

Tobias Stimmer's sources for the astronomical elements of Strasbourg's 16th century astronomical clock

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I have recently published a lengthy book¹ in French on Tobias Stimmer (1539-1584)'s preparatory drawings and paintings for the 16th century astronomical clock in Strasbourg's cathedral. In this book, I have in particular investigated the sources of Stimmer's biblical paintings, and tried to find who were those who influenced him, but I have also analyzed Stimmer's work for the purely astronomical parts of the clock, in particular for the celestial globe and the eclipse charts. Since I drew a number of new conclusions on the astronomical sources, I thought that my work should be made available to a wider audience, and I have therefore made an English translation of my description of the globe and of a few other parts of the clock.

1 Introduction

Before entering in the detailed description of the astronomical parts of the clock, I first want to recall a number of general facts on the Strasbourg cathedral astronomical clock.

This clock is one of the great attractions of the Strasbourg Cathedral. The current clock is the third of its name, at least the third completed one. A first astronomical clock had been built in the 14th century opposite the current clock and the only part that remains is the automaton cock kept in the Museum of decorative arts (*Musée des arts décoratifs*) of the city of Strasbourg.

The second clock was started in the 1530s, but the work was interrupted. It was resumed around 1571 and completed in 1574 by the mathematicians Conrad Dasypodius and David Wolkenstein, the Swiss clockmakers Isaac and

¹[Roegel (2024)], available on <https://roegeld.github.io/stimmer>. The book contains the sources of all the illustrations, which are not repeated here.

Josias Habrecht and the Swiss painter Tobias Stimmer. The case of the current astronomical clock, a stone construction covered with woodwork, is that of this Renaissance clock. This clock, due to lack of maintenance, worked less and less well and was finally left still around 1788.²

It was only fifty years later that the renovation of the clock was undertaken. More than a renovation, it was a reconstruction of the clock, or at least of its mechanisms. Jean-Baptiste Schwilgué (1776-1856) was responsible for this work, which was carried out between 1838 and 1843 and which resulted in the current clock, which is therefore a construction essentially from the 16th century containing mechanical parts from the 19th century.

I will not go into further detail about the functions and workings of these clocks and I refer interested readers to the reference works on the subject.³ However, we can look at the engravings of the clock made in the 16th century, because they give us an excellent idea of what the clock was like at that time.

1.1 The clock in the 16th century

Here I first summarize Stimmer's main "historical" engravings of the astronomical clock.⁴

Stimmer engraved⁵ the astronomical clock of Strasbourg Cathedral in three sizes.⁶ On these engravings, we can clearly see Stimmer's main painted panels, be it those of the creation of the world or the resurrection, those of the turret of the weights, or even the paintings of eclipses.

Figure 1 represents one of the variants of the large woodcut of the clock.⁷ This engraving from 1574 (image: 29.0 cm × 51.9 cm)⁸ is made of two pieces of wood and contains in two cartouches the German translations of the passages of the Bible inscribed on the clock. It exists in several variants for the text and the

²We often read that the clock *stopped working* at that time, but the truth is rather that it was then abandoned, which is not the same thing. It could very well have continued to work.

³See [Ungerer and Ungerer (1922), Bach et al. (1992), Oestmann (2020)]

⁴I would have liked to examine the engravings of the clock in the possession of the *Cabinet des dessins et estampes* of the Strasbourg museums, but its curator did not respond to the requests I sent in 2023. I have therefore only consulted the engravings held by the *Bibliothèque nationale et universitaire de Strasbourg* (BNU).

⁵It goes without saying that when I write that Stimmer "engraved," it is an abuse of language meaning that Stimmer "drew with a view to have it engraved."

⁶[Andresen (1866), p. 50-51]

⁷See [Oestmann (2020), p. 58] and [Beaujean and Tanner (2014a), p. 98-99]. This engraving was printed by Jobin, see [Weber (1976), p. 284-285].

⁸These dimensions are those given by [Geelhaar et al. (1984), p. 107]. The dimensions may vary slightly from one copy to another, I have for example measured 29.1 cm × 52.5 cm for one copy (R.96) and 28.9 cm × 52.5 cm for another (R.97) at the BNU, these two versions being the variants on six columns of text. The total dimensions, with the text, were 44 cm × 58 cm (R.96) and 36,5 cm × 56 cm (R.97).

titles.⁹ It was notably accompanied by a poem by Fischart.¹⁰ It was reproduced in a fold-out plate in 1922 by Ungerer.¹¹

As Andersson writes,¹² this engraving can be seen as a guide to the iconographic program of the astronomical clock. In fact, it could still be distributed today to tourists who come to admire the clock.¹³

The medium woodcut (figure 2) has the image dimensions 22.3 cm × 38.5 cm¹⁴ and a single cartouche on the right.¹⁵ It does probably also date from the same period¹⁶ and was reprinted in 1598 in the *Opervm poeticorum Nicodemi Frischlini, pars epica* by Frischlin (1547-1590),¹⁷ where Stimmer is cited on page 79. This engraving still exists with a text by Fischart on an additional column on the left,¹⁸ or with an empty cartouche.¹⁹

The small woodcut (figure 3) has image dimensions of 7.8 cm × 10.7 cm and

⁹The variant with six columns of text is illustrated in the Basel exhibition catalogue [Geelhaar et al. (1984), p. 104]. See [Weber (1976), p. 284], number 29. The variant that I present contains 147 verses by Fischart, but it is this one that seems to be classified among the “small versions” by Weber.

¹⁰See [Weller (1857)], [Kurz (1867), p. XIV-XVI and 383-391] (where the original transcribed contained gaps), [Hauffen (1896)], [Geelhaar et al. (1984), p. 104] (with gaps). Besson writes that these verses “can count among the most insipid [that Fischart] ever composed: it is rhymed prose, and painfully rhymed; the pegs abound and the style is remarkably banal and flat. Obviously, what Jobin asked for was not a work with vast horizons, where the poet gave the full measure of his talent, but a simple and modest explanatory brochure, accessible to the most mediocre intelligences and capable of making them more or less understand the wonders of the clock of which the city of Strasbourg was rightly proud.” [Besson (1889), p. 206-207]

¹¹[Ungerer and Ungerer (1922)]

¹²[Andersson (1985), p. 322]

¹³Even today, there is no explanation in front of the clock, although one can buy a small guide on the clock at the cathedral.

¹⁴These dimensions are those given by [Geelhaar et al. (1984), p. 108]. On a copy of Frischlin’s 1598 edition kept at the BNU (R.100.954), I measured the frame at 21.1 cm × 37.5 cm. There must however be some variations here again, because the copy I saw bears in the cartouche “417. * * * HOROLO-gium Argento-ratense”, while the figure shown here does not have the “417.” This number seems to be the page number where the plate was to be placed, knowing that in the editions of 1612 [Frischlin (1612)] and 1614 [Frischlin (1614)] (but not 1598) the part on the clock begins on page 417. One can therefore wonder whether the plate seen in Frischlin’s 1598 copy is indeed the one intended for this edition.

¹⁵See [Oestmann and Schramm (1992), p. 82], [Oestmann (2020), p. 59], as well as [Beaujean and Tanner (2014a), p. 100-101]. The *Cabinet des estampes et des dessins* in Strasbourg has a copy with the number “417” [Kintz (2022), p. 82], which certainly comes from an edition by Frischlin from 1612 or 1614.

¹⁶This engraving was also printed by Jobin, see [Weber (1976), p. 284-285].

¹⁷[Frischlin (1598)]

¹⁸See the print 77.998.0.424 from the *Cabinet des estampes et des dessins* in Strasbourg, illustrated in [Kintz (2022), p. 812].

¹⁹See the print 77.998.0.423 from the *Cabinet des estampes et des dessins* in Strasbourg, illustrated in [Kintz (2022), p. 758].

accompanies Frischlin (1575)²⁰ and Dasypodius (1578 and 1580)²¹'s descriptions.

During the following centuries, many engravings were produced by other artists, often based on those of Stimmer. Let me simply mention Isaac Brunn's engraving (1619 or 1621)²² and the very detailed drawings made by Michel Grieshaber (1816-1890) for Schwilgué's astronomical clock. One of these drawings represents the clock in its 1574 state and I illustrated some excerpts in the chapter on Stimmer's sources in my book.²³

However, it should be kept in mind that Grieshaber clearly did not represent the clock as it was before Schwilgué's intervention, but the clock as he thought it had been in 1574, using the data available to him, that is, first of all the clock itself, then the engravings by Stimmer or others such as those by Brunn.

²⁰[Frischlin (1575)] On Frischlin's description of the clock, see [Kühlmann (2016)] and [Frick and Grütter (2021)]. A critical edition of Frischlin's text and other contemporary texts on the clock was recently published by Kiening, Frick and Grütter [Kiening et al. (2024)].

²¹[Bendel (1940), p. 71], [Geelhaar et al. (1984), p. 107-109], [Himmelein (1986), p. 488-489], [Oestmann (2000), p. 53], [Oestmann (2020), p. 57], [Oestmann (2020), p. 60-62], [Beaujean and Tanner (2014b), p. 211], [Beaujean and Tanner (2014c), p. 117]

²²[Oestmann (2020), p. 63]. This engraving is kept under the shelf numbers R.101 and R.102 at the BNU. Oestmann dates it 1609 [Oestmann (2020), p. 57], perhaps in relation to a pencil annotation on engraving R.101. However, on the one hand the engraving must be later than this date, because the eclipses indicated are those of the second series, and on the other hand the year is in fact indicated in a barely veiled form by a fairly explicit cryptogram, incorporating the Roman numerals of the date. This cryptogram includes in that order the letters I, I, D, M, I, I, V, I, C, I and X and if we add the corresponding values of these letters, we obtain 1621. This date is also given in [Himmelein (1986), p. 401-402]. If, on the other hand, we read 9 for IX, the sum translates to 1619. (J.-P. Rieb drew my attention to this cryptogram on February 18, 2024, and he had had exchanges on this subject in 2012 with the *Historische und Völkerkundemuseum*, since 2023 *Kulturmuseum*, in St. Gallen, Switzerland.)

²³[Roegel (2024)] The plans of Schwilgué's clock exist in two copies which were originally contained in a special closet. One copy is kept at the *Fondation de l'Œuvre Notre-Dame* but was seriously mutilated during World War II after being removed from its closet (still kept). The second copy is in storage at the *Musée des arts décoratifs* in Strasbourg [Martin et al. (2020)]. There, the plans are still in the cabinet, but the cabinet is partly broken, probably because it was handled with little care by a former curator. It is necessary to underline here the total lack of interest of past curators for this heritage, not to mention the current blockages put in place by the management of the Strasbourg museums against me. The chief curator of the museums, Mr. Lang, has for example never responded to my letters about my work on these plans, nor to my proposal for a meeting to consider the best measures to take for their conservation. To give just one example, by subcontracting all restorations, curators often do not realize that the first priority should not be to restore. Before restoring the plans, for example, they must first be scientifically digitized (and not with *Adobe Photoshop!*). The current approach of the Strasbourg museums is certainly not the best way to manage scientific and technical heritage.



Figure 2: Stimmer: medium woodcut of the astronomical clock published in [Frischlin (1598)].

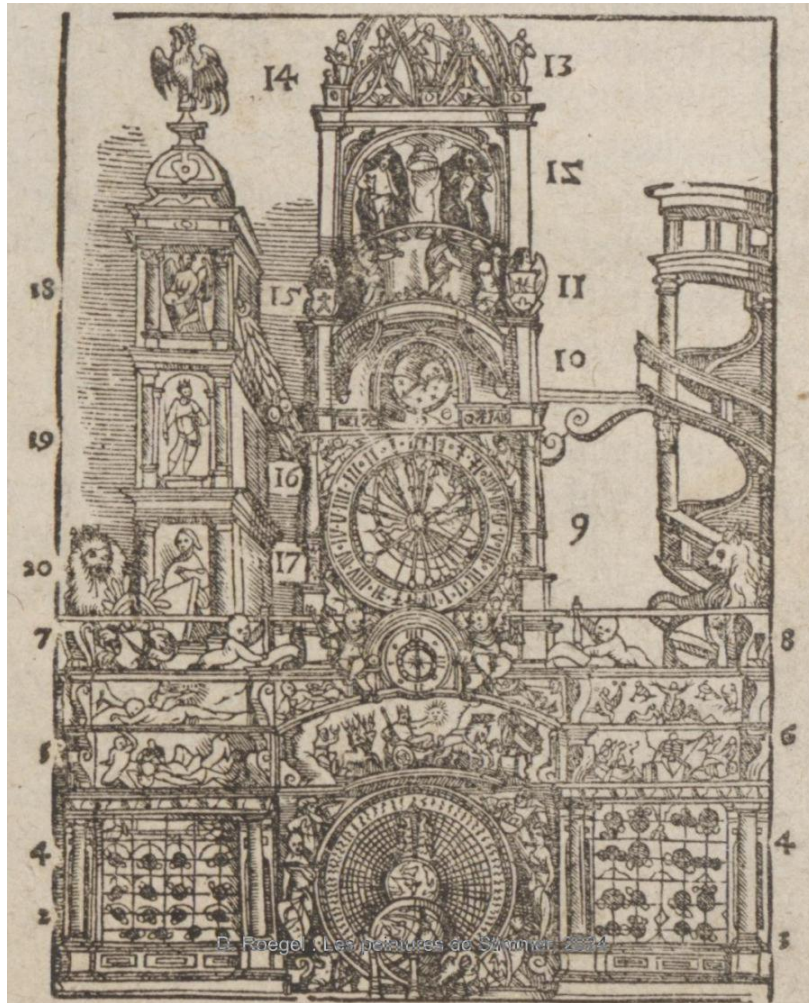


Figure 3: Stimmer: small annotated woodcut of the astronomical clock, as it appears in Dasypodius' two descriptions of 1580 [Dasypodius (1580a), Dasypodius (1580b)]. Dasypodius' 1578 description includes the same woodcut, but without the annotations.

2 Recent research work

In my book on Stimmer’s paintings,²⁴ I also summarized the recent research work on the astronomical clock. Here I am restricting myself to research related to the astronomical parts of the clock.

Since the publication of the works of Bach and Rieb in 1992²⁵, and of Oestmann in 1993²⁶, the main developments published around the Strasbourg astronomical clock have been the work of Joseph Flores on Klinghammer’s computus in 2007²⁷, the publication of a translation of Dasypodius’ *Heron mechanicus* by Oestmann in 2008²⁸, Dengler’s thesis on the *Zeitmaschinen* in 2011²⁹ (especially on the design of time), the expanded English translation of Oestmann’s thesis in 2020³⁰ and Marugg’s book on the Habrecht dynasty in 2021.³¹ In 2006, following my earlier research, a scientific committee was also formed to oversee the astronomical clock, and this committee has contributed to a better understanding of the clock, even though most of its work has not been published.

Other relevant and recent works have been the recent small guide³² published on the astronomical clock by the scientific committee of the clock, the restoration of Dasypodius’ sundials, although it is regrettable that the DRAC Grand Est (*Direction Régionale des Affaires Culturelles*, the regional heritage administration) has not produced any research work following this intervention and has not made its archives fully accessible to researchers. In 2021, I also had the pleasure of seeing the reappearance of the reduced model of Schwilgué’s computus of 1821, of which I hope one day to be able to publish a detailed description.³³ In 2022, I also sought to better understand the problem of the motion of Mars on Dasypodius’ clock, and I now believe I have a plausible explanation for the poor precision observed.³⁴

Let me also point out that work is currently underway on the reception of Dasypodius’ clock, through an analysis of contemporary texts, notably those of Frischlin.³⁵ And a school project of “digital humanities” led by Delphine Viellard was also interested in Frischlin’s description of the clock, notably in his

²⁴[Roegel (2024)]

²⁵[Bach et al. (1992)]

²⁶[Oestmann (2000)]

²⁷[Flores (2007)]

²⁸[Dasypodius (2008)]

²⁹[Dengler (2011)]

³⁰[Oestmann (2020)]

³¹[Marugg (2022)]

³²[Rieb (2019)]

³³This project has been in progress since the end of 2022, but unfortunately its completion does not depend only on me.

³⁴[Roegel (2023)]

³⁵[Frick and Grütter (2021)]

Carmen de astronomico Horologio Argentoratensi of 1575.³⁶

As I observed in my book, we can therefore see that there is a certain dynamic around the astronomical clock of Strasbourg Cathedral, but also around Tobias Stimmer, and that our knowledge of the clock, and in particular of Stimmer, continues to improve.

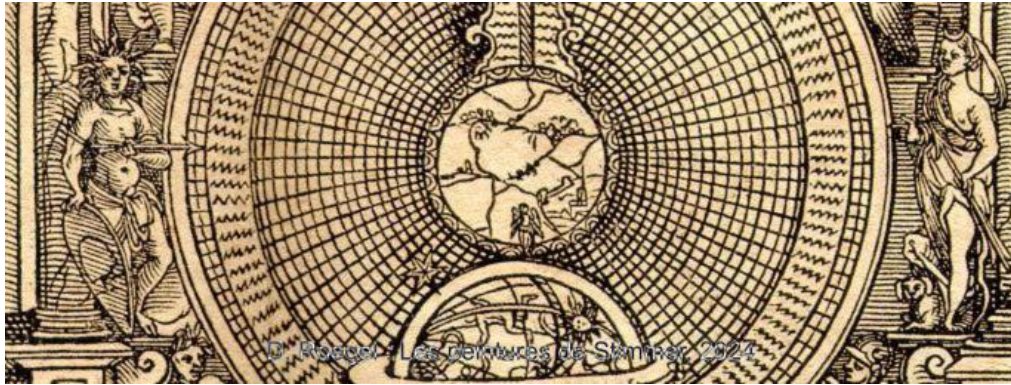


Figure 4: The statuettes of Apollo and Diana on the left and right of the clock calendar. (excerpt from the medium woodcut of the clock by Stimmer published in [Frischlin (1598)])

³⁶[Frischlin (1575)]

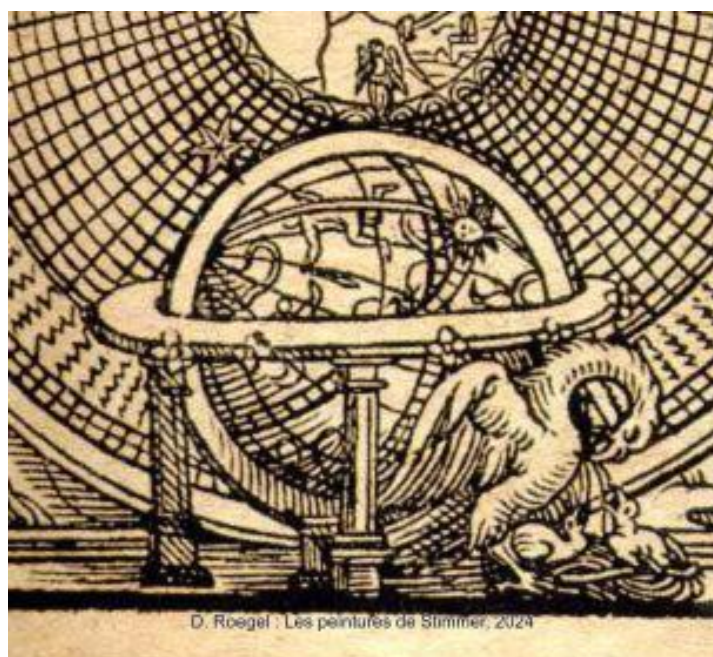


Figure 5: The globe and the pelican, from Stimmer's medium-sized woodcut published in [Frischlin (1598)].



Figure 6: Lorenz Fries's world map published in 1522 in Ptolemy's *Opus geographiae* (Jean Grüniger, Strasbourg). Of particular note is the spelling AFRICA. Lorenz Fries made another slightly different map, also included in the same work. Both maps are adapted from a map by Martin Waldseemüller.

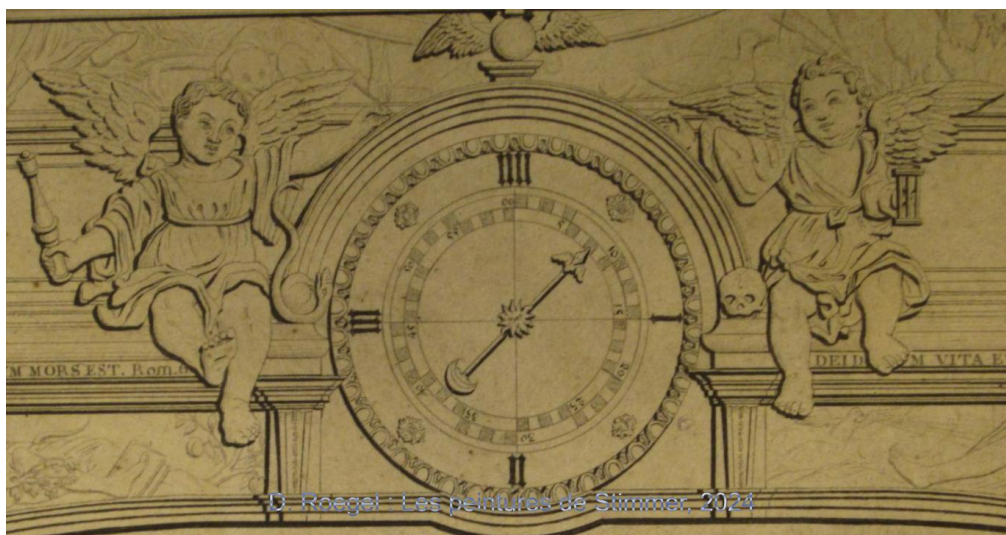


Figure 7: The time dial and the two cherubs on Grieshaber's large drawing, part of the plans kept in the *Musée des arts décoratifs* (c1845).

