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# Chapter 3

## Erhard Ratdolt's Edition of Sacrobosco's *Tractatus de sphaera*: A New Editorial Model in Venice?



Catherine Rideau-Kikuchi

**Abstract** The aim of this paper is to investigate the construction process of Sacrobosco's *Tractatus* as a successful venture in the early publishing market and the seminal role of some of its editions. Venice is a good case study since Venetian printers regularly printed the early editions of the *Sphaera* and fashioned the way the text was laid in print. In 1478, in the context of aggressive competition with Erhard Ratdolt, Franz Renner chose a traditional conceptual approach to the text and printed it in a new formal adaptation. Ratdolt responded by emphasizing the importance of the illustrations and by printing Sacrobosco's treatise with other texts from contemporary scholars Georg Peurbach and Regiomontanus. His editions could be found across Europe. His choices also inserted Sacrobosco's thirteenth-century treatise into contemporary academic debates. Finally, Ratdolt's edition set a formal standard, completed with Santritter's 1488 edition, and copied in Venice and across Europe. In the following years, many Venetian printers copied the publishing solution developed by Ratdolt and fully realized it in Johann Lucilius Santritter's 1488 edition in an environment of harsh competition. However, other models were developed and coexisted in Venice, probably targeting different audiences and different reading practices.

**Keywords** Johannes de Sacrobosco · Early modern cosmology · Erhard Ratdolt · Early modern Venice · Book history

### 1 Introduction

Johann of Sacrobosco's (d. 1256) *Tractatus de sphaera* was one of the earliest best sellers. By examining the catalog of Sacrobosco's thirty-eight known incunabula editions, one can distinguish three main production centers: Paris, Leipzig, and Venice. Venice, in particular, led the early stages of Sacrobosco's printing history, with four editions existing before 1480. The aim of this paper is to investigate the

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construction process of Sacrobosco's *Tractatus* as a successful venture in the early publishing market. The seminal role of some editions has to be examined: Which formal solutions did they offer? How were these solutions and works copied or adapted by subsequent printers and publishers? Indeed, the key to this successful reception was the publishing solutions implemented in Venice, some of which were copied over the years and proved successful. Three aspects may help us understand Sacrobosco's diffusion in print:

- first, the specific position of individual printers in the Venetian printing industry;
- second, the position of Venetian printers in the European book trade and academic market;
- finally, the way Venetian printers adapted this text in an actualized *mise en livre* (the layout) (Martin 2000; Chartier 1997), as well as the different texts printers chose to combine Sacrobosco's *Tractatus de sphaera* with.

This study will investigate these three elements to consider the early printing diffusion of the *Tractatus de sphaera* and the part played by some editions, as a materially, socially, and economically situated configuration of economic and technical actors, authors, and texts. Specifically, Erhard Ratdolt's (1442–1528) 1482 and 1485 editions are often considered as important milestones for Sacrobosco's printing reception. On that point, bibliographical sources, as well as archival sources, will be used. This documentation will enable us to examine the social and economic background of Sacrobosco's printers. I wish to examine his editorial choices in relation to his position in the Venetian printing world, and as a publishing strategy targeting the European academic public. These editorial choices must be questioned in relation to the choices of previous and successive Sacrobosco printers. The first European book producers did not like innovation for its own sake: innovations could be a great economic risk if the public was confused or did not recognize what it expected in a specific book. One should ask oneself how these various choices were made possible and considered viable in a competitive market; we can then examine their impact on the construction of a publishing model for Sacrobosco's *Tractatus de sphaera*.

This paper will examine Venetian editions of the *Tractatus de sphaera* before 1520, with a special focus on Erhard Ratdolt's editions. Other Italian editions of the earlier times will be examined, but other production centers of the same period will only be mentioned. The leading position of Venice and the fact that local models were often constructed through multiple local influences justifies that scale of analysis, even if a broader study would be useful. However, by the beginning of the sixteenth century, it is no longer justified to focus solely on Venice—this is when our study will end.

**Table 1** List of known Sacrobosco's *Tractatus de sphaera* editions before 1485

Format	Year	Place	Other authors	Producers	Main type of characters	General layout
in 4°, 24 fol., 3 quires	1472	Ferrara	Anonymus, <i>Ratio dierum secundum ordinem planetarum septem</i> (1 fol.)	Belfortis, Andreas	Roman	One column
in 4°, 42 fol., 4 quires	1472	Venice		de Argentina, Florentinus	Roman	One column
in 4°, 28 fol., 4 quires	1475–1477	Venice		Pietro, Filippo di	Roman	One column
in 4°, 18 fol., 2 quires	1478	Milan		Lavagna, Filippo da	Roman	One column
in 4°, 48 fol., 6 quires	1478	Venice	Gerardus Cremonensis	Renner, Franz	Roman	One column
in 4°, 16 fol., 2 quires	1478	Venice	Often found with Gerardus Cremonensis	Adam of Rottweil	Rotunda	One column
in 4°, 20 fol., 3 quires	1480	Bologna	Gerardus Cremonensis	Fusco, Domenico	Roman	One column
in 4°, 60 fol., 8 quires	1482	Venice	Georg Peurbach, Regiomontanus	Ratdolt, Erhard	Rotunda	One column
in 4°, 58 fol., 7 quires	1485	Venice	Georg Peurbach, Regiomontanus	Ratdolt, Erhard	Roman	One column

### 1.1 Before Erhard Ratdolt: Sacrobosco in Italy

Before 1482, Venetian printers issued four editions of the *Tractatus de sphaera* and two others were published in Northern Italy (Table 1).<sup>1</sup>

They were all rather small formats (in-4°, between sixteen and 48 folios, between two and six quires). Their similarities illustrate the original perspective on the *Sphaera*. The very first editions printed Sacrobosco's text alone—the Ferrarese edition only printed one sheet of *Ratio dierum secundum ordinem planetarum septem*,

<sup>1</sup> The editions listed in Table 1 are: (Sacrobosco 1472a, b, 1475–1477, 1478a, b, c, 1480; Sacrobosco et al. 1482, 1485).

but no commentaries and no other treatise. This “stand-alone” type of editions was relatively rare in the course of the publishing history of the *Tractatus de sphaera*: only eighteen of such editions were produced, and all before 1515 (*Sphaera Corpus Tracer*). In 1478, Franz Renner (1450–1486) introduced a shift of perspective: he printed the *Tractatus* with Gerardo Cremonensis’ (1114–1187) work, *Theorica planetarum* (Sacrobosco 1478b). The same year, Adam Burckhardt, also known as Adam de Rottweil (b. ca. 1470), seems to have also produced his edition of the *Sphaera mundi* (Sacrobosco 1478c) at the same time as an edition of Gerardo Cremonensis’ *Theorica planetarum*, but book historians are unsure whether it was the same edition or two simultaneous editions.<sup>2</sup>

In 1478, Franz Renner introduced some formal innovations as shown in (Shank 2012). He maintained the general layout with large margins and a single column, which was also a common format for manuscripts containing Sacrobosco’s *Sphaera* and his commentators (Thorndike 1949). However, Renner was the first to introduce Sacrobosco’s text with woodcuts and decorated initials. The first incunabula editions had no illustration. Printers left some blank spaces (Pantin 2020) and large margins, so that some readers drew their own diagrams, as in the copy of (Sacrobosco 1472a) preserved in the Biblioteca Nazionale Centrale di Firenze.<sup>3</sup> As far as the diagrams go, one could argue that Renner referred in part to the manuscript tradition, which consisted mostly of non-illustrated volumes, but also included a significant minority of illustrated ones (Pantin 2020).<sup>4</sup> The illustrations of Sacrobosco’s *Tractatus de sphaera* used by Renner—the elemental and celestial sphere, the terrestrial zones, and the lunar and solar eclipse—already had a long manuscript tradition, and their use dated back to late antiquity (Pantin 2020; Obrist 2004; Müller 2008). Nine half-page diagrams also illustrate the *Theorica planetarum*. Renner drew inspiration from Johannes Regiomontanus’ (1436–1476) editions in Nuremberg, especially the edition of the *Disputationes contra deliramenta cremonensis* and of *Theoricae novae planetarum* by Georg Peurbach (1423–1462) printed in 1475 (Peurbach 1475). Both editions presented a similar layout, even if Renner chose slightly larger margins and characters. Renner’s diagrams are also much simpler, but the integration of illustrations in the course of the argumentation seems to be a direct inspiration of Regiomontanus’ edition. It presents a significant change in comparison to the previous editions, in which only the text was presented to the buyer, provided that he would fill in the blanks for the initials and main illustrations and draw his own diagrams.

In Renner’s case, the form was new but the content was old: Renner used Regiomontanus’ technical innovations to print the *Theorica planetarum*, which was

<sup>2</sup> See the Incunabula Short Title Catalog (ISTC) and Gesamtkatalog der Wiegendrucke (GW) records for the Sacrobosco and Gerardo Cremonensis editions (Sacrobosco 1478c; Cremonensis 1478).

<sup>3</sup> Call number Magl. A.5.46. The treatise is available online: <https://archive.org/details/ita-bnc-in1-00001011-001>. Accessed 04 June 2021. In the same year, another edition was also published: (Sacrobosco 1472b).

<sup>4</sup> Seven of the twenty manuscripts of *De sphaera* examined by Lynn Thordike in (Thorndike 1949) were illustrated.

precisely the text against which Regiomontanus wrote his *Disputationes contra deliramenta cremonensis*. Michael Shank seemed surprised by this editorial choice, mixing Regiomontanus' formal innovations with the traditional, criticized text attributed to Gerardo Cremonensis (Shank 2012). On the contrary, this publishing strategy is pragmatic and paradigmatic of the printing and book trade during these first years. Four editions of the *Tractatus de sphaera* were issued in Italy before Renner. There was definitely a market for this textbook, but it was a competitive and occupied market. Given this situation, Renner had to take a stand, to distinguish himself. Renner's in-quarto edition, with its Roman type, clear layout, and headlines, with its illustrations and elegant technical solutions, was clearly meant to be a practical textbook for students and scholars. The choice of the *Theorica planetarum* seems to have occurred at two different Venetian printers at the same time for good reasons. The association between the *Tractatus de sphaera* and the *Theorica planetarum* was useful in the context of *quadrivium* classes in universities and was customary in both the academic curriculum and in the manuscript tradition (Thorndike 1949). On the one hand, Sacrobosco's *Tractatus de sphaera* "gave a general introduction to the spherical astronomy and astronomical geography" but very little on the motion of the planets (Pedersen 1981, 114). It could also be used as a manual for the use of the armillary sphere (Valleriani 2020). On the other hand, the *Theorica planetarum* gave students a necessary insight into the motion of the planets, with the help of models and diagrams (North 1994, 235). Without being a commentary of the treatise, the *Theorica planetarum* offered a practical and mathematical systematization of the more theoretical aspects developed in the *Tractatus* and was, therefore, a useful complement for the study of the *quadrivium*.

