT16 CNCE 54760, USTC 862070.

cultural references and an acceptance of canons of taste that characterised elites. In this instruction, the values of poetry and epistolography, calibrated precisely according to the situations and for the recipient, are perceived as necessary as the practice of calculation, all the more so that Giovanni Battista Verini himself was a poet, and most of all, Florentine.

Giovanni Battista Verini's manual had a systematic approach. It explains step by step how to solve basic mathematical operations: sums, subtraction, multiplication and division, FIG. 11 making frequent recourse to examples taken from mercantile operations, especially in connection to the buying and selling of clothes. Afterward, the rule of three is explained, that is, proportions; examples then followed on weights and on the way to divide the profits of a partnership. Subsequently, there are several so-called 'pleasant cases', that is, recreational problems explained and solved, furnished with small vignettes, as was used in Tagliente's books; the well-made vignettes aimed to involve the reader/pupil emotionally, facilitating mnemonic learning. The last part is dedicated to card tricks and included both abacus matters (for example, the calculation of how much would cash loans pay during a card game) and recreational game matters, with the goal of making a good impression in society after dinner among 'Signori et gentili huomini'.[58] It seems worth mentioning that the *Specchio* is the earliest printed source for methods of card tricks and the first known to have illustrations accompanying a trick.[59] FIG. 12 The general approach, therefore, was exquisitely practical; it keeps its distance from the most advanced developments of mathematics and remains faithful to the medieval and Renaissance practical abacus tradition, confirming the correspondence to an application of applied knowledge that characterised the Milanese context.

The typographical rendition of *Specchio del Mercantante* was accurate and without any specific defects that would have been signs of frugality, such as composition or printing errors, nonuniform inking and so on.[60] Any typographical problems with the calculated results were not always solved but in fact were all bypassed: metallic lines and dashes that would have been inserted horizontally within the mathematical calculations, in fractions and, even the most common, the cross used to verify multiplications were completely missing. All these signs, fundamental in giving meaning to the calculation, were integrated manually (with some omissions), probably by the owner herself of this single copy. In fact, one more element was transmitted with this unique and precious specimen: a provenance note. The following words, handwritten in a still uncertain and irregular hand, can be read on folio 21r: 'questo libretto è di s.ra [?] Franc.ª Buonamici chi lo trova lo rende' (this little book is owned by Ms Francesca Buonamici, the one who finds it, gives it back to me), a signature that restores a student's name from the past. FIG. 13 The focus on instruction of women, which the Verini demonstrated in their printed works, is here confirmed by this unique copy, even if, naturally, it does not prove that Francesca Buonamici was their student in Milan but rather used this effective small manual in another abacus school in Italy. The offer of training, so insistently oriented toward women, implies that a female copyist and a bookkeeper were anything but rare and that various working

[58] It was a recurring section in practical mathematics texts: Van Egmond, *Practical Mathematics*, pp. 23–25. See also: Raffaella Franci, 'Giochi matematici in trattati d'abaco del Medioevo e del Rinascimento', in *Atti del convegno nazionale sui giochi creativi (Siena, 11-14 giugno 1981)* (Siena, Tipografia Senese, 1981), pp. 18–43; *Luca Pacioli e la matematica*, *cit.*, pp. 73–76 and 96.

[59] William Kalush, 'The first card tricks in print?', *Conjuring Arts*, June 23, 2021, https://conjuringarts.org/2021/06/the-first-card-tricks-in-print/?fbclid=IwAR2YYC2OyZvJeGjHzJdM5j6dJ2QJHrjrx6A5jTMcpZ65qbfd1GCFcrvr2As.