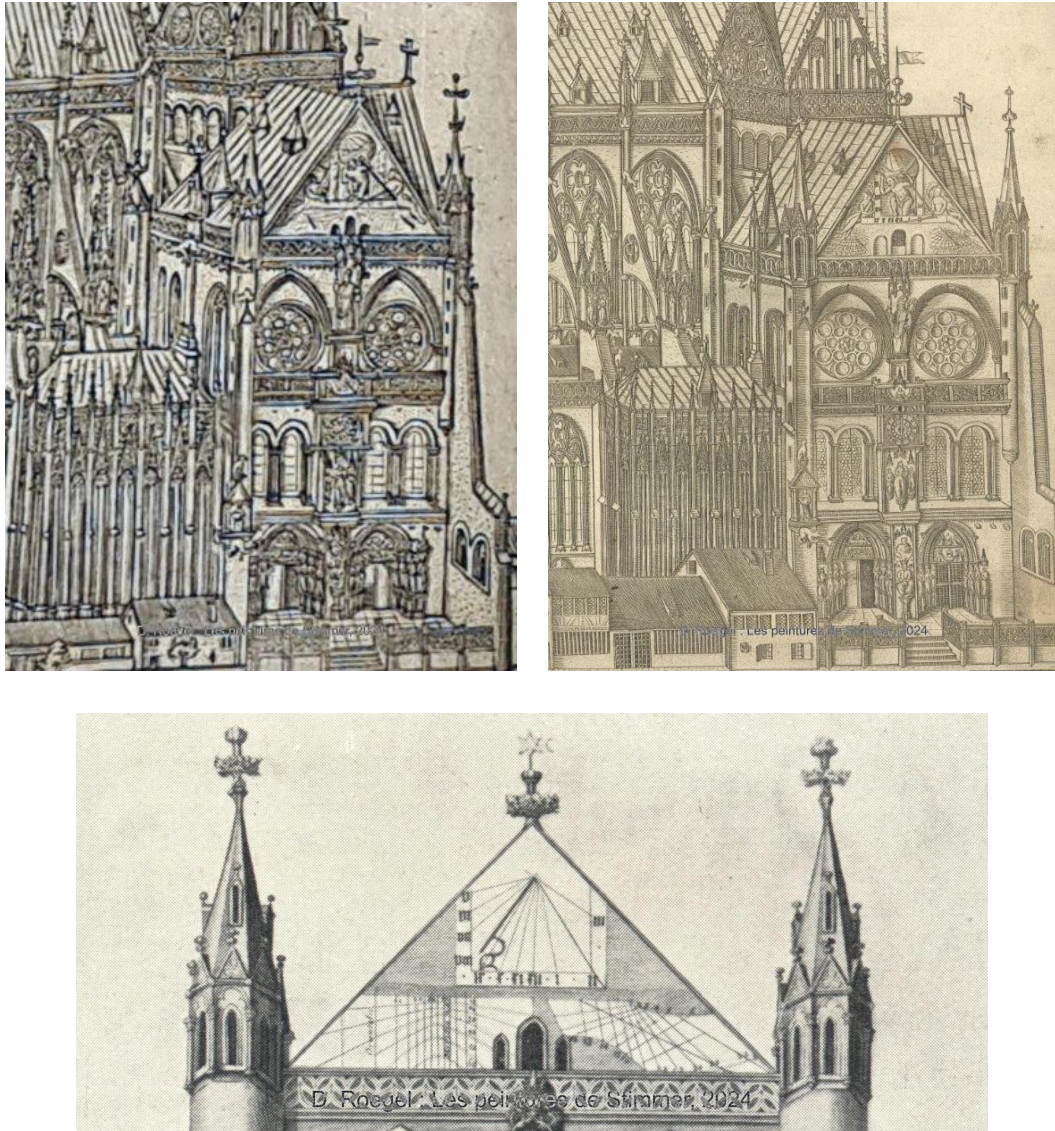


Figure 8: The exterior of the south transept of the cathedral in three engravings. Top left, an excerpt from Daniel Specklin's engraving from 1587 [Strauss (1975), p. 976] reprinted in 1617 in *Summum Argentoratensium templum* [Schad (1617)]. Top right, an excerpt from an engraving by Isaac Brunn (born 1586) from 1615 still showing Stimmer's fresco. Below, an excerpt from a woodcut after Jean-Jacques Arhardt, around 1660-1670, where the fresco no longer appears.

3 Astronomical and calendrical elements

As part of its astronomical program, Dasypodius' clock included a large calendar, an astrolabe giving the position of the planets visible to the naked eye, the phase of the moon, a celestial globe and upcoming eclipses, not to mention the sundials located outside the cathedral. I review these elements here and provide some additions to all that has already been said and written about them.

3.1 Celestial globe

Just as a celestial globe is located today in front of Schwilgué's astronomical clock, there was another globe in front of Dasypodius' clock. This globe, which I will sometimes call the globe of Stimmer-Dasypodius,³⁷ was roughly oriented along the north-south axis and not like the current globe which is arranged with its axis forward (therefore symmetrically to the clock). The old arrangement of the globe can still be seen in a lithograph by Chapuy published in 1827³⁸ (figure 9), but also in woodcuts by Stimmer (figure 4)³⁹ and Grieshaber's large drawing (figure 10).⁴⁰

The globe was briefly described by Dasypodius.

In his two descriptions in German,⁴¹ Dasypodius indicates that he had been in possession of this globe for 14 years, perhaps counted up to the start of the construction of the clock. In any case, one can assume that he had possessed this globe since around 1560, or perhaps only since the death of Herlin (1562) if it was from him that he inherited it.⁴² Dasypodius also seems to say that he chose to integrate this globe into the clock in memory of Herlin.⁴³

After its replacement by Schwilgué's globe, the old globe was stored at the *Œuvre Notre-Dame* (figure 11). In 1924, it was transferred to the *Musée des arts décoratifs*, in the newly created clock room, where it is still located.

³⁷See [Dasypodius (1578), ch. 4], [Dasypodius (1580a), ch. 4], [Dasypodius (1580b), ch. 3], [Ungerer and Ungerer (1922), p. 24-25], [Bach (1979)], [Bach et al. (1992), p. 97-107], [Oestmann (2000), p. 92-97], [Oestmann (2020), p. 127-141] and [Bendel (1940), p. 61-62].

³⁸[Chapuy and Schweighaeuser (1827)]

³⁹In this woodcut, one might have the impression that a small statuette of an angel appears at the top of the globe, but this statuette must in fact have been at the base of the map of Germany.

⁴⁰It should be noted in passing that Grieshaber represents the globe more accurately than Stimmer, particularly with regard to the position of the four supports (see figure 5). On the other hand, old engravings show a star in the extension of the axis of the celestial poles (see figure 5) and this star was not taken up by Grieshaber.

⁴¹[Dasypodius (1578), ch. 4], [Dasypodius (1580a), ch. 4]

⁴²[Oestmann (2020), p. 132]

⁴³In the 2024 exhibition catalogue, Kieffer states that the globe was "designed by the first team on the construction site" [Dupeux and Huhardeaux Touchais (2024), p. 149], without it being very clear what she meant. This may be a confusion with the primitive geographical nature of the globe.

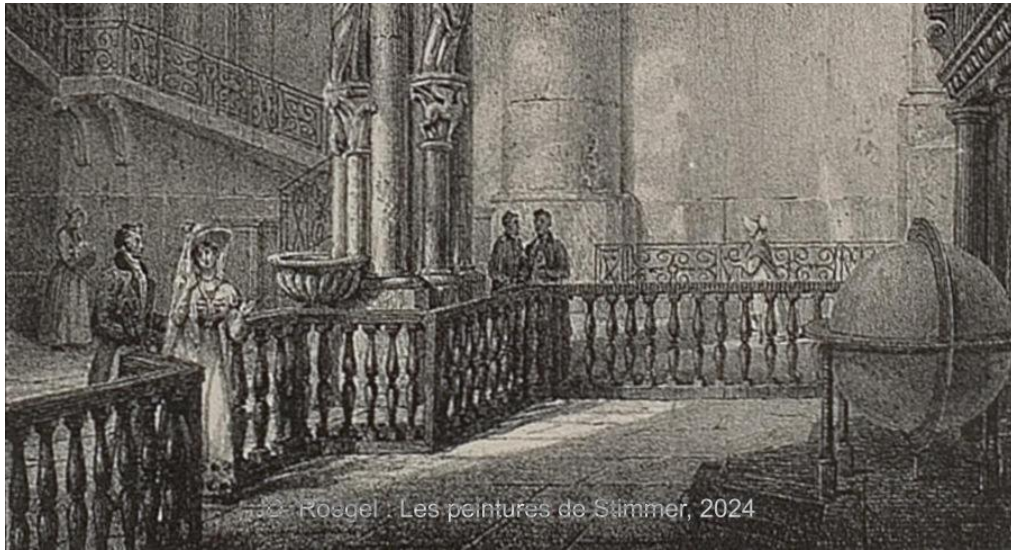


Figure 9: The position of the celestial globe in 1827 (excerpt from [Chapuy and Schweighaeuser (1827)]).

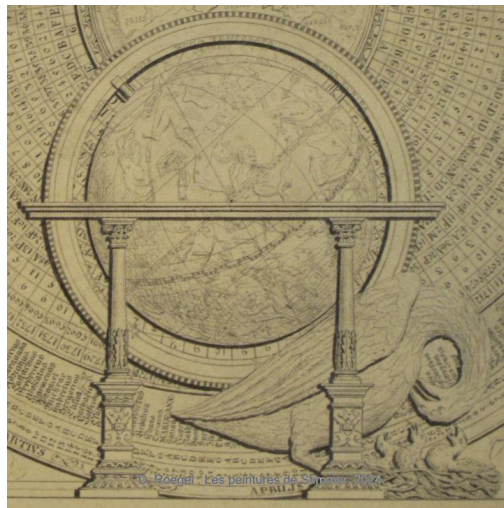


Figure 10: The globe on Grieshaber's large drawing, part of the plans kept in the *Musée des arts décoratifs* (c1845).



Figure 11: The globe in 1922 [Ungerer and Ungerer (1922)]. It was placed on the back of the astrolabe (tympanum).

3.1.1 Objectives of an analysis

Before describing this globe, it is important to define a methodology of analysis. What exactly am I trying to know about the globe? What has already been done? What remains to be done?

Surprisingly, the globe had not been described at all in Ungerer's seminal work,⁴⁴ not even from the point of view of the gears. A study had probably been carried out, but perhaps not included in the book due to lack of space. It was not until 1960, with the publication of the joint study by Victor Beyer, Henri Bach and Ernest Muller⁴⁵, that we became a little better acquainted with this globe. Beyer,⁴⁶ Bach and Muller's analyses were subsequently taken up by Bach⁴⁷ and Oestmann.⁴⁸

Beyer's analysis mainly focused on the history of the globe and the indication of the constellations. In retrospect, Beyer's work was remarkable, especially as he was a curator whose interests were more focused on sculpture and stained glass. However, since Beyer was not a historian of astronomy, he did not explore certain astronomical questions in depth, in particular on the consideration of precession, on the sources of the coordinates of the stars, on those of the constellations, or on the more general conception of the globe. Henri Bach, instead,⁴⁹ was more interested in the physical construction of the globe and the mechanical aspects, but not in the design of the maps, which therefore remains a subject that is still incomplete.

This therefore clearly outlines my objectives, which are the same as for the other elements of the clock. I am trying to find out what the sources of Dasypodius, Wolkenstein and Stimmer could have been, and how, from these sources, the globe could have been painted. More precisely, I will distinguish on the one hand the sources for the coordinates of the stars, on the other hand those for the drawings of the constellations, which may be different. We must then also distinguish the form of the graphic sources, namely the flat celestial maps and the globes. In both cases, we must imagine a way to transfer the information onto a globe. Finally, I will try to suggest what, in my opinion, was the most likely manufacturing process of the globe.

I will not, however, be interested in stylistic influences, the interpretation of which I leave to others.⁵⁰

⁴⁴[Ungerer and Ungerer (1922)]

⁴⁵[Beyer (1960), Bach (1960), Muller (1960)]

⁴⁶[Beyer (1960)]

⁴⁷[Bach et al. (1992)]

⁴⁸[Oestmann (2020)]

⁴⁹[Bach (1960)]

⁵⁰Cottin, basing himself without saying so on Beyer [Beyer (1985)], sees for example in the presence of the ship *Argo* the influence of the Venetian painters Gentile Bellini and Vittore Carpaccio, but this conclusion seems hasty to me [Cottin (2020), p. 234]. He also states a little further on that the globe contained a Lutheran manifesto, while the papers covering the back of the globe are merely old hymn sheets [Cottin (2020), p. 235].

3.1.2 General description of the globe

The globe of the clock is an old geographical globe from 1546 converted into a celestial globe, that is to say showing a certain number of constellations and stars (figures 12 to 18).⁵¹ This terrestrial globe belonged to Dasypodius who may have inherited it in 1562 from Herlin.⁵² Its structure was designed by Hans Erstein⁵³ and the entire geographical part by Heinrich Zell.⁵⁴ During the transformation into a celestial globe, its diameter was increased to reach 83 cm.⁵⁵ On the clock, the globe was mechanically moved and made one revolution around the axis of the celestial poles in one sidereal day. Two hands indicated the average revolutions of the sun and the moon. These hands also turned around the axis of the celestial poles and carried the sun and the moon on slides, in order to be able to vary their declination manually during the year. The globe was painted and not printed. It included several circles which will be described later. An inscription on the globe indicates who the original authors were (figure 12).

Moreover, under the globe there was a pelican that hid its workings and to which I will return. The vertical colure of the globe bears the names of cities located at different latitudes and the corresponding climates (figure 19). These indications may date back to the original globe.

Some parts of the clock had to be restored or adapted in 1670 as is evident from an inscription on the globe (figure 13). The mathematician Julius (and not

⁵¹Several beautiful photographs of the globe can also be found in [Bach et al. (1992)].

⁵²Ungerer incorrectly interprets the words of Dasypodius and claims that Dasypodius had the globe made for himself [Ungerer and Ungerer (1922), p. 24].

⁵³[Beyer (1960), p. 106].

⁵⁴See [Beyer (1960), p. 110], [Kolb (1972)], [Burmeister (1978)] and [Oestmann (2020), p. 131-133]. (Muris and Saarmann incorrectly attribute the globe drawings to a Hans Ernst [Muris and Saarmann (1961), p. 138]) Zell is said to have been born around 1518 in Cologne and may have been a student of Sebastian Münster in Basel. After being in Wittenberg in 1538, he married in Strasbourg in 1546. He then made a number of maps and improved the cartography of Germany [Paulusch (2019), p. 32-33]. As for the globe, one can legitimately wonder what Zell did exactly. No other globe by Zell seems to be known. One could imagine that Zell only obtained gores from a globe maker. On the other hand, there seem to have been very few globes as large as the one that formed the basis of the clock globe and predating 1550. Skelton states that the largest printed gores preserved from the 16th century are those of a Venetian globe of 71 cm diameter [Skelton (1969 (?))]. Dekker mentions only one globe larger than that of the clock, namely a terrestrial globe of 87 cm diameter by Johannes Schöner of 1520 [Dekker (2007)]. She does not mention the terrestrial globe that constituted the base of that of the clock. It is therefore not impossible that Zell's work, perhaps for Herlin, was a unique piece, either printed or drawn directly on the globe. The transformation of the globe is therefore all the more unfortunate.

⁵⁵On the structure of the globe, see [Bach (1960)]. Bach indicates that in order to protect the globe (which various people had fun spinning), its original wooden axis was replaced in 1953 and the original axis may still be somewhere in storage in the Strasbourg *Musée des arts décoratifs* [Martin et al. (2020)]. Since I have been denied access to this storage area since 2014, I unfortunately do not know more. In the current configuration, the globe is no longer attached to the gears and can turn freely. In 2023, tourists also had fun spinning it, as I noticed. This also raises the question of the protection of the globe, which is clearly insufficient.

Peter) Reichelt (1637-1717),⁵⁶ the clockmaker Isaac Habrecht III (1611-1686),⁵⁷ and the painter Johann Mock⁵⁸ were involved. Reichelt probably did not have a major role in the globe and these inscriptions refer rather to the clock as a whole, or even only to the calculations of eclipses and the calendar.⁵⁹

It can be noted, however, that the representation of the Argo ship includes the coats of arms of several notables (figure 14), including Bernegger.⁶⁰ This is certainly Matthias Bernegger (1582-1640) who prepared the list of eclipses from the period 1613 to 1649, still on display in the clock room. One might think that the inclusion of these coats of arms goes back to the 1670 restoration, the only one documented. These coats of arms cannot in any case be original, since Bernegger was not yet born at the time of the construction of the clock. On the other hand, one of the coats of arms is that of the Wurmser family and it is found on one of the mascarons of the clock on Brunn's engraving of 1619 or 1621 (figure 20), and this could in this case indicate an undocumented addition from the 1610s, precisely at the time of Brunn's engraving and the calculation of the new series of eclipses. Furthermore, the date 1603 is found on the outer dial of the clock, and this date could correspond to some additions, although probably not that of Bernegger, still too young at that time.

⁵⁶On Reichelt, see [Le Minor (2009)].

⁵⁷The intervention of Isaac Habrecht III is mentioned on the entablature of the central body of the clock [Garcia-Darowska and de Gorostarzu (2021), part 1, p. 9], but the lack of collaboration of the curators of the DRAC did not allow me to verify this.

⁵⁸Johann Mock notably produced paintings around 1670 for the Sainte Aurélie church in Strasbourg.

⁵⁹[Beyer (1960), p. 104]

⁶⁰[Beyer (1960), p. 118]

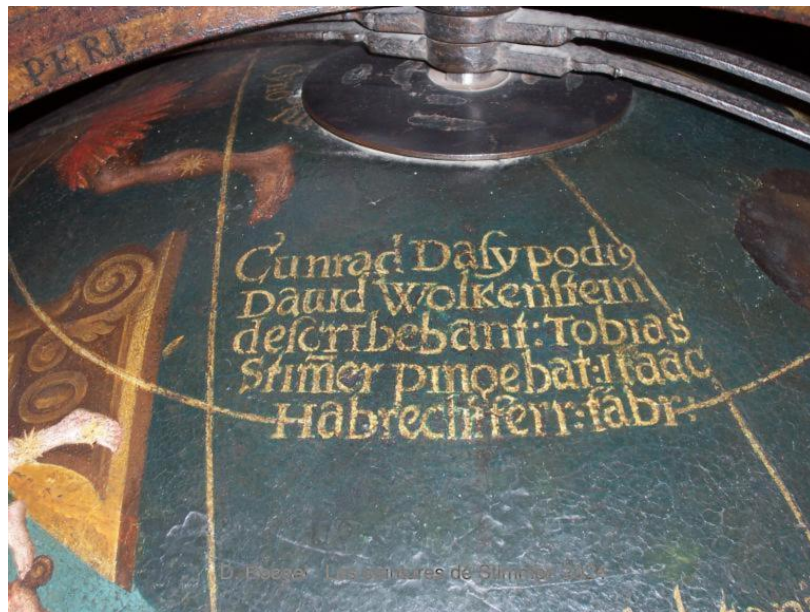


Figure 12: Inscription indicating the manufacture of the globe.



Figure 13: Inscription of the renovation of the globe in 1670.



Figure 14: Detail of the constellation of the ship Argo. The ship bears the coat of arms of the Wurmser family (Stettmeister) (1st coat of arms from the left) and of Matthias Bernegger (1582-1640) (2nd coat of arms from the right). Some of these coats of arms, such as that of Bernegger, may date from the restoration of the globe in 1670.



Figure 15: Detail of the globe with the constellation Canis Major and, on the right, the old constellation Argo.



Figure 16: Detail of the globe: Sagittarius and Corona Australis (compare with figure 33).



Figure 17: Detail of the globe: the constellation of Piscis Austrinus.



Figure 18: Detail of the globe with the meridians crossing at the north pole of the ecliptic. The north celestial pole is a little further to the left at the level of the axis of rotation.



Figure 19: Detail of the vertical colure of the globe with some cities of the temperate zone (TEMPERATA on the edge). We can recognize in particular Lisbon, Toulouse, Lyon or even Erfurt.