This "old wine in new skin" strategy was not unusual for the early years of printing, at a time (especially in Venice at the end of the 1470s) when the European and especially Venetian book market began to be congested (Zorzi 1986). In the hope to survive and to make readers buy new editions of texts already on the market, printers and publishers had to insist on the editorial work that brought the old text up to date. The paratexts and the texts printed in the same volume played an important part in emphasizing the novelty and therefore the desirability of a given edition (Chap. 10). This is what Ezio Ornato called the "rhétorique de la nouveauté;" these rhetorical and advertising methods were used by printers and booksellers to create a need for new books (Ornato 1997). Therefore, Renner's strategy was to print texts that the public was familiar with and that was needed in academic curricula. But he printed them wrapped in a new layout inspired by the manuscript tradition, taking advantage of the technical possibilities offered by printing and the lowering of production costs. He positioned himself on the academic market as a printer offering useful texts and relatively secure innovations that did not disrupt the public but enabled readers to buy an illustrated text in print that would have been much more expensive in manuscript form.

Franz Renner's 1478 edition (Sacrobosco 1478b) was an important step in the reception of Sacrobosco's *Tractatus de sphaera* in print. Renner was probably a very well-established printer at the time. Active in Venice since 1471, he was specialized not only in liturgical and religious books—i.e., Bibles, sermons, etc.—but

also in academic books, such as the works of Thomas Aquinas (1225–1274) and the commentaries of Aristotle (385–323 BCE). When he published Sacrobosco's *Sphaera mundi*, Renner already had experience in publishing academic texts and also had the commercial network that enabled him to sell these books across Italy and Europe. He had very close connections with Florentine booksellers. His employee Simone de Verde seemed to have been entrusted with a large number of books to sell to merchants from Lucca and Genoa (Ridolfi 1967, 60–61). Lorenz Böninger recently reconstructed Renner's commercial network between Venice, Florence, Lucca, and Genoa. The bookseller, in association with Venetian patrician Leonardo Donà (1536–1612), had significant sales figures across northern Italy and Tuscany (Böninger 2020). In addition to his own commercial network, Franz Renner had a very close relationship with one prominent Venetian bookseller. His daughter, Cristina Fontana, was married to Francesco de Madii, one of the main Venetian booksellers at the time.<sup>5</sup> The journal of de Madii's shop has been studied by Martin Lowry (Lowry 1979), and more recently by Cristina Dondi and Neil Harris (Dondi and Harris 2013, 2014). In four years, thirteen thousand books passed through his shop; more than thirteen hundred were on sale at the same time, Venetian editions as well as books printed elsewhere in Italy or in Germany (Nuovo 2003, 40). Franz Renner had a close relationship with this major figure in the Venetian book trade at the time and had first-hand experience with the export of this kind of book. He was aware of the demand for books in Venice and in Europe and had ways to distribute them efficiently. On top of that, as with many German printers in Venice, he probably maintained a very close connection with German cities, even after many years in Italy, which allowed him to remain aware of Regiomontanus' editions and technical innovations. His position between the German and Venetian environment enabled Renner to adapt these innovations to his perception of the academic book market.

His solution seemed to have worked out. Adam of Rottweil used the same layout for his own edition of Sacrobosco and of Gerardo Cremonensis, as did Domenico Fusco, a Bolognese printer, for his Sacrobosco and Gerardo Cremonensis edition of 1480 (Sacrobosco 1480). The illustrations were copied from Renner's edition, but much more poorly executed. Franz Renner's publishing choices seemed to have been a good strategy, imitated by both Venetian and Bolognese printers in the following years. It is not an intellectually innovative model, but successful editions at that time rarely were.

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<sup>5</sup> Cristina Fontana was mentioned in 1490, after Franz Renner's death, as "*Dona Crestina relicta de quondam ser Francesco de Mazi da Como et fie che fo del quondam ser Francesco Fontana*" (ASV, Giudici del Procurator, Sentenze a legge, b. 12, fol. 24, December 17, 1490). Cristina soon also became an important figure in the Venetian printing industry, having the inheritance of her father, raising her brother Benedetto Fontana to be a printer himself, marrying for the second time with the printer Paganino Paganini, and raising the illegitimate son of her husband, Alessandro, also to be a major printer in Venice. See in particular (Nuovo 1990).

## 2 Erhard Ratdolt's Editions in the Venetian Context

### 2.1 Renner Versus Ratdolt

Erhard Ratdolt, like Franz Renner, had been active in Venice for some years when he printed the *Sphaera mundi*. He arrived from Augsburg in 1476, where he was a bookbinder just before he left for Venice (Redgrave 1894; Gerulaitis 1970). He began printing with two other German associates: Bernard Maler (d. 1477) and Peter Löslein (d. ca. 1487). The debate is still open as to whether Maler was responsible for the artistic quality of the company's editions. Their first editions in Venice were Regiomontanus' *Calendarium* in Latin and in Italian. Ratdolt, Maler, and Löslein were the first to publish the German astronomer apart from his own editions in Nuremberg. It is not likely that Ratdolt was in Nuremberg when Regiomontanus printed there between 1473 and 1475, since he is last mentioned in Augsburg's tax books in 1474, and he mentions in an autobiographical document that he came to Venice on September 15, 1474, "for the last time."<sup>6</sup> However, Nuremberg and Augsburg had close links at the end of the fifteenth century. Therefore, it is not at all surprising that Ratdolt had good working knowledge of contemporary astronomical debates and more specifically of Regiomontanus' scientific and publishing work. Ratdolt, Maler, and Löslein's company ended in 1480, but Ratdolt continued to print texts related to the *quadrivium*. By 1482, Ratdolt already had a great deal of experience printing illustrated texts and academic books.

During his Venetian career, alone or in collaboration with others, Erhard Ratdolt dedicated almost a third of his production to mathematical, geometrical, astronomical, or alchemical texts such as Pietro Borgo's (d. after 1494) *Aritmetica mercantile* (Borgo 1484), Gaius Julius Hyginus' (64–17 BCE) *Poetica astronomica* (Hyginus 1482), and of course Euclid's (4th–3rd cent. BCE) *Elementa geometrica* (Euclid 1482). He managed this ambitious publishing agenda by diversifying his publications and publishing some breviaries and other liturgical books. These editions were likely to sell quickly and safely, which enabled him to have more peculiar or even risky projects, like refined illustrated editions. From the beginning, Ratdolt positioned himself as a specialist in publications related to mathematics, natural science, and astronomy. In that context, Renner's 1478 edition may be seen as a provocation. Before that date, Renner did not seem to have taken an interest in that specific kind of work. However, in 1478, not only did Renner published the *Tractatus de sphaera*, he also printed Dionysius Periegetes' (b. 290) *De situ orbis* (Periegetes 1478), and Pomponius Mela's (b. 15) *Cosmographia* (Mela 1478a). Erhard Ratdolt had already published the first one in 1477 (Periegetes 1477) and the latter in 1478 (Mela 1478b).

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<sup>6</sup> The hypothesis of Ratdolt's stay in Augsburg was suggested in (Redgrave 1894) but refuted by (Gerulaitis 1970) on the basis of this autobiographical document, "*Notae biographicae et genealogicae, quas Erhardus Ratdolt, primus Venetiarum reipublice typographus, de se suisque propria manu conscripsit, a. 1462–1524 de currentibus, Germ.*," last edited in (Diehl 1933): "1474 ady 15 setemer. Item ich bin dass lest mal gen Venedig kumen."



If we take a closer look at these editions, one can see that the relationship between the two printers is more intricate than a simple overlap of editorial strategies. If the two *De situ orbis* editions are already very similar, Renner's edition of Pomponius Mela is a direct line-by-line copy of Ratdolt's 1478 edition—as has already been noted by Redgrave (Redgrave 1894, 14). The only difference is that Ratdolt's edition has bigger margins, the woodcut initials are different, and of course, the colophons differ. Moreover, the Roman characters used in these two editions are extremely similar and can be traced thanks to the *Typenrepertorium der Wiegendrucke* (TW).<sup>7</sup> The characters used by Ratdolt when he first arrived in Venice were very close (but not identical) to Renner's (TW 1:109R), which he had been using since 1471. This kind of Roman type was probably inspired by Regiomontanus' work in Nuremberg (TW 1:94R), Wendelin de Spira in Venice (TW 4:85R), and Nicholas Jenson (TW 1:115R) (Redgrave 1894). When Ratdolt first arrived in Venice in 1476, and while he was in partnership with Maler, he used Roman characters very similar to those of prominent printers at the time. He changed after 1480 and used mainly *rotunda* types in the years that followed.<sup>8</sup> However, at the end of the 1470s Ratdolt's types do not seem to have gone unnoticed. In 1478, for his edition of Dionysius Periegetes' *De situ orbis*, Renner changed his Roman font and used a slightly different type (TW 5:109R), extremely close to Ratdolt's (TW 1:109R), which he used in his own *De situ orbis* edition in 1477. We can only make assumptions, but it seems very likely that Renner copied Ratdolt's types to pursue the same market for scientific editions.

It is highly improbable that these similarities were due to a peaceful collaboration between the two German printers. First, had it been an agreement between both printers, Renner would not have copied Ratdolt's characters but would have borrowed or rented them. Moreover, the publication of strictly identical editions, as were the *De situ orbis* and the *Cosmographia* editions, is a commercial nonstarter. Two workshops could publish similar editions while collaborating: for example, in 1477, Johann of Cologne published the second part of Antonin of Florence's *Summa theologiae* (Florentinus 1477a) while Nicholas Jenson (d. ca. 1480) was simultaneously printing the third part (Florentinus 1477b). This led Martin Lowry to believe that an agreement existed between the two firms, before their formal merger in 1480 (Lowry 1981). In this case, the two editions were complementary and did not concern the same text, contrary to Renner's and Ratdolt's case. Their simultaneous editions would not be bought twice by the same reader and could risk flooding a still fragile and unstable book market (Zorzi 1986). The similarities between Ratdolt's and Renner's editions were likely the result of direct and aggressive competition for the market of academic books.

At the end of the 1470s, the Venetian printing industry was a highly competitive one and printers fought to exist in the shadow of the two main typographical companies, Johann of Cologne and Johann Manthen on the one hand, and Nicholas Jenson

<sup>7</sup> The characters used in both editions of *De situ orbis* are Renner's 5-109R and Ratdolt's 1:109R according to the TW.