[60] Laura Carnelos, 'Popular print under the press: Strategies, practices and materials', *Quaerendo*, 51 (2021), pp. 8–35.

activities were open to women, especially in support of their husbands' and fathers' professions.[61] FIG. 14

Conclusions

The reconstruction of a few stages in the printing production of books to train merchants has allowed a better focus on some of the main characters active in the first pioneering phase and on the major obstacles that had to be overcome to make such a publishing genre profitable. An extensive public of teachers and students, albeit a public still elusive and certainly not clearly defined like the one who enlivened the traditional training paths, made the market prospect of these initiatives uncertain. Printing an abacus book was complex and required specific typographical solutions. Not a few had to renounce the endeavour. There exists documentation, for example, of the printing privilege for abacus books granted to Bartolomeo Pasi in 1500 and to Sigismondo Fanti in 1526,[62] which, as far as is known, did not result in any production; and certainly, the printing of abacus books did not interest only Venetian printers.

In relation to the manuscript tradition, printing accentuated the role of the author. This opportunity had a particular value for authors who were also private or semi-private teachers, who had every interest in creating the largest resonance possible around their own abilities. Printing provided them this proscenium. Consequently, anonymous abacus books (such as the first ever to be published, *Aritmetica di Treviso*, in 1478) became very rare over time, and in this case, they were generally mere compilations of a few pages.

Shifting the analysis of printed books to privilege requests, as seen in the previous pages, means backdating the study of every publishing initiative from production to planning. In this way, a key element regarding the legal statute of every edition is ascertained: if the privilege had been requested by the printer or by the author, that is, whoever was the agent investing and taking the risk, then, as an investor, he could be considered by the state as meriting commercial protection by means of exclusive printing rights. The privileges demonstrate how authors of books on practical mathematics and bookkeeping had always requested the concession personally, including Luca Pacioli, who was not even a subject of the Republic of Venice. Until about 1545, the request of a privilege by the author was not so widespread as in the second half of the century: most of the privileges were requested by printers, in other words, by those who represented the recognized economic driving force of the printing world. For a long time, publishers avoided bearing responsibility for the production expenses of this book genre.

Giovanni Battista Verini asked for the privilege from three different administrations (Rome, Florence and Milan)[63] and demonstrated the programming capacity and market expectation similar to that which, in the same years (*mutatis mutandis*), the great contemporary authors showed, like Ludovico Ariosto and Sebastiano Serlio. These circumstances attest to a large awareness of their works' impact, as well as to a certain interest in the protection of these

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[61] Brian Richardson, *Women and the circulation of texts in Renaissance Italy* (Cambridge, Cambridge University Press, 2020), pp. 87–89; Luisa Miglio, *Governare l'alfabeto. Donne, Scrittura e libri nel Medioevo* (Rome, Viella, 2008); Tiziana Plebani, *Il 'genere' dei libri. Storia e rappresentazioni della lettura al femminile e al maschile tra Medioevo e età moderna* (Milan, Franco Angeli, 2001), pp. 164–170. The presence of women in the firm, assigned to bookkeeping in the owner's absence, is mentioned also by Luca Pacioli (*Summa de arithmetica*, f. 200r).

[62] *Early Modern Book Privileges in Venice*, ID 488 and 3884 respectively. For Fanti, read Erika Squassina, *I privilegi librari a Venezia (1469–1545)*, in Squassina & Ottone (eds.), *Privilegi librari*, cit., p. 348.

[63] The Venetian privilege was granted only to those who were going to print in Venice or at the least in the territory of the Republic, for which Verini was never able to request it.

works on the part of the administrations. The Serenissima, moreover, was particularly careful to grant privileges for the various *Tariffe* publications (tariffs for weights and measures, exchanges, etc.), which were also requested by the relevant authors (like Bartolomeo Pasi, Giovanni Mariani, Giovanni Manenti and others). Fig 14

Thanks to books that have become extremely rare today, it is possible to reconstruct the Verini's professional and educational environment in Milan, which had previously been virtually unknown. The proactive ability of these businessmen in education, information about current events and entertainment reveals, at their first appearance, the most innovative mechanisms of urban communication in the early modern period, able of creating and ready to satisfy both the growing training needs and the cultural and informational consumption of an evolving society.