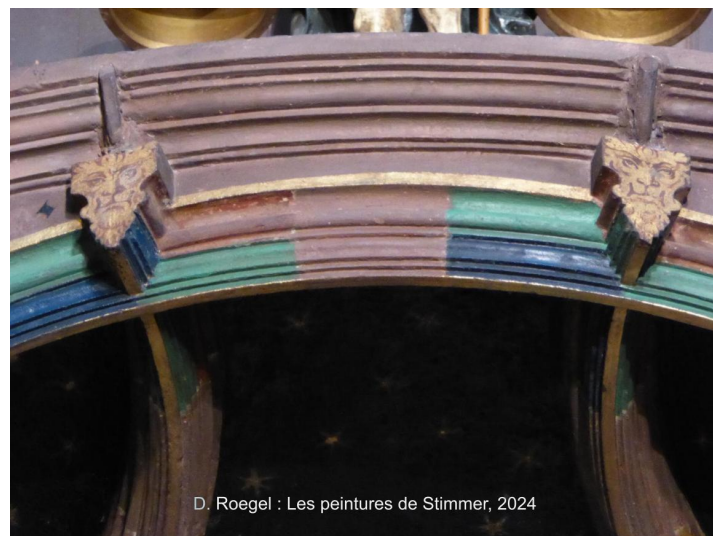


Figure 20: Decorations of the mascarons of the interrupted ribs. Top: on Brunn's engraving of 1619 or 1621. Bottom: in 2023.

3.1.3 The constellations on the globe

The globe of the clock essentially represents the constellations of Ptolemy's star catalogue. This catalogue includes 1028 entries and 48 constellations, but they ultimately correspond to only 1022 stars, in particular due to duplicated entries. On the globe, the number of stars must be smaller, perhaps around 700, because only the brightest stars have been represented.

In the constellation of Cassiopeia, for example, there are 13 stars in Ptolemy's catalogue (and also in those of the Alfonsine and Prutenic tables). However, on the globe of the clock, there only seem to be 8 or 9 stars (perhaps one in the head, to be verified). On Digges' woodcut (figure 22), the 13 stars are numbered from 1 to 13.

We can, in passing, notice that there is a large void under the constellation of Centaurus (figure 16). This void is present on other maps such as that of Amman (figure 28) and is due to the fact that the constellations near the southern celestial pole were not known to Ptolemy.

Ptolemy's 48 constellations were as follows:

Andromeda	Aquarius	Aquila	Ara	Argo Navis	Aries
Auriga	Boötes	Cancer	Canis Major	Canis Minor	Capricornus
Cassiopeia	Centaurus	Cepheus	Cetus	Corona Australis	Corona Borealis
Corvus	Crater	Cygnus	Delphinus	Draco	Equuleus
Eridanus	Gemini	Hercules	Hydra	Leo	Lepus
Libra	Lupus	Lyra	Ophiucus	Orion	Pegasus
Perseus	Pisces	Piscis Austrinus	Sagitta	Sagittarius	Scorpius
Serpens	Taurus	Triangulum	Ursa Major	Ursa Minor	Virgo

In his study of the globe,⁶¹ Beyer gave a list of 48 constellations, but which are in fact not exactly those of Ptolemy.⁶² Beyer omitted the following five constellations which are part of Ptolemy's 48: Serpens (perhaps integrated into Ophiucus on the globe), Sagitta, Taurus, Eridanus and Hydra.

On the other hand, Beyer cited five constellations which are not given by Ptolemy:

- the goat (Beyer/5): this is probably the star Capella in the constellation of Auriga;
- Medusa (Beyer/7); this is not a constellation, but a nebula in the constellation of Gemini;
- the greyhounds (Beyer/28): this is the modern constellation of Canes Venatici introduced by Hevelius in 1687; Beyer's interpretation is therefore anachronistic;

⁶¹[Beyer (1960)]

⁶²In his description of the globe, Bach limits himself to observing that there are 48 constellations [Bach et al. (1992)], visibly following Beyer [Beyer (1960)].

- Coma Berenices (Beyer/30): this constellation is not in Ptolemy and is located between the constellations of Leo and Boötes;
- Antinous (Beyer/36): this is not a constellation of Ptolemy either and it was integrated into the constellation of Aquila.⁶³

Beyer certainly classified into constellations what were only named groupings of stars, therefore asterisms, knowing that such asterisms can supplement the classical constellations.

At this point, I must ask for the reader's indulgence for not describing all the constellations of the globe, because I was not able to make such a description.⁶⁴ My description is therefore based solely on Beyer's elements and on some partial observations in the clock room. I can therefore not verify the locations of the constellations omitted by Beyer (Taurus, Eridanus and Hydra are certainly present!), nor what led Beyer to see a constellation of "Greyhounds."

It should be noted that the constellations given in the Alfonsine and Prutenic tables are exactly those of Ptolemy.

3.1.4 The coordinate system

The globe has meridians at intervals of 30 degrees and these meridians do not pass through the celestial pole, but through the poles of the ecliptic, as is the case on most celestial globes of this period.

The advantage of having the meridians pass through the poles of the ecliptic allows one to easily place the stars from Ptolemy's star tables, the Alfonsine tables or the Prutenic tables, where the coordinates are given in the ecliptic system.

3.1.5 The 1572 supernova

One of the peculiarities of the clock globe is that it depicts the 1572 supernova (SN1572) (figure 24).⁶⁵ The supernova, a new star, appeared in early November 1572 in the constellation of Cassiopeia and was visible until March 1574. It was therefore only barely visible when the clock was completed. At the time, people

⁶³Let me mention for the anecdote that in Isaak Habrecht II's celestial globe of 1621, this constellation bears both the name of Antinous and that of Ganymede [Dolz (2014)].

⁶⁴As I have already mentioned several times, the Strasbourg museums have never (since 2002) facilitated my access to the globe, and since 2021, all my research requests have been denied (or ignored), in particular by the chief curator of the museums, Mr. Paul Lang, but also by the curator of the museum of decorative arts, Mr. Louis Panel, and by the administrator of the museums, Mr. François Pfalzgraf.

⁶⁵See also the special issue "Astronomie" of the journal "Saisons d'Alsace" [Rieb (2023)] (2023) which has a better photograph than mine. Note that the supernova was not mentioned by Bach in 1992, while it can be seen on page 102 of his work [Bach et al. (1992)]. Beyer did not mention it in 1960 either [Beyer (1960)].

only spoke of *nova*, the term *supernova* not having been introduced, it seems, until the early 1930s.

One of the first to observe the 1572 supernova was Tycho Brahe (1546-1601) who devoted a study to it in 1573 (figure 21).⁶⁶ Other pamphlets appeared at the same time, notably by Thomas Digges (figure 22),⁶⁷ Leowitz⁶⁸ and Dasypodius (figure 23).⁶⁹ A somewhat similar map (but not with the same constellations) was drawn by Georg Brentel in 1573.⁷⁰ The engraving accompanying Dasypodius' pamphlet is possibly by Stimmer.

One may wonder whether there are other globes showing the supernova. For example, does Schissler's 1575 globe show the supernova?

⁶⁶[Brahe (1573)] See also [Sparavigna (2017)] and [Friedman Herlihy (2007), p. 121] on specialized celestial maps.

⁶⁷[Digges (1573)]

⁶⁸[Farkas and Zsoldos (2007)]

⁶⁹[Dasypodius (1573)] See also the illustration in [Beaujean and Tanner (2014a), p. 113] (which does not mention Dasypodius) and [Strauss (1975), p. 1005]. The map showing the supernova is also mentioned by [Kanas (2019)].

⁷⁰Zentralbibliothek Zürich, PAS II 10/18.

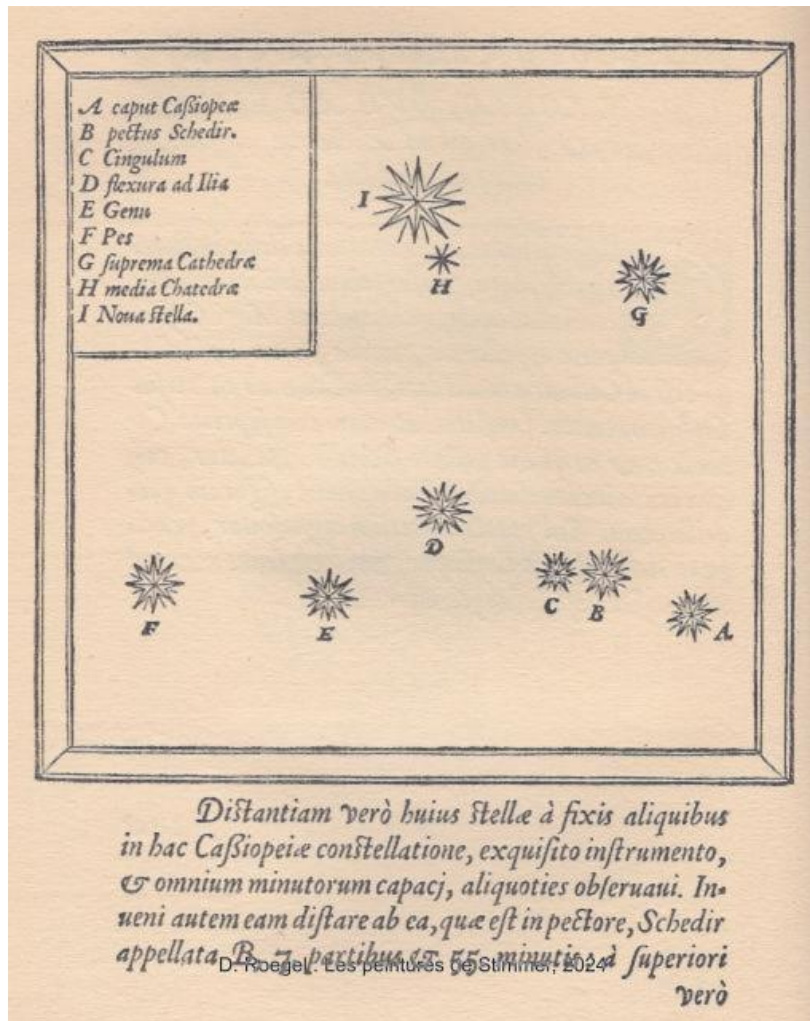


Figure 21: The constellation of Cassiopeia in Brahe's 1573 work [Brahe (1573)]
 This is a geocentric view. The new star is at *I*.

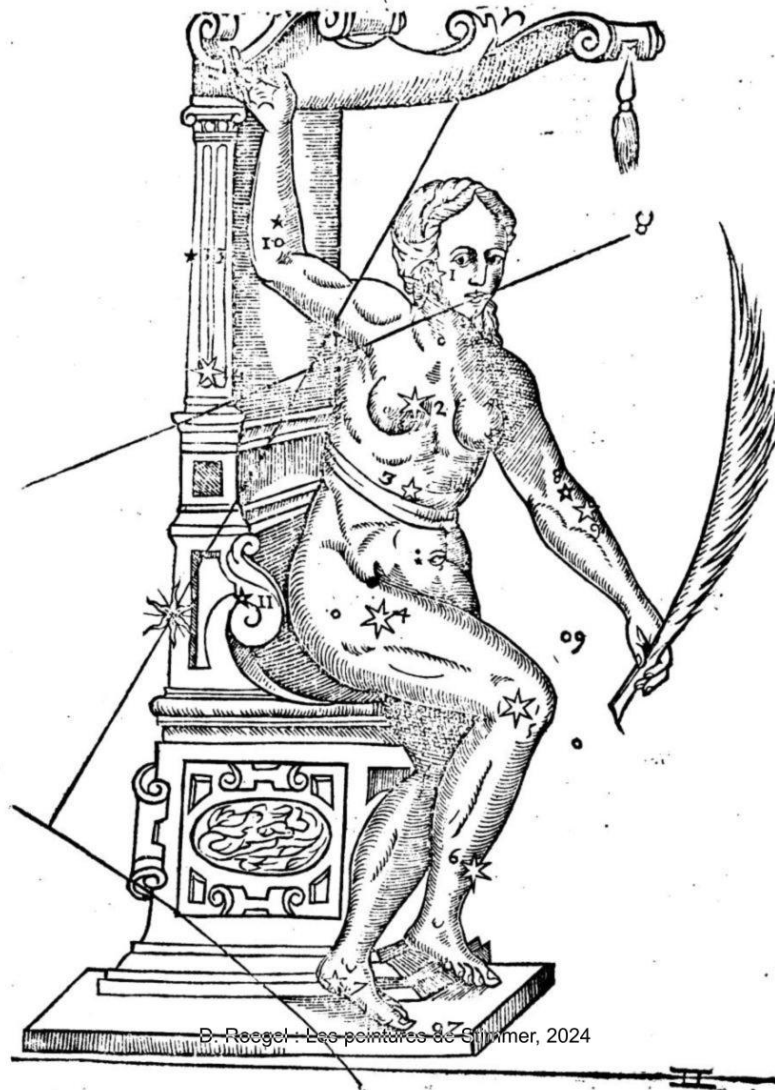


Figure 22: The constellation of Cassiopeia in Digges' 1573 description [Digges (1573)]. This is a geocentric view. The new star is the one to the left of star 11.

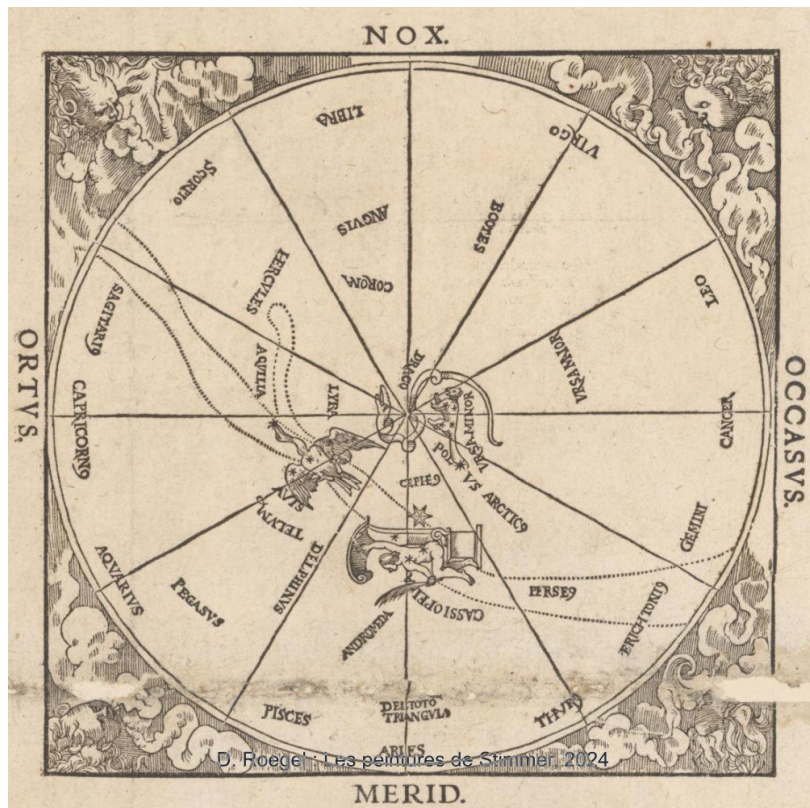


Figure 23: The map accompanying Dasypodius' description of the 1573 super-nova [Dasypodius (1573)]. The new star is just above Cassiopeia. This is an external view.



Figure 24: The 1572 supernova on the clock globe, visible in the constellation of Cassiopeia. This is the new star located to the right of Cassiopeia's buttocks. We should not forget that the constellations are here reversed compared to the geocentric vision. Only eight stars can be distinguished in the constellation.

3.1.6 Celestial maps before Stimmer

There are a number of celestial maps prior to the globe of the Strasbourg clock and it seems useful to give an as detailed as possible overview.⁷¹ However, it is necessary to distinguish the maps that show a geocentric view of the sky, from those that show the external view, normally adapted to celestial globes. The majority of the maps adopt an external point of view, which indicates that they were not maps intended for a direct observation of the sky.

The maps giving a geocentric point of view are those of Honter (1532/1541), Apian (1533), Postel (1553, copied from Honter), Aratus (1559, copied from Postel) and Garcaeus (1565). To these, we can add the geocentric drawings of the constellations in the editions of Hyginus (1482) and Avienus (1488), and in Piccolomini's atlas (1540). All the other maps listed here give the external point of view.

If Stimmer, for example, based himself on a geocentric flat map of the sky, he would have had to reverse all of its representations. I believe, however, that Stimmer essentially used a pre-existing globe and star coordinates to make the clock globe and that therefore the question of reversing the constellations did not really arise.

Vienna (1435) The Vienna maps made around 1435 are two maps of the celestial hemispheres representing the constellations seen from the outside, therefore not in a geocentric perspective.⁷² They may be associated with the astronomer Johannes von Gmunden or his entourage.⁷³ The coordinates of these maps seem to correspond to the year 1424.⁷⁴

These charts are centered on the poles of the ecliptic and the equatorial celestial poles are therefore off-center. As I have already noted, due to the non-visibility of stars near the southern celestial pole, this area appears empty⁷⁵ and it is off-centered due to the centering on the poles of the ecliptic.

⁷¹I refer firstly to Friedman Herlihy's synthesis [Friedman Herlihy (2007)], then to general works on the subject, in particular to the volumes of Brown [Brown (1932)] (which I have not seen) and [Warner (1979)], but these must be supplemented by more recent works. On the Arab-Muslim origin of celestial cartography, see in particular the recent [Dekker (2021)].

⁷²Vienna, ÖNB, Cod. Vin. 5415.

⁷³I refer the reader to the studies of Saxl [Saxl (1927), p. 25-40 and 150-155], Panofsky [Panofsky and Saxl (1933), p. 238-241], Voss [Voss (1943)], Friedman [Friedman Herlihy (2007), p. 109, 111], Dekker [Dekker (2013)], Roland [Roland (2016)] and Gaab [Gaab (2015), p. 35-40] for detailed descriptions of these maps. See also the mention by Durand [Durand (1952), p. 116-117]. These maps are also illustrated by Ameisenowa [Ameisenowa (1959), fig. 38-39] and mentioned by Seznec in his analysis of the stylistic evolution of representations of divinities [Seznec (1993), p. 218-221].

⁷⁴See [Roland (2016), p. 15] and [Dekker (2016a), p. 52]. See Gaab who compares several catalogues for 1424 [Gaab (2015), p. 78].

⁷⁵[Friedman Herlihy (2007), p. 102]

The 1435 maps seem to have been the source of the 1503 and 1515 maps described below,⁷⁶ but they also seem to have influenced the maps of the globes of Dorn (1480) and of 1525.

Hygin (Hyginus) (1482) Among the precursors of Dürer's map, I must mention the edition of Hyginus's *Poeticon astronomicon* (67 BC - 17 AD) published by Ratdolt in 1482.⁷⁷ Unlike the 1435 map and the maps described later, it is not a celestial map, but rather a number of very free and independent engravings of the constellations. And this is also the first time that illustrations of the constellations have been published⁷⁸.

The representations of the constellations in this edition are geocentric, even if this is not always obvious at first glance.

The 1534 edition⁷⁹ of the *Poeticon astronomicon* uses the external perspective.

Avienus (1488) The edition of Aratus' *Phenomena* by Avienus (c305-c375) printed in 1488 in Venice⁸⁰ includes a map of the northern celestial hemisphere, as well as the figures of the constellations already published in Hyginus' edition of 1482 (some in mirror copy).⁸¹ The hemisphere is centered on the northern celestial pole and the view is geocentric. The representation is, however, very approximate and no stars or coordinates are indicated.⁸²

1503 Map This set of two celestial maps,⁸³ one for the northern hemisphere, another for the southern hemisphere, was made in 1503 in Nuremberg by

⁷⁶After analyzing the errors in the catalogues, Gaab considers that Regiomontanus' catalogue, kept in Nuremberg, is a copy of a 1424 catalogue that was in Vienna and of which the catalogue used for the 1435 map is possibly also a copy. However, the catalogue attached to the 1435 maps is probably not exactly the one used for the 1435 maps. Furthermore, according to Gaab, there were copies of the Vienna maps of 1435 that must have served as the basis for the Nuremberg maps of 1503 and 1515. This transmission probably took place via Reinhard Gensfelder. It is indeed he who would have written the Vienna codex containing the 1435 maps and it is probably he who made an excerpt from the star catalogue to take it to Reichenbach Abbey in Bavaria, near Regensburg [Gaab (2015), p. 79].

⁷⁷See [Hyginus (1482)]. See also [Gaab (2015), p. 31-32] and [Ashworth (1997)]. The constellations published in 1482 were republished partly in mirror copies in Avienus' version of Aratus' *Phenomena* in 1488 [Avienus (1488)] and in Negri's collection in 1499 to illustrate Aratus' *Phenomena* [Negri (1499)]. On Aratus, see in particular Dekker's publications [Dekker (2010a), Dekker (2013)].

⁷⁸[Friedman Herlihy (2007), p. 110]

⁷⁹[Hyginus (1534)]

⁸⁰[Avienus (1488)]

⁸¹On the editions of Aratus' *Phenomena*, see [Dekker (2010a), Dekker (2013)].

⁸²[Gaab (2015), p. 73]

⁸³Nuremberg, Germanisches Nationalmuseum, Inv. Nr. Hz 5576 and 5577.

Konrad Heinfogel (died in 1517)⁸⁴ and an anonymous artist.⁸⁵ They are certainly inspired by the 1435 maps. The perspective of these maps is that of the outside. There is, as on the 1435 maps, an empty area in the southern hemisphere around the southern celestial pole.