<sup>8</sup> According to the TW, Ratdolt used a variety of *rotunda* characters between 1480 and 1482: 4:56G, 5:155G, 6:76G. This formal change in Ratdolt's production will be examined later on.

on the other. Franz Renner and Erhard Ratdolt saw a commercial opportunity in astronomical treatises, a kind of niche publication. This led to their direct confrontation and to what we can clearly identify as Renner's piracy of Ratdolt's publications between 1476 and 1478. Ratdolt's 1482 edition of the *Tractatus de sphaera* can be seen as a response to this attack, on an editorial but also on an intellectual level.

## 2.2 *Ratdolt's Reinterpretation of Sacrobosco's Tractatus de sphaera*

Erhard Ratdolt's 1482 edition (Sacrobosco et al. 1482) is a milestone for Sacrobosco's reception from different points of view. First, the 1482 edition was the first one that associated Sacrobosco's *Sphaera mundi* with Georg Peurbach's *Theoricae novae planetarum* and Regiomontanus' *Disputationes contra Cremonensia deliramenta*. As we mentioned before, Regiomontanus saw Peurbach's text as a replacement for the old *Theorica planetarum* (Horst 2019). Erhard Ratdolt clearly adopted this point of view by choosing to print Sacrobosco without any of the traditional medieval commentaries or treatises, but with the new treatise on the motion of the planets, alongside Regiomontanus' plea for the new *Theoricae* and criticism of the old *Theorica planetarum*. By doing so, Ratdolt inserted the *Tractatus de sphaera* in the intellectual debates of the time on Ptolemaic and Aristotelian models (Pedersen 1981); these debates were particularly vivid in the humanist and intellectual circles of southern Germany and in Austria (Horst 2019). Owen Gingerich stated that binding Sacrobosco's *Sphaera mundi* with Peurbach's *Theoricae novae planetarum* had been common since the beginning of the fifteenth century (Gingerich 1999). However, the manuscripts studied by Michela Malpangotto only contain Peurbach's treatise, not the *Sphaera*, even in Viennese copies (Malpangotto 2012). It does not appear that the habit of reading Sacrobosco with Peurbach was very well established (Pedersen 1975). Ratdolt's choice can be explained by his knowledge of the learned debates in southern Germany, but could also be reproduced in a Venetian and Italian context. Peurbach's work was supported by Cardinal Bessarion (1403–1472), who himself possessed a copy of the *Theoricae novae planetarum* (Horst 2019). Bessarion being close to the political and intellectual Venetian elite, the reception of Peurbach's treatise was probably facilitated thereby. Moreover, Bessarion also acted as pontifical legate across Italy and Europe. He protected Regiomontanus in Rome in the 1460s, and the German astronomer died there in 1476. The decision to print Peurbach's treatise and Regiomontanus' text alongside the *Tractatus de sphaera* can be understood in this intellectual environment.

Given these various elements, Ratdolt must have felt that Peurbach's treatise was likely to have a good reception both in German-speaking regions and in the Italian peninsula. His personal knowledge of it is not surprising given the tight links he maintained with the German-speaking region and, at the same time, his close connections to the Venetian patriciate. He also received the support of some officials,

such as Matthias Corvin and Michael Turon, bishop of Milkow and suffrage bishop of Esztergom in Hungary, who commissioned him a breviary for the diocese Esztergom in 1480 (*Breviarium* 1480). His connections with Augsburg authorities must have still been important: in 1486, he returned to his city, called upon by the bishop of Augsburg. He also remarried in Augsburg in 1485, while he was still active in Venice.<sup>9</sup> In Venice, apart from his close partners Maler and Löslein, and a collaboration with the German printer Nicolas of Francfort (1473–1524), Ratdolt does not seem to have had many professional relations in the Venetian book market, especially outside the German community. However, he was not without support: some of his editions included luxury exemplars, printed on vellum and in gold. The letter of dedication and the remaining exemplars lead us to believe that the edition was probably completed in part with the support of the doge Mocenigo (Carter et al. 1983; Baldasso 2013). While choosing to print Peurbach's and Regiomontanus' texts, Ratdolt was probably already counting on the support of part of both the south-German and Venetian elite, some of whom were already well aware of these works and their intellectual significance.

### 2.3 *Sacrobosco and the Italo-German Comparison*

The direct influence of Regiomontanus' editions and the choice of German authors to print in complement to Sacrobosco's *Tractatus de sphaera* can also be understood in relation to the position of Ratdolt between Venice and German cities, and more generally the German market. Ratdolt's catalog already presented a certain number of German authors: Werner Rolewinck (1425–1502) *Fasciculus temporum* (Rolewinck 1480; Rolewinck 1481), Paul of Middelburg's *Prognostico* (Middelburg 1481–1482). After 1482, he also published Johann Danck's commentary of the Alphonsine tables (Alfonso 1483), Mark of Lindau's *Buch der zehn Gebote* (Lindau 1483), and two more editions of Rolewinck's *Fasciculus* after 1482 (Rolewinck 1484, 1485). These publishing decisions can be linked to the close ties he maintained in German cities and to his targeting of German markets. Moreover, for German scholars, Regiomontanus must have been a particularly good selling argument. In the humanist circles of Augsburg, Nuremberg, or Vienna, in the universities of Leipzig or Cologne, demand for such books and the appeal of names well known to local scholars such as Peurbach or Regiomontanus was likely to be high. Later sources underlined the prestige associated with that name. Back in Augsburg, Ratdolt called Regiomontanus "the ornament of Germans" (*germanorum decor*) in a 1488 edition of the almanac.<sup>10</sup> He was not the only one. At that time, German authors and humanists often cited the

<sup>9</sup> Ratdolt wrote: "1485 ady 27 setemer in Augspurg. Item ich hab mein weib fronica genomen den obgeschriben dag und hab huchzeit mitt ir gehabt. 1485 ady 14 nobemer" (Diehl 1933) (Vienna, Osterreichische Nationalbibliothek 15473).

<sup>10</sup> "Johannis de Monte Regio, germanorum decoris, etatis nostre astronomorum, principis Ephemerides" (Author's emphasis) (Regiomontanus 1488, 1r).

German astronomer as an object of pride: Hartmann Schedel used a similar expression, “honor of Germans” (*germanorum decus*), to qualify Regiomontanus (Zinner 1990, 187–188). At a time when the German-speaking territories were divided into a multitude of political entities, these expressions can nonetheless be interpreted as a manifestation of a German conscience of worth in the intellectual contemporary debate, which thrived especially thanks to the emulation of Italian scholarship. The comparison with Italian writers was a real concern for German humanists, between admiration, emulation, and competition, as has been shown, among other examples, in (Bertalot 1975; Dörner 1999; Gier 2010). This phenomenon was not limited to academic controversies. The genre of works dedicated to specific cities, such as Conrad Celtis' (1459–1508) *Norimberga*, also displayed such a comparison with Italian cities and local pride (Celtis 2000; Buchholzer-Rémy 2006). In the arts, Albrecht Dürer's (1471–1528) life and writings are a good example of the ambivalent sentiment German artists could have toward Italy, between admiration and conscience of self-worth (Vaisse 1995).

The intellectual context of emulation between German and Italian scholars laid an interesting backdrop for printers in search of a public. In the early years, Venetian printers of Germanic backgrounds often addressed their origin as an object of pride. The very first printer in the city, Johann de Spira (d. 1470), clearly stated in his colophons the profit German printers brought to Venice,<sup>11</sup> and his brother Vindelinus even prophesied that their hometown, Spira, would be as celebrated as Mantua, Virgil's (70–19 BCE) motherland.<sup>12</sup> In this context, Peurbach's and Regiomontanus' publication could also be seen as a way to assert the worth of German scholarship, printed by German printers in an Italian city. The link between these publications and a German affirmation of self-worth in Venice is explicit in the 1488 Sacrobosco edition, financed by Johann Lucilius Santritter (1460–1498). He was a scholar as well as an investor. In his 1488 edition of Sacrobosco, the colophon is in the form of a poem praising his work, presenting himself as “Joannes Lucilius Santritter from the city of Heilbronn,” acknowledging Girolamo de Sanctis' work as a printer. In a second paragraph, Santritter underlined the “German genius” (*ingenio germanico*), which enabled the completion of his book—he might be talking of himself as well as

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<sup>11</sup> Johan de Spira's colophon reads: “*Primus in Adriaca formis impressit aenis/Urbe libros Spira genitus de stirpe Johannes/In reliquis sit quanta, vides, spes, lector, habenda/Quom labor hic primus calami superaverit artem*” (Cicero 1469); “*Hesperiae quondam Germanus quisque libellos/Abstulit: en plures (plura) pise daturus adest./Namque vir ingenio mirandus et arte Joannes/Exscribi docuit clarius aere libros./Spira favet Venetis: quarto nam mense peregit/Hoc tercentenum his Ciceronis opus*” (Cicero 1470). This affirmation of a proud German identity is particularly developed in Venice and had an effect on the way these German printers were perceived in the Italian context; see (Amelung 1964; Kikuchi 2018c).

<sup>12</sup> Vindelino de Spira wrote: “*Vindelinum.../Cui tantum debes urbs spira superba nepoti/Quantum Virgilio mantua clara suo*” Niccolò Tedeschi (Nicolaus Panormitanus de Tudeschis), *Lectura super primo et secundo Decretalium*, vol. 3: (Tedeschi 1472); and again in 1473, “*Supra tua est virtus italias jam nota per urbes/Ore tuum nomen posteritatis erit*” (Caracciolo 1473). For a complete study of the German community in Venice, see (Braunstein 2016).

the authors published.<sup>13</sup> These points, in an edition containing two texts of German scholars and financed by a German publisher in Venice, are to be understood in this context of competition as an affirmation of the role of German craftsmanship, commerce, and scholarship.

Not only astronomy should be considered to understand Ratdolt's and Santritter's publishing choices. The emphasis on the German origin of printers and scholars in the context of early printing is not only a question of national pride but a commercial one. The German market played an important part in the development of early Venetian printing, and it certainly played a part in Ratdolt and Santritter's strategy, whether they had personal opinions on the intellectual content or not. One way or another, Erhard Ratdolt took advantage of the situation to fashion himself as a thorough scientific publisher and printer on the new and unstable market of academic books.

## 2.4 Ratdolt's Reinterpretation

Erhard Ratdolt was in the right position to print Peurbach's and Regiomontanus' texts with Sacrobosco's *Tractatus de sphaera*. As a well-known Venetian printer, aware of scholarly debates in Germany and in Italy, and capitalizing on the emulation between German and Italian scholars, he made the opposite choice of his opponent, Franz Renner. Regiomontanus' text is a clear and ferocious criticism of the errors and "deliramenta" contained in the old *Theorica planetarum*. Ratdolt positioned himself in a learned debate as well as in an economic market. To that end, he also adapted the form of his edition, going further than Renner. The specific *mise en livre* he chose played a large part in the success of these editions.

The material analysis of Erhard Ratdolt's edition of the *Sphaera mundi* is not new and we will only rehearse the main aspects of it here. The 1482 edition is an in-quarto volume of 60 folios and eight quires, printed in black and red. The layout is dense but leaves a large place for illustrations, which are of high quality. The sketches and tables are printed within the text blocks, as part of the demonstration itself. Owen Gingerich underlined the apparition in Ratdolt's edition of two large figures, an armillary sphere and a sketch of the geocentric universe, which became typical in subsequent editions (Gingerich 1999). He also followed the circulation and transformation of some specific illustrations, as did Jürgen Hamel (Hamel 2006). Ratdolt used all of Regiomontanus' technical innovations to illustrate Sacrobosco as well as the two other texts assembled with the *Sphaera mundi*: tables, geometrical diagrams, models for the eclipse and the movement of the planet, decorated initials,

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<sup>13</sup> Johann Lucilius Santritter wrote: "*Carmina impressorum huius opusculi laudem//Uranie quantum debere fatentur/Cuncta canopeo: cognitaque astra viro/Santritter helbonna lucili ex urbe Joannes/Schemata sic debet ipsa reperta tibi/Naec minus haec tibi de Sanctis Hieronume debent/Quam socio: nanque hic invenit: ipse secas.//Hoc quoque sideralis scientiae singular opusculum/mirifica illa arte nuper ingenio germanico/in lucem prodita impression videlicet/Prididie calenda Aprilis./Anno Salutis./M. cccc.lxxviii/completum est/Venetis.*" (Author's emphasis): Sacrobosco, *Sphaera mundi*: (Sacrobosco et al. 1488).

etc. Some of the sketches were directly copied from Regiomontanus' edition of the *Theoricæ novae planetarum* (Shank 2012). The layout is fuller than in Renner's edition, but the accent is on the beauty, legibility, and diversity of the illustrations. This is truer for the 1485 edition (Sacrobosco et al. 1485), in which the illustrations are even more abundant and diverse (Fig. 1).

Isabelle Pantin (Pantin 2012) underlined how the introduction of diagrams and illustrations in Ratdolt's edition created a standard for the printers and the public. We will see at a later stage how printers reacted to this new standard. After Ratdolt, readers largely expected the *Tractatus de sphaera* to be illustrated, even if it meant a larger investment. It also gave more commercial value to the editions; the vitality of the study of mathematics at the time made the investment worthy of the risk. For Peurbach's treatise, the illustrations were also needed, not only as a demand from the public but also for the pedagogical value of the sketches (Pantin 2012, 2013). In Ratdolt's strategy, Sacrobosco's edition must of course be understood in parallel with the 1482 edition of Euclid's *Elementa*. It was the first attempt to publish Euclid, and Ratdolt immediately set a standard by presenting this richly decorated and illustrated version of the text. The format is different since it is an in-folio; the layout of the illustrations is slightly different since they are not inserted in the block text. However, illustrated scientific books and their pedagogical use were something Ratdolt had been taking seriously during these years.

The first edition sold well; Ratdolt was able to reissue a second version only three years later, a very short period in terms of the delay of profitability in the fifteenth-century printing industry.<sup>14</sup> He took advantage of the reissue to change the form of the edition significantly. The illustrations offered a new pedagogical, visual, and more practical way of conveying these texts. The choice of texts accompanying the classical treatise of Sacrobosco integrated the thirteenth-century *Tractatus de sphaera* in the actual practice and study of contemporary astronomy.

Not only were the illustrations richer and more elaborate in the 1485 edition, but Ratdolt also used a Roman character, rather than the *rotunda* he used in 1482. *Rotunda* types were widely used in Europe for medical, juridical, or mathematical publications. However, Ratdolt's first edition of the *Tractatus de sphaera* was an anomaly among the early editions of Sacrobosco: all were printed in Roman characters except Adam of Rottweil's 1478 edition. If one examines Ratdolt's production in 1482, none of the main sets of types of his publications during this period are Roman. That year, Ratdolt also used a *rotunda* type in printing Alchabitius' *Libellus isagogicus* (Alchabitius 1482) and Jacobus Publicius' *Artes orandi* (Publicius 1482) but reissued them both in 1485 with Roman types (Alchabitius 1485; Publicius 1485). He chose to print texts from the *artes* curriculum in gothic types when other printers would have printed them in Roman.



Was it a deliberate choice or the consequence of the circumstances? Ratdolt seemed to cease using Roman fonts after the end of his partnership with Maler and Löslein, in 1480. Did his partners leave with the material? It seems unlikely

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<sup>14</sup> For an example of delay between production and return on investment, see (Pettas 1973). For the example of Aldus Manutius, see (Kikuchi 2018a).



sicut patet de de/  
nario p̄iecto ī sū/  
do aque lym̄pide  
q̄ p̄pter sim̄ile dif/  
gregationē radio  
rū apparet maior/  
q̄s suę uerę quāti/  
tatis.

**QVOD TERRA SIT ROTVND A.**  
Qd̄ etiā terra sit rotūda sic patet. Signa & stelle nō ēqualiter  
oriunt̄ & occidunt omnibus hominib⁹ ubiq; existentibus: sed  
prius oriunt̄ & occidunt illis q̄ sūt  
uel uersus orientē: & q̄ citius &  
tardius oriunt̄ & occidunt q̄bus/  
dam: causa ē tumor terre: qd̄ bñ  
patet p̄ ea q̄ sūt in sublimi. Vn a  
enī & eadē eclypsis lunę nume/  
ro quę apparet nobis ī prima ho  
ra noctis: apparet orientalib⁹ cir  
ca borā noctis tertiā. Vnde con  
stat q̄ prius fuit illis nox. & sol  
prius eis occidit q̄ nobis. Cuius rei causa ē tantū tumor terre.  
Qd̄ terra etiā habeat tumorositatē a septētrione ī austrū: & ecō  
rra sic patet. Existentib⁹ uersus septētrionē quędā stelle sūt sem  
piterne apparitiōis, scz q̄ p̄pinque accedūt ad polū arcticū. Alię  
uero sūt sempiternę occultatiōis sicut illę quę sūt p̄pinque polo  
antarctico. Si igit̄ aliq; p̄cederet a septē  
trione uersus austrū: intantū posset p̄ce  
dere: q̄ stelle quę pri⁹ erāt ei sempiternę  
apparitiōis: ei iā tenderēt in occasum &  
quāto magis accederet ad austrū: tanto  
plus mouerent̄ in occasū. Ille iterū idem  
hō posset uidere stellas quę pri⁹ fuerant  
ei sempiternę occultatiōis. Et ecōuerso

**Fig. 1** Erhard Ratdolt’s editions provide a close text-image relationship, facilitating the reading of the treatise while offering small informative but also decorative figures, that were copied across Europe. Santritter replicated the same kind of layout in his 1488 edition with a new set of woodcuts. (Sacrobosco et al. 1485, 4v). München, Bayerische Staatsbibliothek—4 Inc.c.a. 430. <https://nbn-resolving.org/urn:nbn:de:bvb:12-bsb00036841-7> CCBY-NC-SA4.0

that Ratdolt did not have the ability to secure a new Roman set since in the same years he had important investments for his Euclid's *Elementa*. But sets of characters were expensive, and it is possible that he chose to continue his activity with his *rotunda* characters while waiting for the right moment to acquire new Roman sets. It was obviously the case in 1485 when he issued a series of publications in Roman types, including a reprint of some of the previously *rotunda*-printed works. While this evolution may be partly due to technical, financial, and material issues in Ratdolt's workshop, it could also indicate how the categorization of works and the use of Roman or Gothic characters were still very unstable. For the same text, and from the same printer in a short period of time, formal aspects could be modified to appeal to different audiences. *Rotunda* characters tended to be more common for university law and medicine textbooks, while Roman characters were used for classical texts or *studia humanitatis* treatises, the kind of works that were also read outside teaching institutions. The importance of Sacrobosco's academic reception is undeniable, but it is also plausible that the use of Roman characters was also a way to target a larger audience. The ambiguity is still present in Venetian production at the end of the fifteenth century, in the production of Ratdolt's successors.

## 2.5 *An Actualization of the Tractatus de sphaera*

While Ratdolt's edition was a key part of a coherent and comprehensive publishing strategy concerning mathematics and natural sciences, it also offered an actualization of the thirteenth-century *Tractatus de sphaera*. In comparison to the previous editions in Venice and in Italy, Ratdolt managed to offer a new material object as well as intellectual content and integrated them into the intellectual debates of his time. It could be used in a traditional teaching context as a standard textbook for students (Chap. 12), offering pedagogical help and a lower cost; it could also be read at a higher level, by scholars interested in the latest astronomical debates. Ratdolt's coherent publishing strategy was able to reach a large audience.

The actualized form and content of the *Sphaera mundi* also had important consequences on the status of those involved. Erhard Ratdolt used the reputation he had already acquired before 1482 to promote this new publishing achievement. In return, he also consolidated his trademark as an academic up-to-date printer, by associating himself with a classical textbook used in universities and with works written by contemporary scholars. The status of the three authors also changed in the process. Thanks to his association with one of the most read textbooks in astronomy, Peurbach and Regiomontanus consolidated their status as important authors in the academic field. The aura of Sacrobosco was used as a "label" in the sense Matteo Valleriani gave to the expression (Valleriani 2017, 430). The association with Sacrobosco probably allowed both authors to gain legitimacy. The next editions of the *Tractatus de sphaera* included the same compilation of works as Ratdolt's, which enforced the association in the publishing market and intensified the legitimization and labeling of both contemporary authors. Peurbach was probably the one who



gained the most in the exchange. This edition was the first step toward the development of his own publishing reputation. In 1495, Peurbach's *Theoricae planetarum* was published in Venice for the first time on its own since Regiomontanus' 1474 edition, and no longer as an addendum to Sacrobosco's or Regiomontanus' works (Peurbach 1495). He continued to be published on his own and with commentaries during the sixteenth century, in German printing centers as well as in Paris (Pantin 2013). Regiomontanus continued to be printed occasionally in Venice, but mainly in German centers such as Nuremberg and Basel.