Each hemisphere is centered on a pole of the ecliptic and is drawn on a square of parchment of 66.5 cm on each side. Unlike other maps, such as those of 1435 and Dürer's of 1515, the 1503 map also has many decorations and is not limited to the outline of the constellations. These decorations were described by Voss⁸⁶ but they were reconsidered by Dekker in the context of the microcosm and the macrocosm.⁸⁷ They draw their inspiration from the *Quatuor Libri Amorum* of the poet Conrad Celtes,⁸⁸ of which three woodcuts are by Dürer and the others by Michael Wolgemut's entourage. In particular, we can note the presence of Sebastian Spreng (Sperantius), the future bishop of Brixen (today Bressanone in Italy), who received as a gift a celestial globe in 1522 described a little further on.

It seems that the coordinates of the 1503 map are the same (with the exception of errors) as those of the 1435 maps, therefore for the year 1424.⁸⁹

Dürer (1515) Albrecht Dürer is the author, in 1515, of the first celestial maps printed in Europe.⁹⁰ In fact, his maps are in line with the maps of 1435 and 1503, whose presentation they follow (figure 25). Like the previous maps, those of Dürer show the view of the sky from the outside (therefore non-geocentric). The hemispheres are centered on the poles of the ecliptic.

To produce these maps, Dürer teamed up with the two astronomers Johannes Stabius (c1460-1522)⁹¹ and Konrad Heinfogel (died in 1517).⁹² Stabius is said to have determined the coordinates, Heinfogel is said to have placed

⁸⁴On Heinfogel, see notably [Pilz (1977), p. 148-151].

⁸⁵See essentially [Voss (1943)], [Pilz (1977), p. 151-153], [Friedman Herlihy (2007), p. 111], [Dackerman (2011), p. 86-89], [Gaab (2015), p. 40-42] and [Dekker (2016b)]. See also [Oestmann (1993), p. 40-43]. These maps are also illustrated by Ameisenowa [Ameisenowa (1959), fig. 40-41]. On astronomy in Nuremberg, see also [Pilz (1977)].

⁸⁶[Voss (1943)]

⁸⁷[Dekker (2016b)]

⁸⁸[Celtes (1502)]

⁸⁹Oestmann [Oestmann (1993), p. 40] indicates that the coordinates of the 1503 map are those of Ptolemy increased by 18°58', which corresponds approximately to the year 1424. See also [Friedman Herlihy (2007), p. 109] and [Dekker (2016a), p. 52]. Bartrum had already made this observation [Bartrum (2002), p. 194]. Oestmann also cites a table of stellar positions in the codex Cod. Vin. 5280 of the Austrian National Library (fol. 47^r-56^r) [Oestmann (2005a), Oestmann (2005b)], but the table in question does not seem to be a list of stellar coordinates.

⁹⁰The most recent and most complete work on Dürer's maps is that of Gaab [Gaab (2015)], but I give below a certain number of additional references.

⁹¹On Stabius, see [Pilz (1977), p. 163-166].

⁹²On Heinfogel, see notably [Pilz (1977), p. 148-151].

the stars, and Dürer is said to have drawn the constellations.⁹³ Dürer's maps are said to have been obtained by stereographic projection.⁹⁴

Dürer's maps would give the coordinates of the stars for about 1500.⁹⁵ Gaab has recently studied the errors in Dürer's maps⁹⁶ and analyzed their origin. It seems that various copying errors were made in the copying of the catalogues, in the transition from a catalogue to the maps, and that in addition there were inversions on the maps themselves. All these errors mean that it is not possible to determine the epoch of the maps merely by examining two or three stars. I have for instance noted the longitudes of three stars close to the ecliptic. I have estimated the longitude of Regulus on the maps at about 142.3 ± 0.1 , which corresponds to 1515 rather than 1500. (Dekker seems to have estimated (?) this longitude at 142.17, which corresponds to about 1503 (and not 1500) in the Alfonsine tables.) Similarly, I have estimated the longitude of Spica (Virgo) at 196.7 ± 0.1 which corresponds to a time well after 1520. . . And for Zubenelgenubi (Libra), I have estimated its longitude in Dürer at 218.7 ± 0.1 which is more than 1 degree off from what it should be. . . It is therefore clear that the examination of three stars is not sufficient to decide the epoch of the maps. It is possible that, excluding anomalies, the average epoch of Dürer's maps is around 1500. Gaab believes in any case that Dürer's maps are either based on a catalogue closely linked to a table calculated at Reichenbach Abbey for 1499,⁹⁷ or possibly were recalculated by Heinfogel

⁹³See [Satterley (2010)], citing [Warner (1979)]. More generally, we can consult [Weiss (1888)], [Hamann (1971)], [Geisberg (1974), p. 685-687], [Pilz (1977), p. 153-157], [Warner (1979), p. 71-75], [Smith (1983), p. 114], [Oestmann (1993), p. 44-47], [Bartrum (2002), p. 194], [Kugel et al. (2002), p. 28], [Wörz (2006)], [Friedman Herlihy (2007), p. 111], [Wood (2008), p. 232-238], [Iwańczak (2009), p. 140-147], [Dackerman (2011), p. 90-93], [Kanas (2019), p. 154-156], [d'Auriol (2019)] and [Hofmann and Nawrocki (2019), p. 90] for additional information. These maps are also illustrated by Ameisenowa [Ameisenowa (1959), fig. 42-43]. On the other hand, they are only mentioned in passing in Panofsky's biography of Dürer [Panofsky (2012), p. 291]. See also the stylistic analyses of Sez nec [Sez nec (1993), p. 218-221].

⁹⁴[Luecking (2018)] Luecking suggests that the manufacture of astrolabes in Nuremberg may have familiarized Dürer with this projection. On the other hand, I have not seen any in-depth study of this issue and the stereographic "style" does not imply that the properties of stereographic projection are truly respected and that the distances to the ecliptic pole are correct. Of course, the stereographic projection has the interesting property that the equator and the other circles of the celestial sphere are projected as circles, although Dürer does not show them.

⁹⁵See [Bartrum (2002), p. 194], [Dekker (1995), p. 90] and [Dekker (2016a), p. 52]. Voss had found an average precession of the order of $19^{\circ}40'$ [Voss (1943), p. 100], corresponding to about 1500, an average confirmed by Dekker [Dekker et al. (2010), p. 48]. With the uncertainty of $10'$, this gives me a range approximately between 1485 and 1520, according to my calculation. Friedman Herlihy also claims that Dürer's maps give the configuration for 1440 [Friedman Herlihy (2007), p. 102].

⁹⁶[Gaab (2015), p. 80-85]

⁹⁷München, BSB, Clm 24103, fol. 55-59.

from a 1424 catalogue. However, the latter hypothesis would not explain why the calculation would have been made for 1499 or 1500 and not for 1515.⁹⁸

Note that Dürer's maps do not include the equator and are therefore not affected by the errors related to the misplacement of the equator on maps such as those of Honter.

Dürer's maps have had a great influence and posterity, as will be seen below.⁹⁹ They have sometimes been reprinted as is, merely with a different title. For example, they were included with a slight modification in a partial edition of Ptolemy's *Almagest* published in 1537 by Noviomagus,¹⁰⁰ but are present only in very rare copies of this work. They were also taken up and adapted by the Venetian architect Giovanni Antonio Rusconi in 1590.¹⁰¹

Volpaia (1530) There is at least one map of the southern ecliptic hemisphere by Volpaia, bearing his name and the year 1530. This map is actually a copy of the corresponding map by Dürer, with some additional stars,¹⁰² and it also gives the external viewpoint.¹⁰³ On the other hand, Volpaia misoriented the south celestial pole, which he moved by about 30 degrees from its real position.¹⁰⁴ Curiously, this error is also found in Honter's map.

Honter (1532/1541) In 1532, Johannes Honter (1498-1549), originally from Transsylvania, made maps corresponding to the geocentric representation of the constellations.¹⁰⁵ These are the first maps printed with such a perspective. The same is true of the maps of Postel (1553)¹⁰⁶ and Garcaeus (1565)¹⁰⁷ which take them up. The hemispheres are always centered on the poles of the ecliptic.

Honter's map contains the same error as Volpaia's map on the southern hemisphere.¹⁰⁸ Moreover, since Honter indicated the equator (absent in

⁹⁸[Gaab (2015), p. 79] See also on this topic Oestman's discussion [Oestmann (2005a), p. 31].

⁹⁹Gaab examines the maps and globes that are based on Dürer's maps [Gaab (2015), p. 113-165], but he does not seem to know the globe of Stimmer-Dasypodius.

¹⁰⁰See [Satterley (2010)] and [Dekker et al. (2010)].

¹⁰¹See [Rusconi (1590)]. See also [Ameisenowa (1959), p. 57-58]

¹⁰²[Gaab (2015), p. 120]

¹⁰³See [Warner (1979), p. 259]. The map is illustrated in [Potter (2004)].

¹⁰⁴This error was not noted by Gaab, *op. cit.*

¹⁰⁵On Honter, see especially [Damian (2022)]. For further information, see [Knapp (1917)], [Gaab (2015), pp. 144-148], [Fischer (1970)], [Warner (1979), pp. 123-126], [Ashworth (1997)], [Friedman Herlihy (2007), pp. 111] and [Kanas (2019), pp. 156-158].

¹⁰⁶[Gaab (2015), p. 148]

¹⁰⁷[Gaab (2015), p. 150]

¹⁰⁸[Gaab (2015), p. 147]

Dürer), it is also misplaced.¹⁰⁹ This error is subsequently found in other maps.

Honter's maps were apparently intended for an edition of Aratus published in Basel in 1535 by Petri.¹¹⁰ They were finally published only in 1541 in an edition of Ptolemy's works by Petri in Basel.¹¹¹

Apian (1533) Peter Apian (1495-1552), professor of mathematics in Ingolstadt, made in 1533 a planisphere where the two hemispheres are combined into one (figure 26).¹¹² This map shows a little more than the northern hemisphere and only the brightest stars.¹¹³ Furthermore, it is not centered on the north ecliptic pole, but on the north celestial pole. It indicates both the ecliptic and the equator, but correctly, without the error of the Volpaia and Honter maps.

This map was engraved by Hans Brosamer and appeared in the *Horoscopia* (1533)¹¹⁴ and the *Instrument-Buch* (1533),¹¹⁵ both by Apian. The perspective of this map is that of the observer on Earth.

Vopel (1534) For the 1534 edition of Hyginus' *Poeticon astronomicon*,¹¹⁶ the cartographer Caspar Vopel (1511-1561) made new engravings of the constellations.¹¹⁷ It is therefore not strictly speaking a celestial map. These constellations are seen from the outside, and they must have served as the basis for the inverted engravings of 1570 by Dasypodius¹¹⁸ that I discuss later.

Apian (1536) In 1536, Peter Apian (1495-1552) made a new map uniting the two hemispheres in a single view (figure 27), or rather, a map that spreads all the constellations in a boreal perspective. But unlike the 1533 map, the perspective here is as in Dürer's 1515 maps, that is to say external and not geocentric.¹¹⁹ Incidentally, Dürer's maps served as a starting point for Apian.¹²⁰ Furthermore, Apian has centered his map again on the north ecliptic pole and it extends further than it did in 1533. The ship Argo is

¹⁰⁹Friedman Herlihy attributes the error to Honter, but it may therefore be earlier than him [Friedman Herlihy (2007), p. 113].

¹¹⁰See [Oestmann (2005a), p. 31] and [Damian (2022), p. 147].

¹¹¹[Ptolemaeus (1541)]

¹¹²On Apian, see notably [Pilz (1977), p. 144-147].

¹¹³See notably [Warner (1979), p. 9].

¹¹⁴[Apian (1533a)]

¹¹⁵[Apian (1533b)]

¹¹⁶[Hyginus (1534)]

¹¹⁷[Dekker (2010b), p. 164-166]

¹¹⁸[Dasypodius (1570)]

¹¹⁹See [Gaab (2015), p. 123].

¹²⁰[Dekker (2010b), p. 164]

now visible, whereas it was not in 1533. This map was taken up in 1540 in his *Astronomicum Caesareum*,¹²¹ but with a different font.¹²²

In 1557, Bassantin also combined the two hemispheres into one in his *Astronomical discourse*.¹²³

Noviomagus (1537) In 1537, Jan van Bronckhorst, also called Johann Noviomagus, from Nijmegen, published a partial edition of Ptolemy's *Almagest*, to which were attached two adapted versions of Dürer's maps.¹²⁴ The maps were re-engraved with a precession corresponding to a date between 1518 and 1536.¹²⁵ Like those of Dürer which they almost copy, these maps show the celestial sphere from the outside.

Piccolomini (1540) In his work *De le stelle fisse* published in 1540,¹²⁶ Alessandro Piccolomini (1508-1579) produced what is considered to be the first celestial atlas, with the positions of the different stars, but without a general map of the sky. In particular, there are no drawings of constellations.¹²⁷ The viewpoint of these maps is geocentric.

Vopel (1545) Caspar Vopel (1511-1561) made a map giving the external viewpoint in 1545, but this map has been lost. It was however included in Girava's book of cosmography¹²⁸ published in 1556 and then on maps by Giovanni Andrea Valvassore (1558), by Matteo Pagano (after 1558), by Bernaard van den Putte (1570), as well as on an anonymous map.¹²⁹ We can note that the tracing of the equator is correct on the map illustrated by Dekker (Valvassore map) and not affected by the error of Volpaia and Honter.

Gastaldi (c1550?) A world map by Giacomo Gastaldi (c1500-1566) has the two celestial hemispheres in the upper spandrels. These maps seem to be taken from those of Dürer, but use the geocentric perspective.¹³⁰

¹²¹[Apian (1540)] See also [Dackerman (2011), p. 104-107].

¹²²See [Dekker (2010b), p. 164] and [Muris and Saarmann (1961), p. 77].

¹²³[Bassantin (1557)]

¹²⁴[Gaab (2015), p. 138-139]

¹²⁵[Dekker et al. (2010), p. 49] The average precession given by the authors is $19^{\circ}53' \pm 24'$, which corresponds according to my calculation to an average epoch of 1527, with a range of ± 44 years. I do not know how the interval from 1518 to 1536 was obtained, but note however that I agree with the authors on the average epoch.

¹²⁶[Piccolomini (1540)]

¹²⁷For further information, see [Warner (1979), p. 200], [Ashworth (1997)], [Kanas (2006)], [Friedman Herlihy (2007), p. 113] and [Kanas (2019), p. 158-161].

¹²⁸[Girava (1556)]

¹²⁹See [Warner (1979), p. 262], [Friedman Herlihy (2007), p. 115] and [Dekker (2010b), p. 169-170, 181-185]. Dekker illustrates Valvassore's maps. See also [Gaab (2015), p. 133-138].

¹³⁰[Friedman Herlihy (2007), p. 115]

Postel (1553) In 1553, Guillaume Postel (1510-1581) produced geocentric celestial maps copied from those of Honter.¹³¹ These maps appeared in his work *Signorum coelestium vera configuratio aut asterismus*.¹³² They seem to repeat Volpaia and Honter's errors mentioned above.

Bassantin (1557) The astronomer and mathematician Jacques Bassantin (c1504-1568) published in 1557 his work *Astronomical Discours*¹³³ in which a map slightly adapted from that published by Apian in 1536 appears. It shows the external view of the sky, on a single extended hemisphere.

Middochius (1558) In 1558 Isibrand Middochius (died 1577) made two maps giving the external perspective of the sky and inspired by those of Dürer of 1515.¹³⁴

These maps were the basis for a goldsmith's work by Jonas Silber in 1589.¹³⁵

Aratus (1559) The two maps published in 1559 by Guillaume Morel¹³⁶ to accompany the edition of Aratus (or Aratos de Soles) show the geocentric perspective of the constellations. They take up Postel's maps of 1553 and probably present the same problems as Volpaia and Honter's maps.

Amman (1564) In 1564 Jost Amman (1539-1591) produced a map where the two hemispheres are placed one above the other (figure 28). We distinguish the void of the unknown zone around the south celestial pole. Amman's map gives the external point of view.¹³⁷ It can be noted that the constellation of Coma Berenices introduced in Vopel's globe of 1536 (see below) is present in Amman's maps, but not the constellation of Antinous which is also found in Vopel's globe.¹³⁸

Amman's map has again the error in positioning the equator that goes back to the Volpaia and Honter maps.

According to Warner, this map appears in some copies of Ptolemy's *Geography* published in 1578 in Cologne.

Amman also made two geographical hemispheres on the same principle. It is believed that both maps were made for a lost treatise by the cartographer

¹³¹ See [Warner (1979), p. 209].

¹³² [Postel (1553)]

¹³³ [Bassantin (1557)] See also [Warner (1979), p. 17].

¹³⁴ [Gaab (2015), p. 155-157] These maps are reproduced in [Strauss (1975), p. 1314-1315].

¹³⁵ [Morrall (2014)]

¹³⁶ [Aratos de Soles and Caius Julius Hyginus (1559)] See also [Przyrkowski (1962), p. 109].

¹³⁷ See [Gaab (2015), p. 149] and [Dackerman (2011), p. 108-111]. See also [Warner (1979), p. 274-275], but where the map is still given as anonymous.

¹³⁸ See [Dekker (2010b), p. 179] and [Gaab (2015), p. 149].

Tilemann Stella (1525-1589) on the manufacture of globes. Stella had also made a celestial globe in 1555 (see below).

Finally, it should be noted that Amman's maps were used in some of Andreas Pleninger's calendar tables (1555-1607).¹³⁹

Garcaeus (1565) The theologian Johann Garcaeus (Gartze) the Younger (1530-1574) included in one of his works published in 1565 two maps that are apparently based on Amman's maps of 1564, but inverted, thus producing geocentric maps.¹⁴⁰ In addition, the equator is incorrectly positioned, as in Amman's maps.

Brahe (1573) In his pamphlet *De nova et nullius ævi memoria prius visa stella, iam pridem Anno à nato Christo 1572. mense Nouembrj primùm Conspecta, contemplatio mathematica* published in 1573,¹⁴¹ Tycho Brahe (1546-1601) described the 1572 supernova and included a map of the constellation Cassiopeia (figure 21),¹⁴² but only with some stars and the nova. It is therefore not a complete celestial map.

Brentel (1573) In 1573, Georg Brentel the Elder (c1525-1610) made a map also showing the 1572 supernova, but placing it within a partial map showing nevertheless all the signs of the zodiac.¹⁴³ The map represents an external view of the sky.

Dasypodius (1573) In 1573, Dasypodius also published a brief description¹⁴⁴ of the supernova illustrated with a map (figure 23).¹⁴⁵ This map also shows the external view of the sky.

¹³⁹[Folk and Altman Poetsch (2016)]

¹⁴⁰[Garcaeus (1565)]

¹⁴¹[Brahe (1573)]

¹⁴²See also [Warner (1979), p. 41].

¹⁴³[Warner (1979), p. 42] A copy is in the Zentralbibliothek Zürich, PAS II 10/18.

¹⁴⁴[Dasypodius (1573)]

¹⁴⁵[Warner (1979), p. 61]

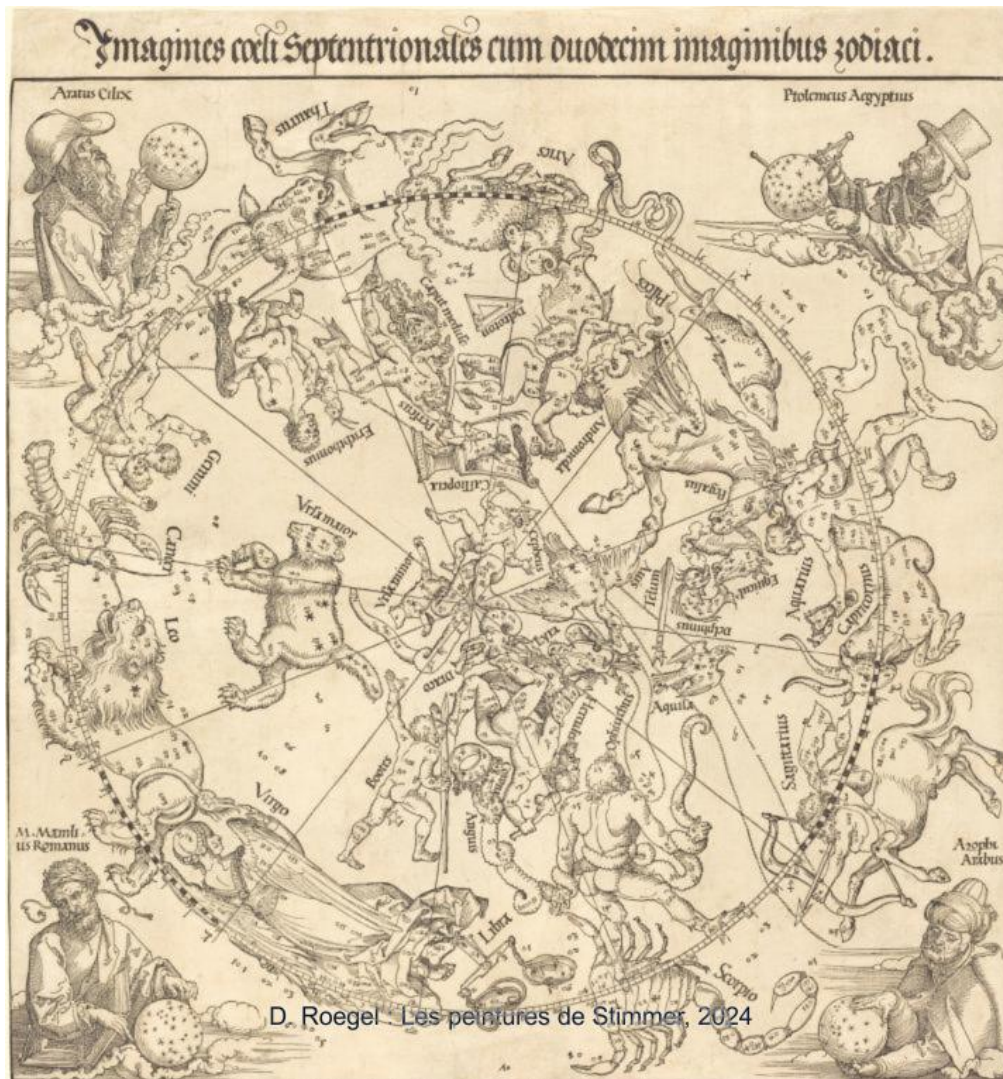


Figure 25: Dürer: the map of the Northern Hemisphere (1515).