But the most important consequence would be for Sacrobosco's text: instead of being relegated as a text from a time gone by, his work was completely integrated with the new discussion, and therefore into the editorial programs of printers all over Europe. While Sacrobosco maintained his position as an important author in academic curricula, he also gained a sense of novelty, thanks to the association with the new form and recent authors. The idea that Sacrobosco was relevant was an extremely important selling point on the new academic book market, as we already mentioned. The *mise en livre* Ratdolt introduced allowed the text to be reinterpreted along with the evolution of the study of mathematics in Renaissance Europe: as later editions show, it became customary to associate Sacrobosco's *Tractatus de sphaera* with treatises and commentaries of other contemporary scholars. Ratdolt gave way to that kind of construction while discarding the old *Theoricae planetarum* and giving his preference to Regiomontanus' and Peurbach's works. For that reason, Ratdolt's editions were an important step in the reception and posterity of Sacrobosco's text, enabling it to be read not only for itself but also in relation to the texts of contemporary scholars.

In that sense, Sacrobosco was not only a label; the perception of his name changed according to the context in which it was used. The presence of multiple names, be they authors, commentators, editors, or printers, alters the perception of all of them individually and collectively. This co-presence created something more than the simple addition of individuals and texts. A compilation that associates these different entities created a new identity and a narrative through the interactions between them.<sup>15</sup> The prestige of some authors or printers may serve in return to enhance the prestige of the other actors associated with a given compilation. This phenomenon may explain why some authors kept being published, while others never really made it to the new printing industry, and some new names managed to emerge from the multitude of authors and commentators present in the book market. This is one explanation why Sacrobosco continued to be published in the following years and decades, rarely alone but in association with other authors, some of the contemporary scholars.

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<sup>15</sup> This analysis is inspired by Harrison White's network analysis, especially in (White 2011) and I worked on a case study in a recent article (Kikuchi 2018b). Recent studies have also shed light on the intricate relationships between every name involved in a compilation and the implication of the compilation or collection format (Ouvry-Vial and Réach-Ngô 2010; Réach-Ngô 2014; Furno and Mouren 2012). See also (Grafton 2011).

### 3 Diffusion and Reinterpretation of Ratdolt's Editorial Model

#### 3.1 Diffusion of Ratdolt's Editions in Europe

As we have examined how Ratdolt's editions offered a new editorial model, at a formal and intellectual level it is now necessary to turn to the actual diffusion of the exemplars produced. This kind of investigation is always a difficult one since we have to rely on the remaining exemplars, which do not always give us relevant information as far as their fifteenth-century ownership is concerned. Thanks to the progress in cataloging from the last decades, it is now possible to have an almost complete overview of the surviving incunabula and their places of conservation. Given this information, present in the ISTC, Ezio Ornato investigated the localization of the surviving copies and inferred the areas these books could reach also based on the global commercial tendencies of the time. His hypothesis is that the circulation of books after their first sales, through collectors, sales of private collections, etc., rarely traveled beyond regional boundaries and does not prevent us from reaching some partial conclusions regarding the commercial networks of printers in the fifteenth century. If one except the bias introduced by great libraries such as the Bibliothèque Nationale de France in Paris or the British Library in London, and the displacement of books in non-European countries, the data might be interpreted with caution (Ornato 2017). The overview of the exemplars remaining in Europe today offers a first overview of the possible diffusion of both editions (Table 2). The 1482 edition has 113 exemplars remaining, 104 of which are in Europe or Russia. The 1485 edition has 110 exemplars remaining, 91 of which are in Europe or Russia. We have presented the distribution of the remaining copies in their holdings, according to contemporary political entities.

Unsurprisingly, the data seems to indicate that both the Italian and the German markets were important for the commercialization of Ratdolt's books. The number of copies is also higher in France for the second edition, but five of those are in the Bibliothèque nationale de France, which might give us false indications.

This method can give us an initial overview; however, it seems too unreliable, especially for editions such as Ratdolt's, which could have interested bibliophiles from the sixteenth century until today. Venetian printed books were under the eye of collectors from all over Europe. Examples present in France today could have been brought back by eighteenth-century bibliophiles.<sup>16</sup> The contemporary localization of exemplars is offered here as a first attempt, but, in our opinion, it cannot be used as a robust argument.

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<sup>16</sup> See for instance François-Xavier Laire, a French collector, who went to Venice in 1789–1790: He encountered Jacopo Morelli, librarian at the San Marco library, who wrote to Angelo Maria Bandini that Laire talked to him endlessly of Quattrocento books: “Qui mi trovo frequentemente col p. Laire da Lei raccomandatemi e si parla di libri del Quattrocento sine fine.” The same Laire was considering doing a catalog of all Venetian Quattrocento editions (Ruffini 2012). This kind of collector was very likely to buy books during a trip.

**Table 2** Localization of surviving copies of 1482 and 1485 Ratdolt editions in Europe and Russia

	Austria	Croatia	Belgium	Czech Republic	Denmark	Finland	France	Germany	Hungary
1482	4		1	1	1	1	3	20	2
1485	3	2					11	23	2
	Italy and Vatican	Netherlands	Poland	Portugal	Russia	Spain	Sweden	UK	Switzerland
1482	44	2	1	2	1	3	2	16	
1485	25	3		1	3	5	1	11	1

Another method to track the circulation of books is to examine the books themselves for possession marks and annotations that may indicate their location at different times. The systematic examination of the surviving copies of incunabula editions considerably diminishes the information available but also limits the risks of over interpreting the results. Cristina Dondi and her ERC Project *15c Booktrade* aimed to make a systematic catalog of all remaining incunabula by examining all the marks that could reveal information on their circulation until today (Dondi 2013). This project gave birth to *Material Evidence in Incunabula* (MEI), a database “which provides copy-specific information on some of the copies listed in ISTC,” according to the presentation. For the 1482 and 1485 Ratdolt editions cataloged in the ISTC, only sixteen and eight copies out of 113 and 110, respectively, are present in the MEI database. This is a drastic reduction of data, but one which can nevertheless yield interesting results. The MEI visualization tool (<https://15cbooktrade.ox.ac.uk/visualization/>) shows that Ratdolt's 1482 edition was probably well distributed in Italy, with five exemplars that can be traced in the peninsula before 1500. However, some copies arrived in Switzerland, Austria, and England not long after the publishing date. The information concerning the 1485 edition is scarcer, but one can still observe that one copy was in Spain around 1500.

These observations are confirmed by the examination of copies in other libraries that are not yet included in the MEI database. For example, the copies currently at the Bayerische Staatsbibliothek were bought by German institutions at the end of the fifteenth or the beginning of the sixteenth century. One copy of (Sacrobosco et al. 1482),<sup>17</sup> has an *ex libris* from the Benedictine convent of the Holy Virgin in Scheyern, in Bayern. A copy of (Sacrobosco et al. 1485),<sup>18</sup> belonged to Johann Albrecht Widmannstetter, a German humanist of the sixteenth century. Outside of the German world, the study of remaining copies seems to confirm a commercial distribution toward France. A copy of (Sacrobosco et al. 1485) preserved at the Bibliothèque Sainte-Geneviève in Paris<sup>19</sup> shows many marginal annotations from the end of the fifteenth or beginning of the sixteenth century, including some in French. The copy of (Sacrobosco et al. 1485) preserved at the Bibliothèque Mazarine<sup>20</sup> used to belong to the Collège de Sorbonne, probably bought not long after the publication date.<sup>21</sup>

The information we have on the distribution of these volumes is always very fragmentary. However, it seems important to underline the wide spectrum of Ratdolt's distribution in Europe, in Italy, and the German world—which is expected considering the background of Erhard Ratdolt—but also in France and in Spain, toward religious institutions and universities. In the 1480s, before his departure from Venice, Erhard Ratdolt must have had a very stable commercial network in Europe, which

<sup>17</sup> Bayerische Staatsbibliothek, 4 Inc c.a. 256.

<sup>18</sup> Bayerische Staatsbibliothek, 4 Inc c.a. 430.

<sup>19</sup> Bibliothèque Sainte-Geneviève Paris, OEXV 762 (2) RES (P.2).

<sup>20</sup> Bibliothèque Mazarine, Inc 412–413.

<sup>21</sup> See Catalogue Régional des Incunables Informatisé (CRII), <http://www.bvh.univ-tours.fr/incunables.asp>. Accessed 08 June 2021.

enabled him to launch some very ambitious editions, such as the 1482 and 1485 editions of Sacrobosco, as well as the 1482 edition of Euclid's *Elementa*. Contrary to Franz Renner, we have few archival sources about Ratdolt's commercial networks. The distribution of his books together with Ratdolt's close connections with Venetian patricians and German cities tend to indicate that he had the means to distribute his production efficiently. However, it is difficult to reach any conclusion about the various markets targeted by the first and second editions.

### 3.2 Adaptations of Ratdolt's Model

Erhard Ratdolt left Venice in 1486 to go back to Augsburg, where he continued publishing Regiomontanus' work and other scientific texts. His departure left space for other printers to occupy the scientific market in Venice (Table 3).<sup>22</sup>

The first to take advantage of the opportunity was Johann Lucilius Santritter. Santritter hailed from Heilbronn like Renner, but he never worked with him. Instead, he worked with Ratdolt on five editions between 1481 and 1485. He must have seen Ratdolt working on Sacrobosco and copied his work in an edition published in 1488 (Sacrobosco et al. 1488). Some of the initials are very similar, but were not printed from the same material: Santritter or his printer, Girolamo de Sanctis (fl. 1487–1494), probably copied the initials from Ratdolt's edition. Ratdolt's 1485 edition also directly inspired their diagrams, with some minor transformations, even if the 1488 edition offers a few new diagrams as well. The general disposition of illustration and text is very close in both editions; Santritter obviously followed the formal model introduced by Ratdolt. The *Tractatus de sphaera* is illustrated in the margins and in the space left by the blocks of text; illustrations are small woodcuts but directly linked to the text they refer to (Figs. 1 and 2). Peurbach's *Theoricæ novæ* are printed in big, unified blocks of text and illustrated with half-page, sober, factual diagrams, whose purpose was to convey the physical and mathematical movements of the celestial bodies. The 1485 edition was the model retained and copied, not only in Venice, but also in other printing centers and from various points of view: Ratdolt's 1485 edition was also the model for Wolfgang Hopyl's (fl. 1489–1523) 1489 edition in Paris, as far as the text and layout were concerned, but with only two illustrations (Pantin 2013, 23). Ratdolt's illustrations also provided a model for the Leipziger editions studied by Richard Kremer in this volume (Chap. 12).

Santritter's 1488 Venetian edition of Sacrobosco is not an epiphenomenon in his publishing portfolio. The same year and in collaboration with the same printer, Girolamo de Sanctis, he also printed John Buridan's (ca. 1300–ca. 1358) *Quæstiones in libros Physicorum Aristotelis* (Buridan 1488); the next year, he printed Johannes Eschuid's *Summa astrologiæ judicialis* (Eschuid 1489). Alongside other editions aimed at the academic market, Santritter took an interest in *quadrivium* publications.