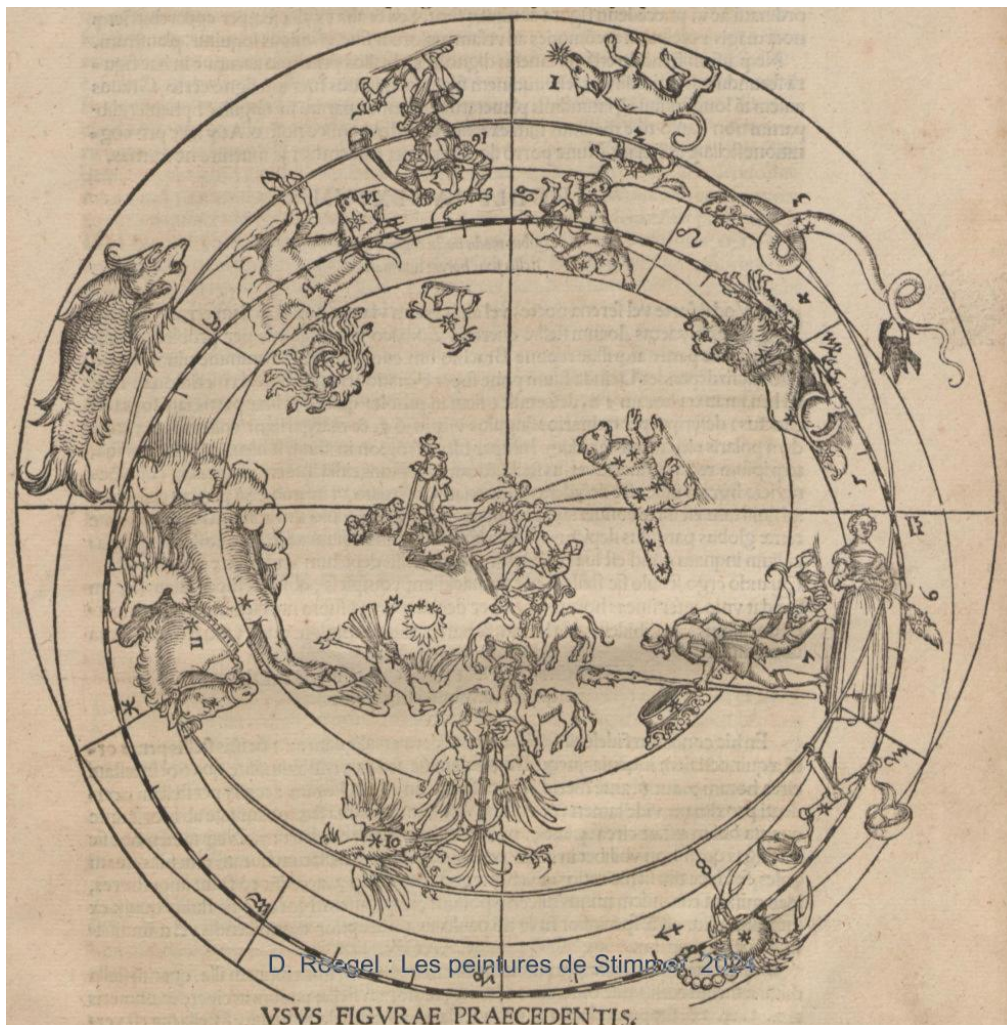


Figure 26: Apian: the map of the two hemispheres in one (1533). Woodcut by Hans Brosamer.



Figure 27: Apian: the map of the two hemispheres in one (1536). Woodcut by Hans Brosamer.



Figure 28: Amman's maps of 1564 (excerpt). This is the sky seen from the outside.

3.1.7 Celestial globes before Stimmer

There are very few globes remaining today that go back before 1500, whether terrestrial or celestial globes.¹⁴⁶ The oldest terrestrial globe known today is the one made in 1492 by Martin Behaim (1459-1507), a native of Nuremberg.¹⁴⁷ Printed globes appeared at the beginning of the 16th century. Before that date, globes were all handwritten, painted or possibly engraved in metal. With the advent of printing, globe designers were able to print gores, often twelve in number, which were cut out and glued onto a sphere.

Examples include gores printed by Martin Waldseemüller (1470-1521) in 1507¹⁴⁸ or by Johann Schöner in 1523.¹⁴⁹ Apian is said to have made geographical gores around 1518.¹⁵⁰ Nawrocki also cites a printed globe by Louis Boulengier in 1514.¹⁵¹

Besides printing, another major driver of the development of globes was the age of exploration. The first great voyages made America known, but also many other territories, and this knowledge was translated into maps and globes. In addition, the idea arose of combining celestial and terrestrial globes, and globe makers often made pairs of globes.

The first celestial globes were based mainly on Ptolemy's list of stars, but other constellations were added later. Dürer's two maps of 1515 were the first celestial maps printed in Europe, and they also renewed the cartography of globes. It was also in 1515 that Johann Schöner (1477-1547) is said to have made the first pair of globes, although this pair has not survived.¹⁵² In the second half of the 16th century, the globe market was dominated by Mercator, who established a model for globe design that served as a basis until the 20th century.

¹⁴⁶On globes in general, see in particular [Stevenson (1921)], [Muris and Saarmann (1961)], [Bertele (1961)], [Fauser and Seifert (1964)], [Dekker and Krogt (1993)], [Dekker (1999a)], [Dahl and Gauvin (2001)], [Dekker (2007)] and [Sumira (2014)].

¹⁴⁷See [Willers (1992)], [Sumira (2014), p. 42-43] and [Dekker (2007)]. Behaim's globe is kept at the *Germanisches Nationalmuseum* in Nuremberg. See Gautier Dalché for globes that preceded Behaim's [Gautier Dalché (2010)]. One of the earlier (and missing) globes is mentioned by Babicz [Babicz (1987)]. See also [Fauser and Seifert (1964), p. 14], [Dekker and Krogt (1993), p. 23, 26] and [Iwańczak (2009), p. 114-132]. On Behaim, see [Pilz (1977), p. 106-109]. On ancient globes, especially that of the Farnese Atlas, see [Dekker (2009)].

¹⁴⁸See [Bagrow (1966), p. 109] and [Sumira (2014), p. 44-45]. There are gores printed by Waldseemüller, but no globes. On the construction of gores in the 16th century, see [Oestmann (1995)].

¹⁴⁹See [Bagrow (1966), p. 129].

¹⁵⁰See [Stevenson (1921), v. 1, p. 77-78], [Muris and Saarmann (1961), p. 76], [Wood (2000), p. 16] and [Dackerman (2011), p. 324-325].

¹⁵¹François Nawrocki, *The pair of printed globes: origin and consecration of a model* in [Hofmann and Nawrocki (2019), p. 134-139].

Nevertheless, according to Cabayé [Cabayé (2001)], Boulengier was well-versed in plagiarism and it is not certain that these printed gores are really his. On the other hand, Boulengier may have wanted to attach a globe to his copy of Waldseemüller's *Cosmography* and the question is therefore not completely settled, nor even on the date which might not be 1514 [Siebold (2021)].

¹⁵²[Dekker and Krogt (1993), p. 23]

According to Hipparchus' rule, the constellations on a globe are represented by looking towards the centre.¹⁵³ We can therefore rather see the backs of characters such as Cassiopeia, Hercules, Gemini, etc. Stimmer also represents Cassiopeia from the back, as can be seen from the positions of the hands' thumbs.

Let me therefore make an overview of the main modern Western celestial globes prior to that of the Strasbourg astronomical clock. I will restrict myself to the main globes and only to those which still exist.¹⁵⁴ I begin with those that were in the possession of Nicholas of Cusa,¹⁵⁵ albeit knowing that there were older celestial globes, the oldest preserved being the one in marble from the Farnese Atlas dating from the second century AD. Celestial globes were also produced in China and by Arab astronomers¹⁵⁶ and I do not list them here. What interests me above all are the globes that may have had a not too distant relationship with Stimmer's globe.

Wooden celestial globe (around 1320-1340) This globe¹⁵⁷ of 27 cm in diameter belonged to the theologian Nicolas de Cues (1401-1464).¹⁵⁸ It is kept at the St. Nikolaus Hospital in Bernkastel-Kues in Germany. It has the particularity of being a precession globe,¹⁵⁹ that is, a globe where the diurnal rotation axis could be adjusted to take precession into account. The celestial poles describe a circle around the poles of the ecliptic.¹⁶⁰

Copper celestial globe (c1450?) This globe¹⁶¹ of 16.6 cm in diameter also belonged to the theologian Nicholas of Cusa (1401-1464) and is unfinished.¹⁶² It has only 44 stars on its surface.¹⁶³ It is also kept at the St. Nikolaus

¹⁵³See [Friedman Herlihy (2007), p. 102] and [Gaab (2015), p. 164]. This rule is not always respected, for example not on two Arabic globes described by Kunitzsch [Kunitzsch (1992)].

¹⁵⁴For a more complete list, I refer to [Dekker (2007)]. My list includes almost all of Dekker's entries up to 1575, and a few after 1575. I do not cite the few "cosmographical" globes which are terrestrial globes with a celestial part (for example a few stars). Various articles cited further on give other lists, more or less complete, for example Lindner for German globe manufacturers [Lindner (1987)]. One may be surprised, by the way, to note that the globe of Stimmer-Dasypodius has apparently not yet been studied in detail, from the point of view of precession or the representation of the constellations, if we except Beyer's isolated work from 1960.

¹⁵⁵[Pilz (1977), p. 52-54]

¹⁵⁶On Arab globes, see mainly [Savage-Smith (1985)]. See also [Kanas (2019), p. 256].

¹⁵⁷Globe (1) in Dekker's list [Dekker (2007), p. 160] and (48) in [Kummer (1992)].

¹⁵⁸See [Hartmann (1919), p. 28-40], [Lindner (1987), p. 169], [Willers (1992), v. 2, p. 508-509], [Dekker and Krogt (1993), p. 16-17] and [Dekker (2013), p. 420-422]. On Cusa, see [Pilz (1977), p. 52-54]. On the origin of the instruments acquired by Nicholas of Cusa, see [Dekker (2013), p. 356].

¹⁵⁹[Dekker (2003)]

¹⁶⁰The principle of precession globes was described by Ptolemy, see [Dekker (2002), p. 62].

¹⁶¹Globe (2) in Dekker's list [Dekker (2007), p. 160] and (49) in [Kummer (1992)].

¹⁶²See the descriptions in [Hartmann (1919), p. 42-50], [Willers (1992), v. 2, p. 509] and [Dekker and Krogt (1993), p. 16]. On Cusa, see [Pilz (1977), p. 52-54].

¹⁶³[Lindner (1987), p. 169]

Hospital in Bernkastel-Kues in Germany.

Dorn (1480) In 1480, the mechanic Hans Dorn (c1435-1506 or 1509?) of Vienna made a celestial globe¹⁶⁴ of 39.5 cm in diameter¹⁶⁵ for Marcin Bylica (c1433-1493), the court astronomer of the Hungarian king Matthias Corvin.¹⁶⁶ Dorn was a collaborator or student of Peurbach¹⁶⁷ and of Regiomontanus,¹⁶⁸ the founders of the Vienna astronomical school.¹⁶⁹ He built many instruments and was notably the first to indicate the magnetic deviation on a compass.

Dorn's globe was built like all Arab globes, namely by assembling two brass hemispheres. The hemispheres are assembled at the equator and meridians are drawn meeting at the poles of the ecliptic. A planispheric astrolabe was fixed above the globe, creating a combination that is unique to this day and could have been used to make measurements.¹⁷⁰

The constellations on this globe were certainly influenced by the 1435 Vienna map.

Stoeffler (1493) The astronomer Johannes Stöffler (1452-1531), originally from Justingen near Ulm, made in 1493 a celestial globe¹⁷¹ of 49 cm in diameter for the bishop of Constance Daniel Zehender, who died in 1500.¹⁷²

X-rays taken in the 1990s revealed that this globe was made of wood and formed of small blocks arranged in spherical layers.¹⁷³ The constellations are painted and small brass nails of different sizes indicate the positions of the fixed stars. This globe has meridians every 30 degrees passing through the poles of the ecliptic. The constellations may be based on those in the 1435 maps mentioned above, or on another lost map.

¹⁶⁴Globe (3) in Dekker's list [Dekker (2007), p. 160].

¹⁶⁵Collegium Maius, Krakow, Inv. 4039, 37/V.

¹⁶⁶On Bylica, see in particular [Domonkos (1968), Hayton (2007)].

¹⁶⁷On Peurbach, I refer only to [Pilz (1977), p. 54-57], but there is in fact a very large literature.

¹⁶⁸On Regiomontanus, I also refer only to [Pilz (1977), p. 58-100] and [Iwańczak (2009), p. 70-85], knowing that the literature on this subject is very large.

¹⁶⁹[Przykowski (1962), p. 104] For additional information on this globe, in addition to the article by Przykowski cited, see [Ameisenowa (1959)], [Domonkos (1968), p. 78-79], [Bartha (1990)], [Hayton (2007), p. 194], [Gessner and Mesquita e Carmo (2011)] and [Dekker (2013), p. 423-426].

¹⁷⁰[Bartha (1990)]

¹⁷¹Globe (5) in Dekker's list [Dekker (2007), p. 160].

¹⁷²The main references on this globe are [Oestmann (1993), Oestmann and Grunert (1995)]. See also [Muris and Saarmann (1961), p. 65, 69], [Fauser and Seifert (1964), p. 131-132], [Lindner (1987), p. 171], [Willers (1992), v. 2, p. 516-518], [Dekker and Krogt (1993), p. 27], [Dekker (2002), p. 66-67] and [Dekker (2013), p. 426-431]. Stoeffler's globe is kept at the *Germanisches Nationalmuseum* in Nuremberg.

¹⁷³[Oestmann and Grunert (1995), p. 61]

Oestmann states that Regulus has ecliptic coordinates $142^{\circ}6'$ and that this would correspond to the epoch 1500.¹⁷⁴ In reality, however, $142^{\circ}6'$ does not correspond to 1500, but rather to 1495. In 1500, one should have had a longitude of $142^{\circ}8'$ according to the Alfonsine tables.¹⁷⁵

Stoeffler is also the author of ephemerides printed in 1499 in Ulm. In 1513, he published a treatise on the construction of astrolabes, the *Elucidatio fabricae ususque astrolabii*.

Unknown (1502) A metal globe¹⁷⁶ dated 1502 and by an unknown maker is kept in Écouen.¹⁷⁷ This globe has a diameter of 70 cm.

The meridians of the globe (every 6 degrees) meet at the poles of the ecliptic and this globe has the particularity of indicating the parallels of latitude for each degree. There is, however, no meridian or parallel for equatorial coordinates, except that the globe is divided into two parts at the celestial equator.

Schöner (1515) The mathematician Johann Schöner (1477-1547) is said to have been the first to associate two globes of the same size in 1515.¹⁷⁸ He is also said to have published in 1515 gores¹⁷⁹ for terrestrial globes and at the same time for celestial globes.¹⁸⁰ Two geographical globes from 1515 still exist and they have a diameter of 27 cm. To accompany his geographical globe, Schöner published a small pamphlet, also in 1515.¹⁸¹ The celestial gores give the external point of view.

Schöner quickly became the most important manufacturer of globes in

¹⁷⁴[Oestmann and Grunert (1995), p. 61]

¹⁷⁵Oestmann's article gives a table with coordinates of stars on the globe and for the epoch 1500, but without saying how these coordinates were calculated. It seems to me that the calculation was not carried out correctly. We can also suspect this when we observe that the longitudes of each of the 34 stars given end in 8: 6.18, 23.28, 14.38, etc., while we should have a random distribution. It is likely that the calculation — right or wrong — was the victim of premature rounding and then a conversion on two digits which destroyed its possible precision.

¹⁷⁶Globe (7) in Dekker's list [Dekker (2007), p. 160] and (210) in Duprat's [Duprat (1973), p. 213].

¹⁷⁷Musée national de la Renaissance, Château d'Écouen, Inv. Cl. 3218.

See [Chapiro et al. (1989), p. 116 and 118-121] and [Hofmann and Nawrocki (2019), p. 89]. I refer to Destombes' study for a detailed description of this globe [Destombes (1968)]. Note that Seznec sees an Italian origin in this globe [Seznec (1993), p. 219].

¹⁷⁸See [Smet (1964)], [Pilz (1977), p. 177-193], [Lindner (1987), p. 171], [Dekker and Krogt (1993), p. 23], [Oestmann (2005b), p. 256-257], [Maruska (2008), p. 151-161], [Iwańczak (2009), p. 160-172], [Dackerman (2011), p. 94-99] and [Hofmann and Nawrocki (2019), p. 135].

¹⁷⁹See entry (13) in Dekker's list [Dekker (2007), p. 160].

¹⁸⁰See [Wood (2000), p. 16] and [Gaab (2015), p. 114-117]. See entry (12) in Dekker's list [Dekker (2007), p. 160].

¹⁸¹[Schöner (1515)]

Europe.¹⁸² The celestial globe that we see in Holbein's famous painting of the *Ambassadors* (1533) is attributed to him.¹⁸³

Brixen Globe (1522) The two Brixen globes, terrestrial and celestial,¹⁸⁴ were given in 1522 as a gift to Sebastian Spreng (Sperantius), Bishop of Brixen (today Bressanone in Italy), who is also represented on the 1503 celestial map that I have already mentioned. These globes have a diameter of 36.8 cm, they are hollow and have been hand painted. They may have been made by Schöner. The celestial globe is apparently based on Dürer's 1515 maps.

Both globes have been in the Rare Books and Manuscripts Department of the *Yale Center for British Art* since about 1999.¹⁸⁵

Unknown (1525?) The catalogue of the Kugel exhibition of 2002 describes an anonymous celestial globe of 11 cm in diameter dated around 1525, certainly coming from Germany or Central Europe.¹⁸⁶

This is a brass globe with two hemispheres joined at the equator, but with meridians based on the ecliptic and passing through the poles of the ecliptic. There is supposedly a shift of about 20 degrees compared to Ptolemy's star catalogue. The cartography of this globe seems to have been influenced by the 1435 Vienna map.

Anonymous (c1525) The astronomical clock kept at the Sainte-Geneviève library¹⁸⁷ in Paris is topped with a small globe of 17.5 cm in diameter.¹⁸⁸ This globe is related to the globe in Holbein's *Ambassadors*.¹⁸⁹

Vopel (1532) Caspar Vopel (1511-1561) was a professor of mathematics in Cologne, then a cartographer and globe maker. In 1532, he made a manuscript celestial globe¹⁹⁰ of 32 cm (or 28 cm?) diameter today kept in

¹⁸²On Schöner and his globes, I refer in particular to [Fauser and Seifert (1964), p. 15 and 123] and [Duzer (2011a), Duzer (2011b)].

¹⁸³See [Dekker and Krogt (1993), p. 24], [Dekker (1999b)], [Dekker and Lippincott (1999)] and [Hauschke (2005a), p. 17].

¹⁸⁴Globe (16) in Dekker's list [Dekker (2007), p. 160].

¹⁸⁵See [Oberhummer and Feurstein (1926)], [Muris and Saarmann (1961), p. 73], [Wood (2000)], [Wood (2008), p. 233-238], [Dackerman (2011), p. 94-96] and [Dekker (2013), p. 383].

¹⁸⁶See [Kugel et al. (2002), p. 28-29] This globe is already described in [Turner (1987)] and [Brink and Hornbostel (1993), p. 152]. This is globe (17) in Dekker's list [Dekker (2007), p. 160].

¹⁸⁷See [Hillard and Poulle (1971)] and [Destombes (1971)].

¹⁸⁸Globe (19) in Dekker's list [Dekker (2007), p. 160]. See also [Duprat (1973), p. 213] (globe number 110). I have kept the date given by Dekker in 2007.

¹⁸⁹[Dekker (1999b), p. 24]

¹⁹⁰Globe (22) in Dekker's list [Dekker (2007), p. 160].

the Kölnisches Stadtmuseum.¹⁹¹

Schöner (c1533-1534) Around 1533-1534, Johann Schöner (1477-1547)¹⁹² made two celestial globes¹⁹³ which are the two oldest known printed celestial globes. One of the globes is in the Science Museum (on deposit from the Royal Astronomical Society) (London),¹⁹⁴ the other (27 cm in diameter) is in Weimar.¹⁹⁵ The twelve gores were printed from woodcuts, printed and then colored. The meridians are centered on the poles of the ecliptic. There is also a terrestrial globe of the same diameter in Weimar.¹⁹⁶ In 1533, Schöner had published two pamphlets on the use of terrestrial and celestial globes.¹⁹⁷

Coudray (1533) The workshop of Julien and Guillaume Coudray and Jean Du Jardin in Blois are credited with making a celestial globe in openwork metal measuring 26 cm in diameter. This globe is kept at the Stewart Museum in Montreal.¹⁹⁸

Vopel (1536) In 1536, Caspar Vopel (1511-1561) made a printed celestial globe¹⁹⁹ with a diameter of 29 cm.²⁰⁰ This globe is apparently the first to indicate the constellations of Antinous and Coma Berenices which are found precisely on the globe of Dasypodius's clock.²⁰¹ After Vopel, these constellations were illustrated by Mercator (1551), who may have been one of Stimmer's sources. According to Dekker, the stars on this globe are positioned for the epoch 1520.²⁰² There are also three sets of gores derived from Vopel's globe.²⁰³

¹⁹¹See [Korth (1884)], [Fauser and Seifert (1964), p. 137-138], [Lindner (1987), p. 172], [Meurer (2007), p. 1220-1221], [Dekker (2010b)], [Dekker et al. (2010)] and [Gaab (2015), p. 128-129]. See also Zinner for a summary of the instruments built by Vopel [Zinner (1967), p. 578-579].

¹⁹²See the references given above (note 178).

¹⁹³Globes (24) in Dekker's list [Dekker (2007), p. 160].

¹⁹⁴See [Sumira (2014), p. 46-49] and [Dekker and Krogt (1993), p. 29].

¹⁹⁵Herzogin Anna Amalia Bibliothek, Weimar, see [Hauschke (2005a), Hauschke (2005b)] and [Willers (1992), v. 2, p. 524-525].

¹⁹⁶Herzogin Anna Amalia Bibliothek, Weimar [Hauschke (2005a), Hauschke (2005b)]

¹⁹⁷[Hauschke (2005a), p. 12]

¹⁹⁸See [Dahl and Gauvin (2001), p. 108-109] This is globe (25) in Dekker's list [Dekker (2007), p. 160].

¹⁹⁹Globe (31) in Dekker's list [Dekker (2007), p. 160].

²⁰⁰Kölnisches Stadtmuseum, Cologne, Inv. 1984-448. See [Fauser and Seifert (1964), p. 16-17 and 137-138], [Dekker (1995), p. 95], [Dekker (2002), p. 70], [Dekker (2010b)] and [Gaab (2015), p. 131-133].

²⁰¹The source of these constellations is apparently the translation of the *Almagest* by George of Trebizond (1396-1472) printed in 1528 in Venice [Dekker (2010b), p. 163].

²⁰²[Dekker (1995), p. 95]

²⁰³[Dekker (2010b), p. 167-168, 180-181]

There is also a printed globe from around 1575, almost identical to Vopel's 1536, its diameter is 29 cm and it is kept in a private collection in New York.²⁰⁴

Schissler's 1575 globe (42 cm in diameter) seems to be based on Vopel's globe.²⁰⁵

Frisius (c1536) Around 1536, Gemma Frisius (1508-1555) made a celestial globe 37 cm in diameter kept in Vienna.²⁰⁶

Frisius (1537) In 1537, Gemma Frisius made a celestial globe,²⁰⁷ which is currently kept in Greenwich.²⁰⁸

This globe seems to be an almost exact transcription of Dürer's maps of 1515.²⁰⁹ Its diameter is 37 cm like the previous one. Its gores pass through the poles of the ecliptic.²¹⁰

This would be the oldest globe engraved in intaglio (i.e. on copper). Copper engraving allowed for much more detailed globes to be made than wood engraving.²¹¹

Hartmann (c1538) Around 1538, Georg Hartmann (1489-1564)²¹² made gores²¹³ for a celestial globe 20 cm in diameter, but no globe by him has survived. These gores still exist.²¹⁴

(after) Vopel (1540?) Gores copied from a globe by Caspar Vopel for a globe of 28.5 cm in diameter are kept in Stuttgart.²¹⁵

Rabus (1546) Jacobus Rabus (1522-1581)²¹⁶ was born in Memmingen, about fifty kilometers from Ulm. He knew Cyprián Leowitz, who will be

²⁰⁴[Dekker (2010b), p. 181]

²⁰⁵[Gessner (2015)]

²⁰⁶Globe (34) in Dekker's list [Dekker (2007), p. 160]. See also [Krogt (1993), p. 53-55, 410-411] and [Wawrik and Hühnel (1994), p. 14-16].

²⁰⁷Globe (35) in Dekker's list [Dekker (2007), p. 160].

²⁰⁸See [Stevenson (1921), v. 1, p. 102-105], [Smet (1964), p. 46-48], [Dekker and Krogt (1993), p. 33], [Krogt (1993), p. 55-57, 411-412], [Dekker (1999a), p. 87-91, 340-342], [Gaab (2015), p. 140-141], and [Hofmann and Nawrocki (2019), p. 135].

²⁰⁹See [Friedman Herlihy (2007), p. 111] and [Dekker (2010b), p. 164].

²¹⁰[Sumira (2014), p. 52-53]

²¹¹[Sumira (2014), p. 20]

²¹²On Hartmann, one can consult [Pilz (1977), p. 169-176] and [Oestmann (2005b), p. 259-260]. On an astrolabe built by Hartmann in 1532, see [Bott and Montebello (1986), p. 435].

²¹³Entry (36) in Dekker's list [Dekker (2007), p. 160].

²¹⁴See [Fauser and Seifert (1964), p. 15-16 and 97], [Krogt (1985), p. 104], [Lindner (1987), p. 171], and [Gaab (2015), p. 141-142].

²¹⁵Entry (37) in Dekker's list [Dekker (2007), p. 160]. See also [Krogt (1985), p. 112].

²¹⁶[Oestmann (2005b), p. 258]

discussed later.²¹⁷ Leowitz in fact dedicated a copy of his ephemerides to him.

Rabus' celestial globe²¹⁸ from 1546 has a diameter of 17.2 cm. It is a handwritten and painted globe.²¹⁹ It shows ecliptic meridians as well as the equator, the tropics and the polar circles. According to Oestmann, it is based on Dürer's maps of 1515.

Also according to Oestmann, this globe increases the ecliptic longitudes of Ptolemy's *Almagest* by 19°40' on average (which indeed seems to be the case on the photographs²²⁰), which corresponds roughly to the year 1500, and not to the year the globe was made. We can therefore assume that Rabus did not recalculate the coordinates of the stars, but took them from an earlier map.

This globe was kept until 1995 in Harburg Castle near Donauwörth, but was auctioned in New York that year.²²¹

Hartmann (1547) In 1547, Georg Hartmann (1489-1564) made gores²²² influenced by Frisius. The celestial globe is said to have had a diameter of 8.4 cm. These gores are perhaps the source of those by Mongenet.²²³

Fobis (c1550) Pierre de Fobis (born in 1507) made around 1550 an astronomical clock with an openwork celestial globe²²⁴ 15.5 cm in diameter.

Mercator (1551) Gerard Mercator (1512-1594) made a 42 cm in diameter celestial globe²²⁵ in 1551 (figure 29) whose copies have been widely disseminated. Mercator had already made a terrestrial globe in 1541.²²⁶

The gores of the new celestial globe were also engraved in intaglio.²²⁷ However, unlike previous globes, the gores are based on the equator and not the ecliptic. The reasons for this choice are unclear and the calculation

²¹⁷See [Oestmann (2002)] and [Oestmann (2005b), p. 257].

²¹⁸Globe (51) in Dekker's list [Dekker (2007), p. 160].

²¹⁹See [Fauser and Seifert (1964), p. 17, 119] and [Oestmann (2005a)].

²²⁰[Oestmann (2005a)]

²²¹[Oestmann (2005a), p. 22]

²²²Entry (52) in Dekker's list [Dekker (2007), p. 160].

²²³See [Sumira (2014), p. 62]. See also [Fauser and Seifert (1964), p. 97], [Krogt (1985), p. 104] and [Lindner (1987), p. 171].

²²⁴Globe (56) in Dekker's list [Dekker (2007), p. 160]. See [King and Millburn (1978), p. 76-77], [Allmayer-Beck (1997), p. 136, 333] and [Kugel et al. (2002), p. 144-151].

²²⁵Globe (58) in Dekker's list [Dekker (2007), p. 160]. For Mercator's globes in general, see [Watelet (1994)]. For various additions, see [Raemdonck (1875)], [Fauser and Seifert (1964), p. 111], [Warner (1979), p. 174-175], [Lindner (1987), p. 172], [Dekker and Krogt (1993), p. 31], [Krogt (1993), p. 67, 413-415], [Dekker (1999a), p. 91-95, 413-415], [Sumira (2014), p. 58-61] and [Hofmann and Nawrocki (2019), p. 135].

²²⁶See [Sumira (2014), p. 20, 54-55].

²²⁷See [Dekker and Krogt (1993), p. 37] for a partial reproduction of three of the gores.

(or mechanical determination) of the equatorial coordinates must have been tedious. In any case, as Dekker notes,²²⁸ Mercator also anticipated, probably unconsciously, the development of stellar cartography. The original gores of Mercator's globes were published by Smet.²²⁹

The different models of this globe are therefore not from the same years, but are based on the same gores. One copy is kept in Greenwich. According to Dekker, Mercator used the Copernican theory to position the stars.²³⁰

This globe introduces Antinous (figure 30) and Cincinnus (Coma Berenices) which previously only appeared on Vopel's 1536 globe. Somehow, Mercator must have been aware of Vopel's globe, even if he did not copy it precisely.²³¹

I believe that Dasypodius may have owned a celestial globe by Mercator (1551) and that this globe served as an iconographic basis for Stimmer's work.

Mongenot (1552) In 1552, François de Mongenet (active around 1550-1560), a physician, mathematician and geographer from Vesoul, made gores²³² of (terrestrial and celestial) globes engraved on wood.²³³

Stella (1555) In 1555, the cartographer Tilemann Stella (1525-1589) made a celestial globe²³⁴ of 27.5 cm in diameter today kept in Weißenburg in Bavaria. This globe is considered to be a reduced version of a globe from the years 1551-1553 now lost.²³⁵ This globe is a globe printed on twelve gores made from woodcuts. These gores meet at the poles of the ecliptic. They were hand-colored.²³⁶ According to Dekker, the stars on this globe are positioned for the epoch 1600.²³⁷ Stella also took up the constellations of Antinous and Coma Berenices introduced by Vopel in 1536.²³⁸

Stella is also the author of the terrestrial globe of St. Gallen (1579) of which a facsimile was made in 2007-2009.²³⁹

In the 1550s, Stella wrote a treatise on the manufacture of globes, the title of which was *Explicatio, et canones globi coelestis, terrestrisque*, but this work is lost. It is believed that Amman's maps of 1564 (figure 28) were

²²⁸[Dekker (1995), p. 78]

²²⁹[Smet (1968)]

²³⁰See [Dekker and Krogt (1993), p. 36] and [Sumira (2014), p. 59].

²³¹[Dekker (1995), p. 82]

²³²Entry (60) in Dekker's list [Dekker (2007), p. 160].

²³³See [Stevenson (1921), v. 1, p. 147-150], [Yonge (1968), p. 90] and [Sumira (2014), p. 62].

²³⁴Globe (64) in Dekker's list [Dekker (2007), p. 160].

²³⁵[Lindner (1987), p. 172]

²³⁶See [Fauser (1973), Fauser (1983)], [Lindner (1987), p. 172], [Dekker (1995), p. 96], [Meurer (2007), p. 1213-1214] and [Pápay (2018), Hamel (2018), Pápay (2019)].

²³⁷[Dekker (1995), p. 96]

²³⁸[Dekker (2010b), p. 178]

²³⁹[Rohrbach and Gnädinger (2009), Schmid-Lanter (2018), Schmid-Lanter (2019)]

intended to accompany this treatise. More recently, Amman's maps have been used to make a virtual celestial globe.²⁴⁰

Imsser (1554/1561) Between 1554 and 1561, with the help of Gerhard Emmoser, Philipp Imsser²⁴¹ made for Otto Henry of the Palatinate (Ottheinrich) (1502-1559) an indoor astronomical clock topped by a celestial globe.²⁴² After Otto Henry's death, the clock was finally acquired by Emperor Ferdinand I (1503-1564).

The celestial globe is based on Dürer's 1515 maps.²⁴³

Heiden (1560) In 1560, Christian Heiden (1526-1576)²⁴⁴ made a mechanical celestial globe in Nuremberg, destroyed during the bombings of Dresden in 1945.²⁴⁵ This globe had a diameter of 7.25 cm and was contained in a terrestrial globe.

Mongenet (c1560) Around 1560, François de Mongenet made (terrestrial and celestial) globe gores,²⁴⁶ 8 cm in diameter. The gores, based on the ecliptic, were also engraved in intaglio. They include the constellation of Antinous, introduced by Vopel in his 1536 globe, but not Coma Berenices, also introduced by Vopel.²⁴⁷

According to Sumira, these gores may have been copied from the 1547 gores of Georg Hartmann (1489-1564) who himself might have been influenced by Gemma Frisius' globes. Mongenet's gores were the source of a number of gilded and silvered globes made in the late 16th century, including those by Georg Roll (1546-1592) and Johann Reinhold (c1550-1596).²⁴⁸

Mongenet (c1560) A celestial globe by François de Mongenet of 8 cm in diameter is kept in Rome.²⁴⁹

Baldewein (1563) In 1561-1563, Ebert Baldewein (c1525-1593) made an astronomical clock topped by a celestial globe.²⁵⁰ This clock is kept in Kassel.

²⁴⁰See <http://terkeptar.elte.hu/vgm/2/?show=globe&id=161>

²⁴¹[Oestmann (2005b), p. 258-259]

²⁴²Globe (63) in Dekker's list [Dekker (2007), p. 160].

²⁴³See [Oestmann (1993), p. 31-34], [Allmayer-Beck (1997), p. 338] and [Gaab (2015), p. 143-144].

²⁴⁴On Heiden, one can consult [Pilz (1977), p. 220, 232-235].

²⁴⁵[Leopold (1986), p. 72-75] See also [Lindner (1987), p. 173].

²⁴⁶Entry (69) in Dekker's list [Dekker (2007), p. 160]. See [Krogt (1985), p. 109], [Sumira (2014), p. 62-63] and [Hofmann and Nawrocki (2019), p. 136].

²⁴⁷See [Friedman Herlihy (2007), p. 111] and [Dekker (2010b), p. 179].

²⁴⁸[Fauser and Seifert (1964), p. 18]

²⁴⁹Globe (70) in Dekker's list [Dekker (2007), p. 160].

²⁵⁰Globe (73) in Dekker's list [Dekker (2007), p. 160]. See [Mackensen (1982), p. 118-121] and [Leopold (1986), p. 61-64].

Praetorius (1565) In 1565, Johannes Praetorius (= Johann Richter) (1537-1616)²⁵¹ made a brass celestial globe today kept in Vienna.²⁵² This globe has a diameter of 28 cm and is said to be based on Dürer's maps.

Praetorius (1566) In 1566, Johannes Praetorius made another celestial globe²⁵³ of 28 cm in diameter²⁵⁴ now kept in Nuremberg.²⁵⁵

Vanosino (1567) In the Apostolic Library of the Vatican there is a globe of 95 cm in diameter²⁵⁶ dating perhaps from 1567. It is a hollow wooden sphere covered with gesso and painted. The author is probably Giovanni Antonio Vanosino (1535-1593).²⁵⁷ In the 1570s, Vanosino also painted two oblong ceilings with the constellations, one in the Vatican, the other in Caprarola.²⁵⁸ According to Warner, the sources of Vanosino's iconography are Mongenet's maps mentioned above.²⁵⁹

Baldewein (1568) In 1563-1568, Ebert Baldewein (c1525-1593) built a clock similar to the one in Kassel (see above).²⁶⁰ This clock is now kept in Dresden.

Rossi (c1570) Vincenzo de' Rossi (1527-1587) is credited with creating around 1570 a sculpture of Hercules carrying an openwork celestial globe 12 cm in diameter.²⁶¹

Heiden (1570) In 1570, Christian Heiden made a celestial globe²⁶² in gilded silver (?) of 9 cm in diameter placed inside a terrestrial globe of 10.5 cm in diameter also in gilded silver.²⁶³ Heiden also took up the constellations of

²⁵¹On Praetorius, one can consult [Pilz (1977), p. 248-254].

²⁵²Globe (74) in Dekker's list [Dekker (2007), p. 160]. See also [Allmayer-Beck (1997), p. 165, 166, 345] and [Dekker (2010b), p. 164].

²⁵³Globe (76) in Dekker's list [Dekker (2007), p. 160].

²⁵⁴See [Fauser and Seifert (1964), p. 18, 118], [Lindner (1987), p. 173], [Willers (1992), v. 2, p. 637-638] [Allmayer-Beck (1997), p. 165, 166] and [Gaab (2015), p. 142-143].

²⁵⁵Gessner, referring to [Korey (2007), p. 13] who in fact has nothing on this subject, mentions a celestial globe from 1566 by Praetorius which was in Dresden but which would be lost [Gessner (2012), p. 156]. Maybe it is a mistake?

²⁵⁶Globe (85) in Dekker's list [Dekker (2007), p. 160].

²⁵⁷See [Hess (1967)] and [Warner (1971)].

²⁵⁸See [Lippincott (1990)], [Lippincott (1991)] and [Gaab (2015), p. 153-155]. There are older painted ceilings of constellations, for example that of the Sagrestia Vecchia of the Basilica of San Lorenzo in Florence, which is said to represent the state of the sky in July 1439.

²⁵⁹See also [Friedman Herlihy (2007), p. 111].

²⁶⁰See [Leopold (1986), p. 65-70], [Lindner (1987), p. 174] and [Poulle et al. (2008)]. The corresponding globe is globe (77) in Dekker's list [Dekker (2007), p. 160].

²⁶¹[Kugel et al. (2002), p. 30-31] This is globe (87) in Dekker's list [Dekker (2007), p. 160].

²⁶²Globe (80) in Dekker's list [Dekker (2007), p. 160].

²⁶³See [Muris and Saarmann (1961), p. 142 and fig. 48], [Leopold (1986), p. 76-85] and [Lindner (1987), p. 173].

Antinous and Coma Berenices introduced by Vopel in 1536.²⁶⁴

Baldewein (1574) In 1574, Baldewein made an independent celestial globe²⁶⁵ with an internal mechanism (lost).²⁶⁶ Its diameter is 13.7 cm.

Dekker states that Baldewein has taken for “his manuscript globes” the constellations of Antinous and Coma Berenices introduced by Vopel in 1536,²⁶⁷ but I do not know to which globes she refers.

Baldewein (1575) A globe by Baldewein of 33 cm diameter (with mechanism) is kept in the British Museum.²⁶⁸

Arboreus (1575) In 1575, Heinrich Arboreus (c1532-1602), rector of the Jesuit college in Ingolstadt, supervised the making of a celestial globe²⁶⁹ 76 cm in diameter in Munich, a counterpart to a terrestrial globe made by Philipp Apian (1531-1589).²⁷⁰ This globe is a painted wooden globe.

Schissler (1575) In 1575, Christoph Schissler (c1531-1608) made a celestial globe.²⁷¹ Schissler was based in Augsburg and this globe is supposed to be the oldest celestial globe in Portugal,²⁷² at least in 1990. It has a diameter of 42 cm and has 12 gilded copper gores fixed on twelve internal metal arcs. The central structure is not made of wood. The gores are centered on the poles of the ecliptic. This globe is presumably based on Vopel’s printed globe of 1536.²⁷³

Let me still mention three globes made after 1575:

Brahe (1570-c1595) In 1570, Tycho Brahe (1546-1601) had a celestial globe of almost 150 cm in diameter built in Augsburg and this globe was completed 25 years later. It consisted of a wooden structure covered with brass plates. It was destroyed during the 1728 fire of Copenhagen.²⁷⁴

²⁶⁴[Dekker (2010b), p. 178]

²⁶⁵Globe (89) in Dekker’s list [Dekker (2007), p. 160].

²⁶⁶See [Leopold (1986), p. 88-92], [Lindner (1987), p. 174], [Allmayer-Beck (1997), p. 324] and [Kugel et al. (2002), p. 152-157].

²⁶⁷[Dekker (2010b), p. 178]

²⁶⁸Globe (90) in Dekker’s list [Dekker (2007), p. 160]. A detailed description is given by Leopold [Leopold (1986), p. 93-102].

²⁶⁹Globe (96) in Dekker’s list [Dekker (2007), p. 160].

²⁷⁰See [Fauser and Seifert (1964), p. 19, 50-51], [Lindner (1987), p. 172-173], [Wolff (1989), p. 153-165] and [Horst (2011)].

²⁷¹[Reis (1990), Reis (1994), Gessner (2010), Gessner and Mesquita e Carmo (2011), Gessner (2012), Gessner (2015)] This is the globe (91) in Dekker’s list [Dekker (2007), p. 160].

²⁷²National Palace of Sintra, Portugal, inventory number 3457.