<sup>22</sup> The editions listed in Table 3 are: (Sacrobosco and Borro 1494; Sacrobosco et al. 1488, 1490, 1491, 1499, 1501, 1508, 1513, 1518a, b, 1519; Sacrobosco and Ferraris 1500).

Nevertheless, Sacrobosco's *Tractatus* seems to have been his only illustrated publication, which he was probably able to do at a reasonable cost since he copied many woodcuts from Ratdolt's edition.

**Table 3** List of known Venetian Sacrobosco's *Tractatus de sphaera* incunabula editions after 1485

Format	Year	Other authors	Producers	Main type of characters	General layout of the <i>Sphaera</i>
In 4°, 69 fol., 8 quires	1488	Georg Peuerbach, Regiomontanus	Girolamo de Sanctis for Johann Lucilius Santritter	Roman	Single column
In 4°, 48 fol., 6 quires	1490	Georg Peuerbach, Regiomontanus	Boneto Locatello for Ottaviano Scoto I.	Roman	Single column
In 4°, 48 fol., 6 quires	1491	Georg Peuerbach, Regiomontanus	Guglielmo Anima Mia da Trino	Roman	Single column
In 4°, 64 fol., 8 quires	1494	Gasparino Borro	Boneto Locatello or Bartholomeo de Zanis for Ottaviano Scoto I.	Roman	Single column, text interspersed throughout commentary
In 2°, 150 fol., 27 quires	1499	Georg Peuerbach, Regiomontanus, Cecco d'Ascoli, Franciscus Capuanus de Manfredonia, Jacques Lefèvres d'Étaples	Simone Bevilacqua	Roman	Single column, text surrounded by commentary
In 2°, 146 fol., 26 quires	1499	Georg Peuerbach, Regiomontanus, Cecco d'Ascoli, Franciscus Capuanus de Manfredonia, Jacques Lefèvres d'Étaples	Simone Bevilacqua	Roman	Single column, text surrounded by commentary
In 4°, 26 fol., 6 quires	1500	Georgius de Ferrariis	Giovanni Battista Sessa I. or Jacopo Pincio for Giorgio de Monteferrato	Roman	Single column, text surrounded by commentary
In 4°, 47 fol., 6 quires	1501	Georg Peuerbach, Regiomontanus	Giovanni Battista Sessa I	Roman	Single column

(continued)

**Table 3** (continued)

Format	Year	Other authors	Producers	Main type of characters	General layout of the <i>Sphaera</i>
In 2°, 159 fol., 22 quires	1508	Georg Peurbach, Regiomontanus, Bartolomeo Vespucci, Robert Grosseteste, Pierre d'Ailly, Franciscus Capuanus de Manfredonia, Jacques Lefèvres d'Etaples	Giovanni Rosso and Bernardino for Giuntino Giunta	Roman	Single column, text surrounded by commentary
In 4°, 47 fol. 6 quires.	1513	Georg Peurbach, Regiomontanus	Melchior Sessa I	Roman	Single column
In 2°, 233 fol., 31 quires	1518	Pseudo-Ptolemy, Campano da Novara, Pierre d'Ailly, Cecco d'Ascoli, Gerardo Cremonensis, Theodosius de Bithynia, Francesco Capuano di Manfredonia, Jacques Lefèvre d'Etaples, Michael Scot, Robert Grosseteste, Regiomontanus	Lucantonio Giunta	Rotunda	Two columns
In 2°, 233 fol., 31 quires	1518	Pseudo-Ptolemy, Campano da Novara, Pierre d'Ailly, Cecco d'Ascoli, Theodosius of Bithynia, Francesco Capuano di Manfredonia, Jacques Lefèvre d'Etaples, Michael Scot, Robert Grosseteste, Regiomontanus	For the heirs of Ottaviano Scotto I	Rotunda	Two columns

(continued)

**Table 3** (continued)

Format	Year	Other authors	Producers	Main type of characters	General layout of the <i>Sphaera</i>
In 4°, 47 fol., 6 quires	1519	Georg Peurbach, Regiomontanus	Giacomo Pincio	Roman	Single column

As Isabelle Pantin showed (Pantin 2020), Santritter's first complete set of "Venetian Sacrobosco diagrams" was in turn copied by many printers in Venice and elsewhere in Europe. However, some copies diverged in the technical and formal innovations. For instance, in the 1490 edition printed by Ottaviano Scotto (fl. 1479–1499) (Sacrobosco et al. 1490) (Fig. 3) and the 1491 edition printed by Guglielmo da Trino (Sacrobosco et al. 1491), the diagrams are the same as in the 1488 edition but the layout is much more cluttered and less clear. Their editions also consisted of one-third fewer folios than Santritter's. To gain space, paper, and money, the diagrams were no longer closely linked to the text they illustrated; sometimes the reader had to search among diagrams to find the right one, instead of simply having it by the text. Pedagogy does not seem to have been at the heart of the conception of these editions, and there was no, or little, thinking on the conception of the diagrams since they were all directly taken from Santritter's edition. The fact that printers now copied illustrations (even though they were not the core of their occupations, and while trying to minimize cost at the expense of legibility and the practical use of the book) confirms that these treatises—the *Tractatus de sphaera*, the *Theoricae novae planetarum*, and the *Disputationes*—were now considered illustrated books. Readers expected diagrams and illustrations. It was no longer acceptable for printers to print the text alone, as in the early stage of Sacrobosco's printing history. The construction of this public expectation is a long process that began with Renner's edition but was emphasized by Ratdolt's and completed with Santritter's.

Moreover, the set of woodcuts used for the diagrams in Scotto's 1490 edition were the exact same as Santritter's (Figs. 2 and 3). The damage spots are identical in both editions. It seems Ottaviano Scotto borrowed or rented Santritter's blocks, through what was probably a commercial agreement.<sup>23</sup> The same woodcuts appear once again in the 1494 edition (Sacrobosco and Borro 1494)<sup>24</sup> printed by Ottaviano Scotto, which is no surprise since Ottaviano Scotto commissioned them both. We do not have any trace of another collaboration between Santritter and Scotto, but there seems to have been a long-running understanding between the two publishers. The circulation of woodcut sets was not unusual in the early years of printing; publishers and booksellers who had the means to pay for such production often reused them or rented them out to profit from their investment (Chap. 5) (Bonicoli 2015). It is therefore plausible that Santritter owned the woodblocks and rented them to Scotto

<sup>23</sup> See also Saskia Limbach's and Richard Kremer's studies (Chaps. 5 and 12).

<sup>24</sup> See the New York Public Library record for (Sacrobosco and Borro 1494): <https://catalog.nypl.org/record=b14346745~S1>. Accessed 04 June 2021.

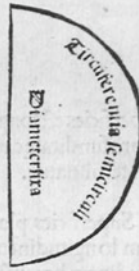


DIFFINITIO SPHAERAE ET DE QUIBUSDAM PRINCIPIS GEEOMTRICIS SVPPONENDIS



Sphæra igitur ab Euclide sic describitur. Sphæra est transitus circumferentiæ dimidii circuli quotiens fixa diame-  
tro quoulsq; ad locum suum redeat. circumducitur. id. est. Sphæra est tale rotundum & solidum quod describitur ab arcu semicirculi circumducto.

Sphæra etiam a Theodosio sic describitur. Sphæra est solidum quoddam una superficie contentum in cuius medio punctus est: a quo omnes lineæ ductæ ad circumferentiam sunt æquales. Et ille punctus dicitur centrum sphære. Linea uero recta transiens per centrum sphære applicans extremitates suas ad circumferentiam ex utraq; parte dicitur axis sphære. Duo quidem puncta axem terminantia dicuntur poli mundi.



De quibusdã principis geometricis supponendis quæ sunt addita

In primis quidẽ uidentur supponenda & intelligenda ab eis qui nesciunt geometricam disciplinam quibus dicenda leuius capere possint: & sunt quæ iam subseribimus & proximioribus nouitiorum gratia addidimus.

Punctus in re quanta: est quid indiuisibile: uel cuius non est aliqua pars quæ uisui percipiatur.



A v

Fig. 2 In Ratdolt and Santritter's editions, diagrams were laid in front of the corresponding text, in a clear layout with large margins that enabled students to take notes (Sacrobosco et al. 1488, A5r). Image courtesy History of Science Collections, University of Oklahoma Libraries; copyright the Board of Regents of the University of Oklahoma

**S**phæra & de quibusdā principiis geometricis supponēdis.  
 Phæra igr̃ ab Euclide sic describit̃. Sphæra ē trāsitus circūferētiæ dimi  
 dii circuli quotiēs fixa diametro quousq; ad locū suū redeat: circūduct̃  
 i. Sphæra ē tale rotūdū & solidū qđ describit̃ ab arcu semicirculi circū  
 ducto. Sphæra ēta Theodosio sic describit̃. Sphæra ē solidū qđdā una  
 superficie cōtētū i cuius medio pūctus ē: a quo oēs lineæ ductæ  
 ad circūferētiā sūt æq̃les. Et ille pūctus dī cēt̃rē sphæaræ. Linea  
 uero recta trāsiēs p cēt̃rē sphæaræ applicās extremitates suas ad  
 circūferētiā ex utraq; parte dicitur axis sphæaræ. Duo qui  
 dem pūctā axem terminantia dicuntur poli mundi.

DE quibusdā principiis geometricis supponēdis q̃ sūt addita.

**I**n primis qđē uident̃ supponēda & itelligenda ab eis q̃nesciūt  
 geometricā disciplinā qbus dicēda leuius capere possint: & sūt  
 q̃ iā subscribimus & pximioribus nouitiog; gr̃a addidimus.

**P**ūctus in re quanta: est quid indiuisibile: uel cuius non est ali  
 qua pars quæ uisū percipiatur.

**L**inea ē latitudo sine latitudine & profunditate: cuius extre  
 ma sunt duo pūctā si finita intelligatur.

**L**inea recta: est breuissima extensio ab uno extremo ad  
 aliud.

**L**inea uero recta est quæ inter extrema curuatur.

**S**uperficies est longitudo cum latitudine profunditate ca  
 rens quæ linea uel lineis terminatur.

**S**uperficies plana est quæ tam secundum longitudinem  
 q̃ secundum latitudinem breuissime extenditur.

**N**on plana est quæ concauitatem uel conuexitatem ali  
 quam habet.

**A**ngulus est duarum linearum contactus applicatione non  
 directā.

**A**ngulus rectilineus est: qui fit ex duabus rectis lineis. An  
 gulus non recti lineus est cum altera linearū est non recta.