²⁷³[Gessner (2012), Gessner (2015)]

²⁷⁴See mainly [Kejlbo (1970)] which refers to Brahe’s description. This globe is also cited in [Gessner and Mesquita e Carmo (2011), Gessner (2012)].

Fontana (c1580?) At Ambras Castle in Innsbruck there is a globe of 18 cm diameter attributed to the painter Giovanni Battista Fontana (1524-1587). Dekker estimates that this globe was designed for the epoch 1585.²⁷⁵ Its main peculiarity is that the gores are printed upside down, that is, to give the geocentric view, but even the inscriptions are upside down, and the reasons for this choice remain to be determined. Perhaps it is simply a design error?

Fontana also made a ceiling of Ambras Castle with allegories of the constellations.

Habrecht (?) (c1593) Finally, I would like to point out a celestial globe of 23.8 cm in diameter, with an internal mechanism, certainly built in Strasbourg, perhaps by Isaac Habrecht,²⁷⁶ one of the two clockmakers who built the astronomical clock. This globe is now kept in Darmstadt. Bott has speculated that the engraving of the globe was made by Hans Christoffel Stimmer,²⁷⁷ Tobias's brother, but this hypothesis is certainly to be excluded, given that this brother died around 1578.



Figure 29: A celestial globe by Mercator.

²⁷⁵[Dekker (1995), p. 97]

²⁷⁶[Bott (2007)]

²⁷⁷Stimmer made a portrait of his brother, see [Beaujean and Tanner (2014a), p. 138].



Figure 30: Excerpt from a Mercator celestial globe with the constellations of Aquila, Sagitta, Antinous and Delphinus.

3.1.8 The sources of the constellations

Given the overviews of maps and globes that I have outlined, one may wonder whether one of these maps or one of these globes could have served as a basis for Stimmer's work, knowing that if a source is found, it will certainly have been adapted to the positions of the stars which, as far as they are concerned, will have been extracted from the Alfonsine or Prutenic tables.

I believe that a pure and simple reuse of maps, a fortiori of small-format maps or maps without graduations, must be excluded.

Even Dürer's engravings and those derived from them are not accurate enough to be translated onto a globe, if one accepts that the aim is to represent the stars as accurately as possible. The recording of the stars on a map like Dürer's, not to mention the size of the stars, is difficult, if not impossible in a reliable manner.

One could imagine that the globe of the clock was produced from another globe, but it is very unlikely that a celestial globe of the same size, and as accurate, was available. If the globe were smaller, all the dimensions would have to be adapted, which is a job as tedious, if not more tedious, than making flat maps to transfer them into paint.

In my opinion, some pre-existing maps could have served as iconographic inspiration, but Stimmer probably simply drew the new constellations on the skeleton of the positions of the stars obtained by the Alfonsine or Prutenic tables, and it is not certain that a better iconographic genealogy can be established. Oestmann, who was also interested in the question, was also unable to establish a sure link with pre-existing maps.²⁷⁸ This obviously does not mean that Stimmer was not aware of a certain number of maps or didn't see certain celestial globes. He probably knew Dürer's maps (1515), and probably also those of Amman (1564), but he also had to implement his freedom as an artist around the constraints of the positions of the stars. We can also imagine that Stimmer saw certain celestial globes in Strasbourg. Scholars like Dasypodius and Wolkenstein must have had celestial globes. Moreover, we know that the base of the clock's globe is a terrestrial globe owned by Dasypodius. Dasypodius certainly had several globes and was not going to part with his only terrestrial globe.

Now, what is particularly interesting is to see on the globe of the clock the presence of the constellation Antinous, because this constellation was recent at the time of the design of the globe. Its introduction was long attributed to Tycho Brahe, then it was discovered that it appeared on a globe by Caspar Vopel (1511-1561) from 1536. This suggests in any case that we must consider that one of the sources of the globe of the clock was, directly or indirectly, the cartographer Caspar Vopel, because at the time of the construction of the clock, Tycho was still far from having produced his star catalogue. This hypothesis does not seem to have been mentioned to date.²⁷⁹

²⁷⁸[Oestmann (2020), p. 129]

²⁷⁹It is in particular not mentioned by Oestmann who does not cite Vopel [Oestmann (2020)].

Furthermore, the globe represents the constellation of Coma Berenices (Circinnus) which was also introduced by Vopel on his 1536 globe.²⁸⁰ Vopel's link therefore seems interesting, but it is not the only one, since Antinous and Coma Berenices were taken up on Mercator's celestial globes in 1551.

We can also observe that Amman's map of 1564 indicates Coma Berenices, but not Antinous.

This therefore seems to exclude Amman's map from Stimmer's direct sources.

It is also interesting to note that in Dasypodius's work *Mathematicum* published in 1570,²⁸¹ we find 43 engravings of constellations in a geocentric perspective (figure 31).²⁸² This observation had already been made in 1960 by Beyer.²⁸³ These engravings are probably not by Stimmer, since they are essentially copies of existing engravings.

Furthermore, these 43 engravings do not cover all of Ptolemy's constellations. On the one hand, there is a first engraving that serves as a caption for the sizes of the stars and a last one for the Milky Way. Then, some engravings cover two constellations, but above all, it is missing the constellations of Aquila, Crater, Corvus, Sagitta, Equuleus and Serpens.

Dasypodius also indicated Procyon as a constellation, but it is a star. This is certainly a reference to Canis Minor. Finally, the work includes a constellation that is not one of Ptolemy's 48 constellations, namely Coma Berenices.

What is the origin of these 43 engravings? These engravings are in fact very close to inversions of the engravings of the edition of the *Poeticon astronomicon* of 1534²⁸⁴ (figure 32) (and not the one from 1482,²⁸⁵ very different), produced by Caspar Vopel. Furthermore, the order of Dasypodius' representations is almost the same as in this work (some constellations are missing). The *Poeticon astronomicon* of 1534 depicts the constellations from the outside, therefore not from a geocentric perspective.²⁸⁶ The fact that the engravings in Dasypodius's work are inversions is apparent when one notices that these engravings depict the geocentric configurations of the constellations, but without being conceived as such, since the conventions of geocentrism are not respected. Virgo, for example,

²⁸⁰See Herlihy [Friedman Herlihy (2007)].

²⁸¹[Dasypodius (1570)]

²⁸²This reference was curiously forgotten by Oestmann [Oestmann (2020)]. Furthermore, in at least two copies of the first volume of *Mathematicum* (1567) (the one in Rome and the one seen by Beyer in 1960), we find plates of the constellations but outside the text. These are probably test plates that were integrated into the first volume later, and not in 1567.

²⁸³[Beyer (1960), p. 115]

²⁸⁴See [Hyginus (1534)] and [Dekker (2010b), p. 164-166]. Another edition with the same engravings appeared in 1539 by the same publisher. We have also consulted editions from 1502, 1510, 1512, 1514, 1517, 1535 and 1549 without finding any greater proximity.

²⁸⁵[Hyginus (1482)] The constellations published in 1482 were republished in mirror copy in Negri's collection in 1499 [Negri (1499)].

²⁸⁶The *Poeticon astronomicon* of 1482 depicted geocentric views, even if the drawing sometimes gives the impression of the opposite.

should be looking towards the Earth, which is not the case.²⁸⁷

The test plates of the constellations inserted in some volumes of 1567 also include the chariots of the days of the week but these chariots are simply inverted copies of the chariots of Pencz. These chariots may have been engraved for use in a publication not yet identified, unless they were intended for the construction of the chariots of the clock.

Since Stimmer included the constellations of Antinous and Coma Berenices, it seems likely that he had at his disposal a celestial globe by Mercator from 1551.²⁸⁸ Dasypodius may have possessed such a globe, which is not unlikely, given their wide distribution.

One could possibly imagine that the engravings of 1570 were based on a celestial globe by Mercator and not on those of Vopel (Hyginus), but this could not be the case, if only because of the canopy of Cassiopeia. Mercator does not show one, while Vopel and Dasypodius do. And moreover Dasypodius does not have any engravings of Antinous. Finally, in Dasypodius' globe, Cassiopeia appears naked, while in Mercator's globe she is dressed.

I think in the end that Stimmer was inspired both by a globe of Mercator from 1551 and by printed representations, notably in the *Poeticon astronomicon* of 1534,²⁸⁹ but by giving free rein to his imagination. Caspar Vopel thus appears as an almost certain, and even double, source of the Stimmer-Dasypodius globe, both probably via a Mercator globe, and via the 1534 engravings. Stimmer's mythological characters were, however, represented more in the style of 1534 than in that of Mercator. Cassiopeia is for example naked in Stimmer's work, which makes her a bit like Eve's counterpart on the globe.

²⁸⁷If these engravings are inversions, it is also because it was easier to copy them in reverse. It was sufficient to copy the printed figures, then to use these copies to make new woodcuts, for example by making marks in the wood by pricking. Another possibility would have been to make tracings of the printed figures, turn the tracings over and mark the wood by pricking. Even without tracings, this process was applicable. It is not very clear why it was not applied. Perhaps Dasypodius wanted to produce geocentric views, but the result is in fact contrary to the conventions of representation of the constellations.

²⁸⁸[Smet (1968)]

²⁸⁹[Hyginus (1534)]



Figure 31: Excerpt from Dasypodius, *Volumen primum mathematicum* [Dasypodius (1567)]. The constellations are represented geocentrically. These are test plates that were not integrated into the text. The engravings were integrated into volume 2 published in 1570.

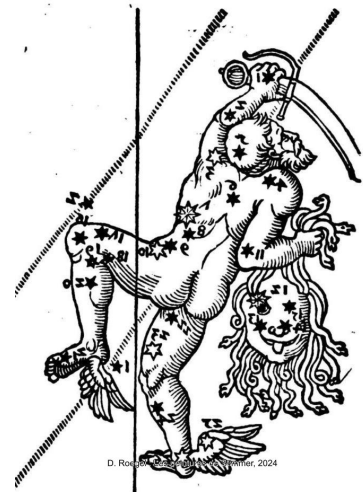
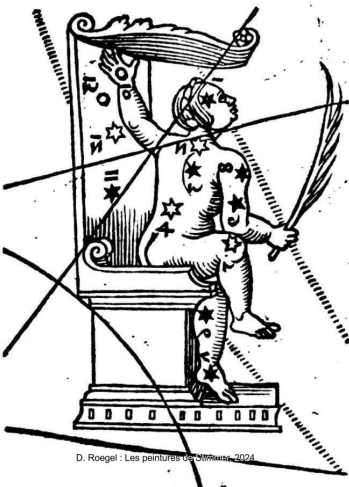
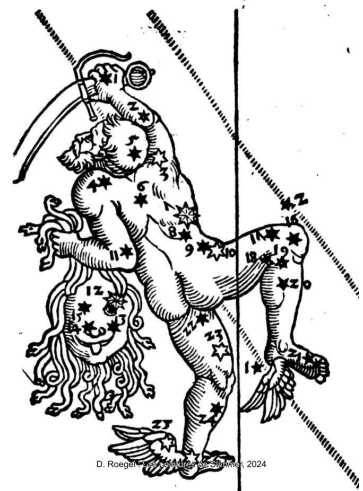
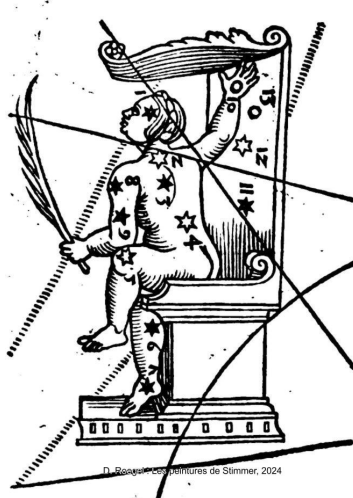


Figure 32: Excerpts from the 1534 *Poeticon astronomicon* [Hyginus (1534)] (top), with the images reversed (bottom), to compare with those of Dasypodius' book.

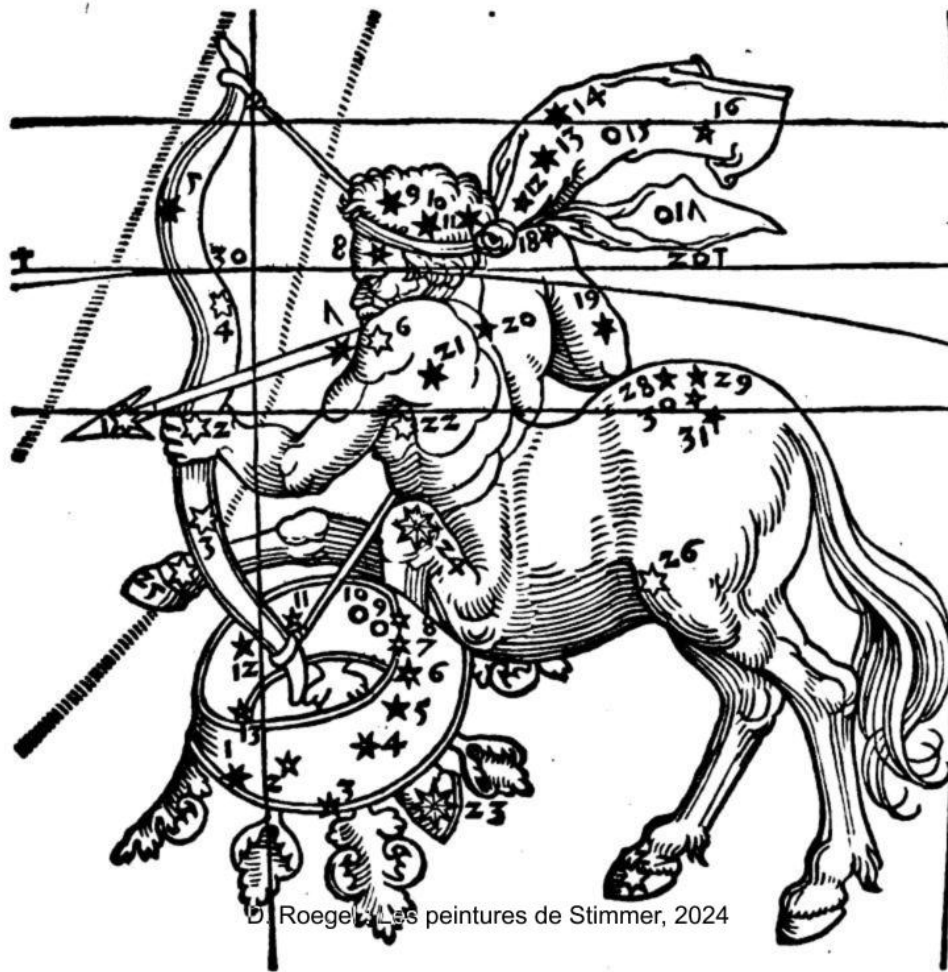


Figure 33: Excerpt from the 1534 *Poeticon astronomicon* [Hyginus (1534)], to compare with the constellation on the globe (figure 16).

3.1.9 The positions of the stars and the question of precession

The stars and the figures of the constellations vary only very slowly over time. On the other hand, the coordinates of the stars change due to the displacement of the Earth's axis of rotation. Indeed, it is the position of this axis that primarily determines the points around which the starry vault seems to rotate, and therefore conditions the axis of rotation of the celestial globes. As time passes, the real axis of rotation of the sky moves further and further away from the axis of rotation — almost always fixed — of a globe. Added to this is the fact that the displacement of the poles automatically causes the displacement of the equator and the meridians passing through the celestial poles. Finally, the origin of the coordinates being determined by the intersection between the equator and the ecliptic, this origin moves little by little along the ecliptic and consequently the coordinates of the stars change little by little.

C ^o stellatio Cassiopeie .i. habētis palmā delibutā .13.			
Que est super caput	0 24 58	S 45 20	4
Que est in pectore: et dicit Scheder	0 27 58	46 45	3 *
Que est declinior ea ad sept. et est sup cingulum	0 30 13	47 50	4
Que est super sedem super duas coras	0 33 48	49 0	3
Que est in duobus genibus	0 37 28	45 30	3
Que est super crus	0 44 8	47 44	4
Que est super extremitatē pedis	0 18 48	S 48 20	4
Que est super adiutoriū sinistrum	0 31 48	45 0	5
Que est super maric sinistro	0 31 48	45 20	4
Que est super brachiū dextrum	0 21 28	50 0	6
Que est super erectione sedis	0 32 8	52 40	4
Que est in medio reclinatorij sedis	0 34 58	51 40	3
Que est in extremitate reclinatorij	0 37 48	S 51 4	6

Figure 34: Excerpt from the 1492 Alfonsine tables for Cassiopeia [Alphonsus X, roi de Castille (1492)].

It is therefore understandable that a globe is almost always made for a given period, because neither the axis of rotation nor the circles such as the equator and the ecliptic can be modified. Only in rare cases is this possible, as for example with the celestial sphere built in the 19th century for the astronomical clock in Strasbourg.

The analysis of a globe, provided that it has an axis of rotation, the equator and the ecliptic, allows in principle to determine the date for which it was designed. Once the ecliptic and the meridians passing through the poles of the ecliptic have been placed, it remained essentially to place the stars. To do this, it was necessary to base oneself on a star catalogue, then adapt it to the chosen period. According to Gaab, virtually all globes of the 16th century were based on

CASSIOPEÆ.									
In capite	1	10	45	20	4				
In pectore	4	10	46	45	3	ma.			
In cingulo	6	20	47	50	4				
Super cathedra ad femora	10	0	49	0	3	ma.			
Ad genua	13	40	45	30	3				
In crure	20	20	45	30	3				
In extremo pedis	355	0	48	20	4				
In sinistro brachio	8	0	44	20	4				
In sinistro cubito	7	40	45	0	5				
In dextro cubito	357	40	50	0	6				
In sedis pede	8	20	52	40	4				
In ascensu medio	1	10	51	40	3	mi.			
In extremo	357	0	51	40	6				
S T E L L Æ 13. quarum magnitud. tertiæ 4. quartæ 6. quinq. 1. sextæ 2.									

Figure 35: Excerpt from the 1551 Prutenic Tables for Cassiopeia [Reinhold (1551)].

Ptolemy's catalogue. The catalogues included in the Alfonsine or Prutenic tables were in fact only adapted versions of Ptolemy's catalogue, i.e. the catalogue included in the Almagest.

It was not until 1599 that Tycho Brahe's catalogue began to be used.

To use a star catalogue, it was therefore first necessary to carry out a reduction, i.e. to bring the coordinates back to the chosen epoch. The catalogues almost all give the ecliptic coordinates and the adaptation of the coordinates consisted in fact simply of adding a constant to the ecliptic longitudes. In the case of the globe of Dasypodius' clock, we can assume that the longitudes were determined for a year like 1574. This calculation was not very complicated, since it was enough to calculate the constant once, then add it to all the longitudes in the catalogue. What we must try to determine is the catalogue that served as a basis for the stars of the globe, and the epoch chosen for the positioning of the stars. And we must in particular determine whether Dasypodius used the Alfonsine tables (figure 34) or the Prutenic tables (1551) (figure 35).

That said, even if the catalogues of the Almagest, the Alfonsine and Prutenic tables, etc., are in principle identical (except for the precession), it can happen that there are small differences in the positioning of the stars on certain maps or globes. Dekker thus points out that on Dürer's maps of 1515, on Apian's planispheres of 1536 and 1540 and on Frisius' globe of 1537, stars 9-10 of Aries (numbered according to the order of appearance in the Almagest) are under the ecliptic and star 23 of Andromeda is in the middle of the sign of Aries, but that on the gores engraved in 1515 by Schöner and on Mercator's 1551 globe, stars 9-10

of Aries are north of the ecliptic and star 23 of Andromeda is at the beginning of the sign of Aries.²⁹⁰ These errors allow us to identify, if not sources, at least traditions.

Dasypodius and Stimmer certainly knew the maps of Dürer and also of Amman, and perhaps others, and doubtless also some globes, but the primary sources for the coordinates of the stars are the catalogues, not the globes or the maps, especially when it comes to making a globe as large as Dasypodius's, certainly larger than any globes Dasypodius or Stimmer could have known.

To try to decide on the use of the Alfonsine or Prutenic tables, that is to say, basically on the use of the theories of Ptolemy or Copernicus, we have noted the coordinates of three stars on the globe of Stimmer-Dasypodius close to the ecliptic, namely Regulus (Leo), Spica (Virgo) and Zubenelgenubi (Libra). Everyone can do the same in the clock room of the *Musée des arts décoratifs*²⁹¹ and note that the longitudes of these three stars differ by about 4 degrees from those given in the Alfonsine tables²⁹² which are for 1252. The longitude of Regulus is about 143.5 degrees on the globe. On Dürer's maps, the longitudes are lower by about one degree, but with uncertainties.

If we now use the Alfonsine theory,²⁹³ it turns out that the longitude of Regulus is equal to about 142.8 degrees around 1574 and 143.5 degrees around the year 1660. Similar conclusions are found for the other two stars examined. The epoch 1660 seems very far from that of the construction of the globe, but should we therefore reject it? We must indeed remember that the globe was restored in 1670, some parts were repainted, and one could wonder whether the globe would not have been updated on this occasion. This hypothesis is however to be excluded, because updating a celestial globe would amount to shift all the constellations, or else to move only the axis of rotation, the equator and to redraw all the coordinate circles. This is clearly an unthinkable operation.