Fig. 3 The 1490 edition used the same woodcuts as Santritter's 1488 edition but in a much more condensed layout, which allowed the printer to gain space but made the page fuller and less legible. The same kind of layout was used in the 1491 edition (Sacrobosco et al. 1491, 5r). Courtesy of the Library of the Max Planck Institute for the History of Science

for the 1490 and 1494 editions.<sup>25</sup> Illustrations being expensive, printers found ways to curb costs, but it could also lead to less acceptable solutions. The illustrations from the 1491 edition were not printed by means of the same woodblocks but their layouts are identical to those of Scotto's 1490 edition. This is probably a case of direct plagiarism among Venetian printers, a habit that they were very eager to denounce.<sup>26</sup> The competition in Venice was harsh and many printers did not hesitate to copy the work of others without permission. It was probably the case of Guglielmus da Trino's edition.

From Santritter's point of view, even if he himself copied most of Ratdolt's edition, the situation was dangerous at a moment when he was trying to distinguish himself on the academic market. Santritter searched for a way to protect his work and turned to the Venetian institution of privileges, which was thriving in those years. A Venetian privilege could not prevent copies from being made outside Venetian territory but could protect it from fellow Venetian printers. In 1498, Santritter was the beneficiary of a privilege from the Venetian authorities for a series of texts, including astronomical instruments, treatises of geometry, and other mathematical and astronomical texts "that were never printed in Venice."<sup>27</sup> He seems to have wanted to take over Ratdolt's former position as leader of the market in mathematical and astronomical books in Venice, a decade after his edition of Sacrobosco. The privilege was supposed to last for ten years, but his last known edition is a Regiomontanus' *Ephemerid* of 1498 (Regiomontanus 1498). He seems to have abandoned his project, maybe due to the competition and the growing influence big publishers such as the Scotto, the Giunta, or the Sessa had in Venice.

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<sup>25</sup> The hypothesis that Santritter owned the woodblocks and rented them to Scotto is more probable than the notion that Santritter's printer, Girolamo de Sanctis, owned the blocks and rented or sold them to Scotto. De Sanctis' production indicates that he was a typographer without a lot of capital and that he most likely lent his technical printing knowledge to publishers such as Santritter or others.

<sup>26</sup> For instance, in the petitions asking for privileges, Gaspar Dinslach wrote: "In order to avoid, after having printed said works at great cost and labor, that some other competitor might reprint them and sell them at a lower price, as it often happens, which would be a ruin and a damage for the petitioner" (Non volendo, che dappoi che cum grandissima spesa et faticha l'havera facto stampar le dicte opere che qualche altro a concurrentia le fesse restampir et poi le vendesse a vil pretio come molto vole achade, che tornaria a ruina et damno de lui supplicante) (ASV, Collegio Notatorio, reg. 14, image 312, Avril 18, 1497).

<sup>27</sup> Santritter's privilege reads: "The works to be printed are the following: *Astrolabium Instrumentum* with canons, *Ephemeridem perpetuum*, *Scotum Super animam*, *Jordanum in Geometrica*, and some other works of astronomy and geometry not yet printed by others in the city of Venice" (Opera autem imprimenda sunt ista videlicet *Astrolabium Instrumentum ipsum cum canonibus suis*, *Ephemeridem perpetuum*, *Scotum super animam*, *Jordanum in Geometrica*, autem nonnulla alia opera et astronomica et geometrica ab aliis non impressa in hac civitate venetiarum). ASV, Collegio Notatorio, reg. 14, image 368\_194r, November 13, 1498.

### 3.3 *Model Replaced: Sacrobosco's Posterity in Venice and in Europe*

A parallel tendency in Venetian publishing appeared with the publication of Sacrobosco's *Tractatus de sphaera* by Simone Bevilacqua (1450–1518) in 1499 (Sacrobosco et al. 1499) (Fig. 4). In opposition to what was usually done until then, Bevilacqua chose to print the *Tractatus de sphaera* in an in-folio format, around 33 cm high, whereas the previous editions, from Ratdolt to Guilelmus da Trino, were in-quartos around twenty to 22 cm high. Regiomontanus' and Peurbach's texts are still present, but there are many other commentaries as well, some of them surrounding the main text they refer to. Among these texts some are common commentaries of the *Sphaera* already present in the manuscript tradition (Thorndike 1949), like Cecco d'Ascoli (1257–1327), others were of fifteenth-century scholars such as Francesco Capuano di Manfredonia (d. ca. 1490) and Jacques Lefèvre d'Étaples (1455–1536). The layout is dense, with the commentaries surrounding the main text. Thus, the publishing model changes drastically, integrating Sacrobosco into the corpus of glossed texts. The integration of this text in the academic curriculum made it useful to add linear commentaries to use in courses. This kind of *mise en livre* is of significance to the status of the author: Sacrobosco is printed as an authority, whose words have to be commented upon and expanded by teachers for their students.

This also changes the general equilibrium between text and images. Here the illustrations are very small in comparison to the page and to the space dedicated to the texts, and the legibility suffers. Moreover, these are not dedicated woodcuts, made for this particular edition and format. Instead, the printers reused in part the same set of woodcuts from the in-quarto 1491 Guglielmo da Trino edition, as can be proven by various damage spots one can identify in both editions (Figs. 4 and 5). Simone Bevilacqua was probably aiming to reduce costs for this already heavy volume, while still presenting a decorated edition. However, while Santritter and Ratdolt made these designs according to their position on the page and the space allocated to them, the layout used in the 1499 edition tends to give more importance to the commentary than to the sketches as a tool for the reader in understanding the text.

The presentation of the *Sphaera* as a glossed text is not unprecedented in the manuscript tradition, even if it is not the most common format (Thorndike 1949). For instance, a manuscript of the Bodleian Library presents a gloss on Sacrobosco's *Tractatus de sphaera* surrounding the original text, though the commentary was probably added in the margins later on.<sup>28</sup> Similar to what Isabelle Pantin already stated concerning Parisian editions (Pantin 2013, 24), this kind of arrangement mirrored scientific manuscripts: in-folio or big in-quarto, dense typography, few and small geometric sketches, and not very legible. This format, layout, and choice of texts and authors can be interpreted as a form of integration of Sacrobosco's *Tractatus de*

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<sup>28</sup> Bodleian Library. MS. Canon. Misc. 161.



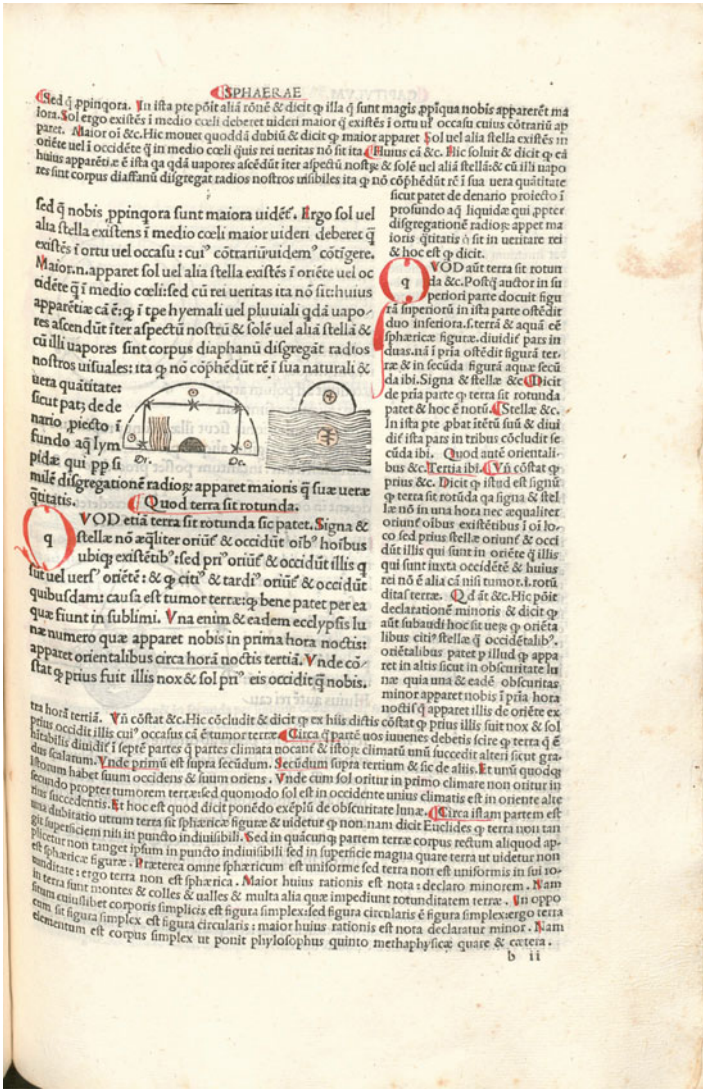


Fig. 4 The edition published in 1499 shows a glossed layout, presenting Sacrobosco’s text surrounded by commentaries. The space left for illustrations is scarce. The accent is laid on the commentaries rather than on the diagrams (Sacrobosco et al. 1499, 8r). München, Bayerische Staatsbibliothek—2 Inc.c.a. 3386. <https://nbn-resolving.org/urn:nbn:de:bvb:12-bsb00054721-1 CCBY-NC-SA4.0>

Quod autem caelum voluit ab oriente occidere signum est. Stella quae oriuntur in oriente: semper elevantur paulatim & successively quousque in medium caeli veniant: & sunt semper in eadem propinquitate & remotioe ad iucem: & ita semper se habent tendunt in occasum continue & uniformiter. Est & aliud signum. stella quae sunt iuxta polum arcticum: quae nobis nunquam occidunt: moventur continue & uniformiter circa polum describendo circulos suos: & semper sunt aequali distantia ad iucem & propinquitate. Vnde per istos duos motus continuos stellas: tendentium ad occasum quae non patet per firmamentum movetur ab oriente in occidentem. DE caeli rotunditate.

Quod autem sit caeli rotundum: triplex est ratio: similitudo: comoditas: & necessitas. Similitudo. non quoniam mundus sensibilis factus est ad similitudinem mundi archetypici: in quo non est principium neque finis. Vnde ad huius similitudinem mundus sensibilis habet formam rotundam: in qua non est assignare principium neque finem. Comoditas: quia omnium corporum huius perimetrorum: sphaera maxima est: omnium est forma: rotunda est capacissima quoniam igitur maximum & rotundum: loco capacissimum: unde cum mundus omnia contineat talis forma fuit illi utilis & comoda. Necessitas: quoniam si mundus esset alterius formae quam rotunde. sive laterae vel quadrilaterae vel multilaterae sequerentur duo impossibilia. scilicet alius locus esset vacuum: & corpus sine loco: quorum utrumque falsum est: sicut patet in angulis elevatis & circumvolutis. Item sicut dicit Alfraganus si caelum esset planum: aliquid per caelum esset nobis propinquior alia: illa scilicet quae esset supra caput nostrum: igitur stella ibi existeret nobis propinquior quam existeret in ortu vel occasu: sed quae nobis propinquiora sunt maiora videntur: ergo sol vel alia stella existeret in medio caeli maior videretur deberet quam existeret in ortu vel occasu: cuius contrarium videmus contingere. Maior enim apparet sol vel alia stella existeret in oriente vel occidente quam in medio caeli: sed cum rei veritas dicitur inter aspectum nostrum & solis vel alia stellae & cum illi vapores sint corpus diaphanum disgregant radios nostros visuales: ita quod non comprehendunt rem in sua naturali & vera quantitate: sicut patet de aërio picto in fundo aquae lymphidae quae per similes disgregationem radiorum apparet maioris quam suae verae quantitas. Quod terra sit rotunda.

Quod etiam terra sit rotunda sic patet. Signa & stellae non aequaliter oriuntur & occidunt omnibus hominibus ubique existentibus: sed prius oriuntur & occidunt illis qui sunt versus occidentem vel versus orientem: & citius & tardius oriuntur & occidunt quibusdam: eadem est ratio terrae quae bene patet per ea quae sunt sublimi. Vnde non eadem eclipsis lunae numero quae apparet nobis in prima hora noctis: apparet orientalibus circa horam noctis tertia. Vnde constat quod prius fuit illis nox & sol prius eis occidit quam nobis. Cuius rei causa est tantum tunc terra: quod terra etiam habeat tunc orositate a septentrione in austrum: & e contra sic patet. Existentibus versus septentrionem quaedam stellae sunt septentrinae appropinquat. scilicet propinquae accedunt.

Fig. 5 This diagram, printed for the first time in Ratdolt's 1485 edition shows the effects of refraction and the false hypothesis of a flat sky (Pantin 2020). This 1491 edition copies the illustrations of Ratdolt and Santritter, but without using the exact same material (Sacrobosco et al. 1491, 7v). München, Bayerische Staatsbibliothek—4 Inc.c.a. 856. <https://nbn-resolving.org/urn:nbn:de:vbv:12-bsb00083188-9> CCBY-NC-SA4.0

*Sphaera* into the more common publishing model for academic textbooks, in particular the *summae* and commentaries used in scholastic teaching frequently printed in Venice. Simone Bevilacqua's choice probably appealed to the actual practice of some readers, especially in university classes. However, Ratdolt and Santritter initiated a very different approach, which was more practical and encouraged a more linear and comprehensive reading of the treatise. It was also perhaps a kind of *mise en livre* adapted to more personal reading and to practical scholarly use. The importance given to the illustrations emphasized the more practical aspects of astronomical reflection and inserted Sacrobosco's more theoretical propositions in space and materiality, not only in logical discourse.

Some printers and publishers followed and adapted Bevilacqua's in-folio model: Giovanni and Bernardino Rosso (fl. 1482–1519) for Giuntino Giunti (1477–1521) in 1508 (Sacrobosco et al. 1508), who published works of Pierre d'Ailly (1351–1420) and Robert Grossetete (1175–1253) in the same edition; Lucantonio Giunta and the heirs of Ottaviano Scotto in 1518 (Sacrobosco et al. 1518b, 1518a), who both added other commentaries and treatises, this time from authors from antiquity: Pseudo-Ptolemy and Theodosius de Bithynia (160–100 BCE). Both 1518 editions chose to print Sacrobosco's *Sphaera* in a two-column format and in a gothic font (Chap. 8). Other editions of the same time held to the model Ratdolt had initiated (in-quartos, no gloss, and the association with Peurbach's and Regiomontanus' texts): for example, the 1501 edition by Giovanni Battista Sessa (fl. 1489–1505) (Sacrobosco et al. 1501), the 1513 edition by Melchior Sessa (fl. 1505–1565) (Sacrobosco et al. 1513), and the 1519 edition by Giacomo Pincio (fl. ca. 1486–1527) (Sacrobosco 1519). Both models were printed simultaneously in Venice, probably targeting different audiences. Indeed, both publishing choices could apply to different scholarly practices: in universities, schools, and the academic milieu, or for scholars and astronomers outside teaching institutions, who probably had a very different way of using this text than did a professor in Paris. These practices of reading and the uses of a text contribute to creating epistemic communities (Jacob 2007; Meyer and Molyneux-Hodgson 2011; Valleriani et al. 2019). There are no unique uses of a book, and evolutions are often not linear. These very different choices in bookmaking remind us to pay attention to their variety and their cohabitation (Martin and Vezin 1990; Martin 2000; Grafton 2011; Pantin 2008).

Since the end of the fifteenth century, several paths had been available for the publication of Sacrobosco's treatise. Most of them were possibilities already present in the manuscript tradition but adapted to new formats and techniques. Each printing center implemented its own solution, printers being influenced by the solutions offered by their immediate neighbors as well as by editions that circulated across Europe. Hopyl's 1494 edition, for example, is also an in-folio format with commentaries, but the layout is significantly different from the 1499 Venetian edition; the commentaries do not surround the main text; however, they are printed with types of different sizes.

The Parisian context became particularly important to understanding the formal solutions offered by printers. Richard Oosterhoff investigates the pedagogical solutions Parisian printers offered while printing with the university public in mind and in relationship with major scholars of the time (Chap. 2). Jacques Lefèvre d'Étaples



introduced many innovations in Paris at the beginning of the sixteenth century (e.g., long lines, a dedicated space for illustrations, tools to facilitate the reading). He did not choose the traditional gloss layout but promoted a format that emphasized the specificity of these treatises: the importance of illustration as a tool for the reader. His solution enhanced the relationship of the texts to formalized diagrams and their pedagogical use. The production of mathematical books in Paris responded to an important demand, in part from the *calculatores* current studied by Alissar Levy (Chap. 13). At that point, formal innovations around the *Tractatus de sphaera* were closely related to the contemporary studies of mathematics in Paris and the work of contemporary mathematicians, especially Oronce Finé (1494–1555). The editions he completed from 1532 on went even further in the direction initiated by Lefèvre d'Étaples as he established a new but enduring design: a continuous presentation of mathematical propositions (*mise au point d'un exposé continu*) (Pantin 2013). After Venice, Paris became one of the leading and most innovative producers of Sacrobosco's *Tractatus de sphaera*.

## 4 Conclusion

Sacrobosco's *Tractatus de sphaera*'s first editions are a good case study for understanding the beginning of the European book market. Its printing adaptations allow us to observe the expectations of printers regarding readership, as well as the progressive evolution of the expectations of the readers themselves. These early editions also enable us to comprehend the publishing history of one specific work in the economic and social milieu of the European book market at the time.

Printers had to anticipate their production and make choices in a very unstable economic environment. The competition between Franz Renner and Erhard Ratdolt in Venice—and in the wider market for academic books—is paradigmatic of this situation. They both had strong ties with German cities and had a robust commercial network across Italy and Europe. Renner chose a traditional approach from an intellectual point of view, printing Sacrobosco with the *Theoricae planetarum*, while implementing some formal adaptations. This enabled him to brand his edition as new and innovative in comparison to the previous incunabula editions, yet still identify with manuscript models known to his public. He did so while directly attacking Ratdolt on his specialty: mathematical and astronomical publications. Traces of this fierce competition can be found in the materiality of their editions.

Ratdolt replied by emphasizing Regiomontanus' formal innovations and by printing Sacrobosco's treatise with different texts: Peurbach's *Theoricae novae planetarum* and Regiomontanus' criticism of the old *Theorica planetarum*. Ratdolt's 1482 and 1485 editions, despite their differences, had a major impact on multiple levels. First, they allowed Ratdolt to symbolically assert his superiority as an academic publisher in this specific market, to bring discredit on Renner's edition, to consolidate his own position in Venice, and to gain wider distribution in Europe. The publication of Regiomontanus and Peurbach was also a good selling point



in the German book market. Moreover, Ratdolt's editions allowed Regiomontanus and Peurbach to benefit from the association with Sacrobosco, which enhanced their perceived legitimacy. In return, it also folded Sacrobosco's thirteenth-century treatise into contemporary academic debates and actualized its significance in the European book market. Finally, Ratdolt's edition set a formal standard, completed with Santritter's 1488 edition and copied in Venice and across Europe.

Following editions of Sacrobosco's texts in Venice, highlight the fiercely competitive market printers had to face. The production of Sacrobosco's text now had to be illustrated, which was more expensive than the plain editions of the early years. Printers, therefore, managed to rent one another's woodcuts—a channel we can often track, though some actors did not hesitate to copy the illustrations of previous editions. The Venetian system of privileges was small protection against a culture of imitation that existed not only within Venetian borders but also at a European level. However, other models were developed and coexisted in Venice that targeted different audiences. Venice progressively lost its leadership; eventually, it was no longer the main source of formal and intellectual innovation in the publication of the *Sphaera*. Paris soon became the most influential center of production, thanks to the collaboration of mathematicians and local presses.

The dynamics between book producers and between book producers and readers are at the heart of the transformations of books and book markets. Sacrobosco's *Tractatus de sphaera* is but one paradigmatic example. Thanks to the multiple aspects of its publication—cost, distribution, text-image relationship, formalization, target markets, partnership with investors and scholars—it highlights some of the main issues in the history of the beginning of printing.

## Abbreviations

### *Digital Repositories*

GW	Gesamtkatalog der Wiegendrucke. Stiftung Preußischer Kulturbesitz. <a href="https://www.gesamtkatalogderwiegendrucke.de">https://www.gesamtkatalogderwiegendrucke.de</a> . Accessed 07 June 2021
ISTC	Incunabula Short Title Catalog. Consortium of European Research Libraries. <a href="https://data.cerl.org/istc">https://data.cerl.org/istc</a> . Accessed 07 June 2021
MEI	Material Evidence in Incunabula. Consortium of European Research Libraries. <a href="https://data.cerl.org/mei">https://data.cerl.org/mei</a> . Accessed 07 June 2021
Sphaera CorpusTracer	Max Planck Institute for the History of Science. <a href="https://db.sphaera.mpiwg-berlin.mpg.de/">https://db.sphaera.mpiwg-berlin.mpg.de/</a> . Accessed 07 June 2021

TW Typenrepertorium der Wiegendrucke. Staatsbibliothek zu Berlin. <https://tw.staatsbibliothek-berlin.de/>. Accessed 07 June 2021

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ASV Archivio di Stato di Venezia

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