On the other hand, if we use the Copernican theory, i.e. the Prutenic tables, it turns out that Regulus has a longitude of 143.5 degrees around 1560 and 143.6 around 1570. The agreement is also better for the other two stars examined. This suggests that there is a certain consistency in the positioning of the stars and that the globe of Stimmer-Dasypodius is less tainted by errors than for example the maps of Dürer described above. There are indeed uncertainties in my survey of longitudes²⁹⁴ and certainly in Stimmer's drawing, but I consider that the positions

²⁹⁰See [Dekker (1995), p. 78] and [Dekker (2010b), p. 167].

²⁹¹[Martin et al. (2020)]

²⁹²[Alphonsus X, roi de Castille (1492)]

²⁹³It is essential to calculate the precession with the Alfonsine tables alone and not to mix the Almagest and the Alfonsine tables.

²⁹⁴This survey can be considered unauthorized, since the museums of Strasbourg have not at any time facilitated my research work, having constantly denigrated me. On Wikipedia, Runi Gerardsen, an acquaintance of the curator of the *Musée des arts décoratifs*, has recently called me incompetent and has done everything to prevent me from contributing to this encyclopedia, which, I must admit, has not helped me much, except for the iconography.

of the stars on the globe agree much better with the Prutenic tables than with the Alfonsine tables and this seems to indicate that Dasypodius used the Copernican theory to produce an up-to-date globe. These investigations should of course be confirmed, first of all by a scientific survey of all the stars on the globe (and not merely by art photographs or photographs subcontracted to restorers, the researchers and not the museum staff should be able to take the photographs), then by a precise statistical approach, which the museums have forbidden me to do.

The use of the Copernican theory for the calculation of precession should not surprise us. According to Dekker, most celestial globes after 1550 used this theory.²⁹⁵ The use of this theory for the calculation obviously does not prejudice the adoption of all Copernican conceptions. Finally, let me recall that I believe that Dasypodius also used the value of the tropical year from the Prutenic tables for the celestial globe and the astrolabe.²⁹⁶ And moreover, the Prutenic tables were partially used for the calculation of the equinoxes.

²⁹⁵See [Dekker (1995), p. 79-80] who compared six globes for precession.

²⁹⁶[Roegel (2023)]

3.1.10 Construction

We have seen that a certain number of celestial globes were made before the globe of the astronomical clock and that maps had also been made. In addition, gores had been printed, but the gores are obviously linked to a certain size of globe and all the globes that we know were significantly smaller than that of the clock.

Even if the globe of the clock is not a printed globe, but a painted globe, one can still wonder if gores could have been used. If one wanted to use gores, one idea would be for example to take existing gores, for a given size of globe, and to make new enlarged gores, by mere proportionality. However, such an operation, if possible, seems interesting only for preparing sketches on paper, and for an artist like Stimmer who did not merely make copies of constellations, this operation would be limited to the positioning of the stars. However, these stars can easily be positioned directly on blank gores from the coordinates of the Alfonsine or Prutenic tables, or even directly on the globe after having marked a network of meridians and parallels.

I therefore believe that the first step in the manufacture of the globe of the clock, after the creation of a uniform surface, was to draw a certain number of circles on it. These circles must have been drawn, either with a compass, or perhaps simply with an equivalent of a compass, for example thin flexible blades with two holes.

Thus, once the poles of the globe were fixed, the equator could have been drawn at an equal distance from the two poles, by calculation or by trial and error, using one of the poles. At the same time, the diameter of the globe could be accurately measured, although it must already be known. It seems quite logical to draw on paper a circle with this same diameter, because such a circle is then more practical for making certain divisions.

The next step must have been the positioning of one of the poles of the ecliptic, that is, the making of a hole at about 23.5° from one of the celestial poles. Then, just as the equator had been drawn at an equal distance from the celestial poles, the ecliptic could be drawn at the same distance from the marked ecliptic pole.

The tracing of the ecliptic allows two new points to be identified, namely those of the equinoxes. By placing a hole on one of these points, always with the same compass opening (or equivalent), the colure of the solstices could be traced, which had to pass through the celestial poles and the poles of the ecliptic.

The intersections of the solstice colure with the ecliptic are the solstitial points and by placing a hole on one of these points, one could trace the equinox colure.

Then, using the tracing on the paper, one could divide the 90-degree intervals into three 30-degree intervals, locate four points at 30 and 60 degrees on either side of one of the equinoctial or solstitial points, then trace the last four great circles. At this stage, the globe had six great circles of ecliptic meridians, so every 30 degrees.

Finally, the globe still has the two polar circles and the two tropics (Cancer

and Capricorn) which could be traced from the celestial poles, by tracing the angles on paper. All these tracings could be made on the bare surface of the globe, with charcoal sticks (a branch of willow or carbonized charcoal).

In total, this operation requires the placement of seven holes for tracing the circles and these holes could obviously then be filled in.

At the same time, on paper, gores could be prepared and the stars that one wanted to put on the globe could be positioned there. These stars could then be transferred to the globe with a simple ruler. The drawings of the constellations could be sketched on paper, then on the globe with charcoal sticks, then painted on the globe.

3.1.11 Future perspectives

As I have indicated several times, no heritage administration supported my requests for research and these researches could therefore only be carried out incompletely.²⁹⁷ I would have long ago produced a photographic coverage of the entire globe of the clock if I had been able to do so and I could also have produced a digitalization of it, because I have the know-how. Today, all this remains to be done.

For the needs of researchers, it is important today to have quality photographs of all the constellations of the globe. This does not pose any particular problems, since the globe can be rotated freely. These photographs must obviously be taken by researchers, with suitable lighting. From these photographs, a list of all the stars on the globe with their coordinates should then be made. In the event that the photographs are taken by “professionals” (but one wonders why), it is important that the photographs are freely available to researchers, in the original format taken by the photographer, and that researchers can use these photographs in all their publications without having to ask the “professionals” for permission.

More generally, it is necessary to succeed in making a scientific map of the globe, for researchers and by researchers, and not by curators for the needs of an exhibition or mediation. Curators must support researchers, not replace them, or block their research, as is unfortunately currently the case in Strasbourg’s heritage circles, at the expense of the beneficiaries of the heritage.

A *scientific* documentation of the globe (as well as of the colures) therefore remains to be done and I hope that the curators of the *Musée des arts décoratifs* will take up this project and that they will carry it out by involving researchers and restorers. It is particularly important to carry out a faithful digitization of the

²⁹⁷The *Musée des arts décoratifs* did not respond to my requests for documentation of the globe, which explains the poverty of the views presented here, in particular for the 1572 supernova. The museum administrator had asked me in 2021 to gather my demands (one wonders why?), but never followed up on them. Neither Mr. Panel, the curator of the *Musée des arts décoratifs*, nor Mr. Lang, the chief curator, have responded to my requests. And the latter justified his lack of response to the *Défenseur des droits* (dDefender of rights) by the so-called abusive nature of my requests.

globe and then to be able to make suitable projections from these digitizations (which must therefore not only be developed with this objective, and then be accessible to researchers for mathematical processing). This digitization could be used to create an interactive 3D globe,²⁹⁸ but it is essential that the underlying digitizations are fully accessible in digital form to researchers, which is, for example, not the case today for digitizations made for the astronomical clock. Heritage authorities, whether museums or DRACs, must understand that science and research can in no case advance solely through the impetus of these authorities, and that, moreover, scientific research must remain free. This requires greater openness for these structures.

²⁹⁸Such interactive digitizations were, for example, carried out in 2020 at the British Library.

3.2 Calendar

The calendar ring bears the names of the months, the dates, the letters of the days (seven letters, starting on January 1st with “A”), the saints and important holidays and twelve small drawings for the entrances into the signs of the zodiac (figure 36). These drawings are placed in relation to the Julian calendar, since it was still in force when the calendar was last updated in 1669. Although the Gregorian calendar was introduced in Strasbourg in 1682, the calendar of the clock has not been changed afterwards. The entries in the signs of the zodiac are therefore shifted by about 10 days compared to the current beginnings of the signs, which was the shift between the Julian calendar and the Gregorian calendar in 1582.

The annual part of the calendar, the 365 or 366 days, must be as Stimmer drew it, even if it is now a little faded.

It can be noted that the horizontal plate of the globe also has a calendar, which perhaps dates back to the ancient state of the globe, when it was still a terrestrial globe. That said, celestial globes are also equipped in some cases with a horizontal calendar. Here, the calendar of the globe also has the signs of the zodiac and these signs should be compared more finely with those of the large vertical calendar.²⁹⁹ Did Stimmer copy the drawings of the signs of the zodiac from this horizontal calendar, or are they entirely different? Unfortunately, the impossibility of accessing these elements closely did not allow me to go further in these investigations.³⁰⁰

Finally, the secular part of the calendar must have been repainted in 1669, because the old one could not be reused. Even though the Julian calendar was still in force in 1669 at the time of the last update, the date of Easter followed a cycle of 532 years and it was not possible to merely shift the years and keep the other inscriptions. Furthermore, the moments of the equinoxes³⁰¹ also had to be reported. We can therefore admit that, with the possible exception of the dominical letter, the entire secular part was repainted in 1669.

²⁹⁹In his time, Bach had given some indications but had wished that the study be more in-depth, which never seems to have been done [Bach (1979)].

³⁰⁰Neither the current curator of the *Musée des arts décoratifs* (Mr. Louis Panel), nor the previous curator (Mr. Étienne Martin), helped me in my efforts.

³⁰¹All the original secular indications have been preserved in the German description of the clock from 1580 [Dasypodius (1580a)]. It is interesting to note that the times of the equinoxes were certainly calculated from the Prutenic tables, but only correctly from 1573 to 1652. The values for 1653 and 1654 probably suffer from small errors, and the values from 1655 to 1673 are all very wrong. They do not, however, seem to have been calculated with the Alfonsine tables. A calculation error seems to have propagated, because the error increases progressively from 1655 to 1673. The values of the equinoxes for 1670 to 1769 were most likely calculated using the 1627 Rudolphine tables, probably by Julius Reichelt.



Figure 36: Excerpt from the calendar for the first days of January (top) and for the month of August (bottom). We recognize the drawing of the sign of Aquarius placed around January 10, therefore ten days before the current date. We distinguish the Assumption of Mary on August 15. The sign of Virgo appears here around August 12, which was the date of entry into the sign before the Gregorian reform.



D. Roegel : Les peintures de Stimmer, 2024

Figure 37: Detail of the horizontal ring of the globe, with the calendar and the drawings of the constellations.

3.3 Map of Germany (calendar)

3.3.1 Description of the map

The map in the center of the astronomical clock calendar represents Germany at the time of the clock's construction (figure 38).³⁰² This map mainly contains regional names and a hydrographic network (figure 40). It is this network that allows one to orient oneself on the map. We can see that it is not Strasbourg that is in the center of the map, but rather Frankfurt. The name Strasbourg appears in German on the map, a little to the right.

This map was described as follows by Dasypodius³⁰³:

Das dritte theyl diser scheuben hatt in sich eyn gemeyne landtaffel, und beschreibung des Theuschlandes, in sonderheyt aber des Rheinstroms, und auch eyn abconterfetzung der Stat Straßburg mit eynen kleinen tüfelein, in welchem unsere namen zu eyner gedechtnuß verzeychnet seindt, aber dise kleine scheib bleybt stettigs still ston, unn hatt eyn zeiger welcher zeyger und weyser alles das jenig so oben erzelet ist, in der mittel scheyben die in 100 Jahren eynmal umbgehet wie dans vor gemelt ist.

It can be noted that the map places the North on the left, the South on the right, the East at the top and the West at the bottom. In the lower left corner, an inscription indicates who the authors of the map are (figure 39),³⁰⁴ while the lower right corner shows a view of Strasbourg, from the west.

The orientation of the map may be surprising, but it is in fact a completely natural orientation knowing that the astronomical clock was on the eastern side of the cathedral: looking towards the East, the North is precisely on the left.³⁰⁵ It should be noted that the inscriptions *Mitnacht* and *Mitag* which are present in Stimmer's map are found on certain maps of the 15th and 16th centuries.³⁰⁶

³⁰²The map can also be seen on Stimmer's engravings (figure 4), but with much less detail. On the other hand, on his large drawing of the clock, Grieshaber has reproduced with great care this network and the inscriptions on the map (figure 41). In particular, the Rhine can be easily recognized.

³⁰³[Dasypodius (1578), ch. 5] See also [Dengler (2011), p. 141-142].

³⁰⁴On the imperfect verb form in the signature of the map of Germany and its tradition and meaning, see Kieffer [Dupeux and Huhardeaux Touchais (2024), p. 159].

³⁰⁵Regardless of the logic that must have prevailed on the astronomical clock, it should be noted that Sebastian Münster showed Europe with the North at the bottom, but that some Dutch cartographers showed the East or the West at the top, without there being any particular reason for this, other than practical reasons [Heijden (1987), p. 68-69].

³⁰⁶See for example a map of central Europe from 1493 illustrated by Bagrow [Bagrow (1966), p. 90 and pl. LXXIII].



Figure 38: The map in the center of the calendar (rectified view). At the upper edge, one can clearly see half of the Bohemian massif.

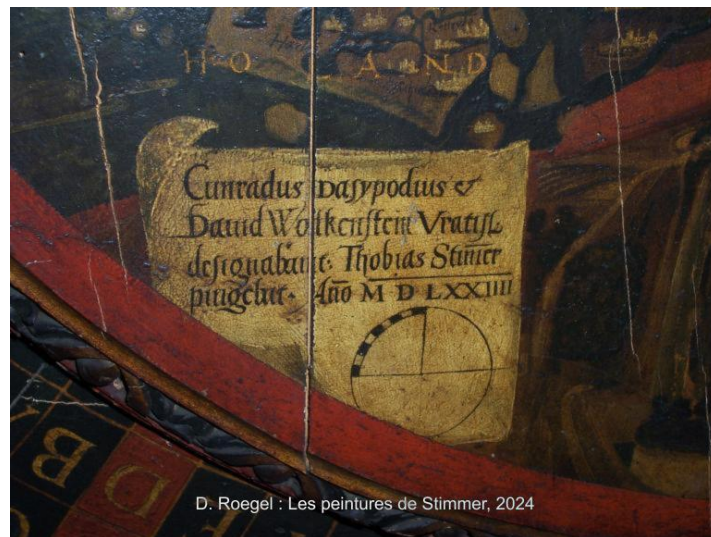


Figure 39: Detail of the map with the names of the designers (Dasypodius and Wolkenstein) and the painter (Stimmer).

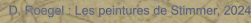


Figure 41: The map of Germany (partially hidden by the globe) on Grieshaber's large drawing, part of the plans kept in the *Musée des arts décoratifs* (c1845).

3.3.2 Source analysis

The essential question raised by the clock calendar map is that of its sources. To date, this question has hardly been studied,³⁰⁷ no doubt in part due to the low visibility of the map, lost in the middle of the calendar, which the public cannot approach and is difficult to photograph.

This question is not so easy to answer, because the clock map contains relatively few details. The names of the cities are hardly visible (Strasbourg is one of the exceptions),³⁰⁸ and one can mainly distinguish the names of the regions,³⁰⁹ a hydrographic network and representations of the vegetation. For example, we can see at the top of the map a part of the Bohemian massif, which can be found on all the maps of this period.

The search for possible sources is therefore based essentially on the hydrographic network that we have shown in figure 40. Let me begin by making a brief overview of the state of cartography at the time of the completion of the astronomical clock.

It turns out that cartography underwent fundamental transformations in the 16th century, both as a result of new explorations and the printing press. I will not attempt to explain all these transformations and will confine myself to a few general indications.³¹⁰ The world was becoming better and better known and the maps were becoming more and more precise and detailed. Ptolemy's *Cosmography* printed in 1482³¹¹ only included old maps for Antiquity. It was only with Ptolemy's *Geography* printed in 1513 in Strasbourg³¹² that "modern" maps were introduced in addition to the maps for Antiquity. These maps were made by Martin Waldseemüller³¹³ and one of them thus represents Germany, another the Rhine plain from Basel to Mainz, etc. There is also a world map, where a part of America appears (without naming it), but however less than on the map of Waldseemüller and Ringmann of 1507 where the name "AMERICA" appeared for the first time.³¹⁴

³⁰⁷No source has been proposed by Oestmann for the map [Oestmann (2020), p. 67-68]. We agree with Oestmann, however, that the central map of Germany should not be seen as a geocentric representation of the world that would echo the astrolabe.

³⁰⁸However, if we look closely at the figure 39, for example, we can clearly see several small inscriptions around HOLAND. There are surely many others.

³⁰⁹We can distinguish in particular the inscriptions Holland, Brabant, Burgund, Safoy, Westrich, Alsace, Sundgau, Brisgow, Schweiz, Tyrol, Wurtemberg, Pfalz, Hessen, Schwab, Bayern, Boehm, Meissen, Duinge, Friesland, Westphaln, Saxen, Marcken, etc.

³¹⁰On the history of cartography, I refer in particular to the work of Bagrow [Bagrow (1966)], to the multi-volume work *History of Cartography*, in particular volumes 1 and 3 [Harley and Woodward (1987), Woodward (2007)] or to the shorter Short [Short (2004)]. One can also consult the excellent catalogue [Bischoff et al. (2015)].

³¹¹[Ptolemaeus (1482)]

³¹²[Ptolemaeus (1513)]

³¹³On Waldseemüller, see [Meurer (2007), p. 1204-1207].

³¹⁴See also [Casin et al. (2017), p. 138-139] for a local insight into Waldseemüller's world map.

Ptolemy's *Geography* printed in 1522 in Strasbourg³¹⁵ differs little from that of 1513 as far as the maps of Antiquity are concerned, but modern maps are not the same as in 1513. Waldseemüller's world map has been replaced by a map by Lorenz Fries that I have already illustrated (figure 6).

Ptolemy's *Geography*, printed in Basel in 1540, was the first to be published by Sebastian Münster (1488-1552).³¹⁶ The figures 42 and 43 represent the maps of Germany (with the north at the bottom) and the Rhine plain, from Basel (left) to Strasbourg (right). We can already, at this stage, make comparisons between the map of the clock calendar and that of 1540. We can recognize the Bohemian massif. However, if we compare the hydrographic network, it appears that the Münster map is not detailed enough and that Stimmer necessarily had to use another map to make his own. Note that many maps were inspired by those of Münster, this is for example the case of Stumpf's map of 1548 (figure 44).

Apart from the editions of Ptolemy's *Geography*, many other maps have been produced, notably in the Netherlands and Italy. What we are looking for are essentially maps of Germany, including the Netherlands, with a developed hydrographic network, and where certain aspects are present. For example, we can note the presence or absence of certain tributaries or certain details. Near Hamburg, there are thus two branches of the Elbe which are not present on all the maps, but which are present on Stimmer's map. The absence of one of these two branches can lead to the elimination of a particular map. Another particularity of this region is that the Spree, a tributary of the Havel and a sub-tributary of the Elbe, is poorly represented on some maps which show it flowing into the Baltic Sea. This is the case on the map of the *Geography* of Münster from 1540 (figure 42) or on a map by Gastaldi from 1564 adapted from a lost map by Heinrich Zell from the 1540s,³¹⁷ while on the map of the calendar of the clock (figure 40) the Spree is a priori well represented.³¹⁸

Among all the maps that have been produced, some represent Germany³¹⁹,

³¹⁵[Ptolemaeus (1522)]

³¹⁶[Ptolemaeus (1540)] Münster published four editions of Ptolemy's *Geography* from 1540 [Ptolemaeus (1540)] to 1552 [Ptolemaeus (1552)] and continued the tradition of Martin Waldseemüller and Mathias Ringmann, the authors of the 1507 planisphere. For Münster, I refer the reader to the works of Burmeister, and in particular to his biography of Münster [Burmeister (1963)]. See also the work of Matthew McLean and Jasper van Putten on Münster's *Cosmography* [McLean (2007), Putten (2018)]. We can also refer to [Meurer (2007), p. 1209-1213] and [Iwańczak (2009), p. 58-65].

³¹⁷See [Paulusch (2019), p. 32-33].

³¹⁸This error is also a way of establishing the lineage of old maps, as has been clearly shown by Grenacher [Grenacher (1959)].

³¹⁹For an overview of the cartography of German territories from the period 1450-1650, I refer to Oehme [Oehme (1986)] and to Meurer's synthesis [Meurer (2007)]. For maps of Germany prior to the 16th century, one can also consult [Durand (1933)]. For an overview of maps of Germany, see [Paulusch (2019)]. It includes in particular an excerpt from Ptolemy's 1482 *Geography* [Ptolemaeus (1482)] for ancient Germany, a map of Germany from Schedel's chronicle (1493) [Schedel (1493a), Schedel (1493b)], an excerpt from Ptolemy's 1511 *Geography*

France, England, etc., as a whole, and others are limited to a region, for example to the Rhenish Palatinate.³²⁰

In 1500, Erhard Etzlaub³²¹ had made a map of central Europe showing the routes to Rome.³²² This is an example of a map that is still too crude for my purposes. On one version of this map (there are several), there is only one branch of the Elbe at Hamburg.

Another example of the difference between a printed map and the one on the clock concerns the tributaries of the Elbe. The clock map (figure 38) shows two small tributaries at the Hamburg loop, but these tributaries are non-existent on the 1540 Münster map (figure 42). This does not exclude that Stimmer could have used the 1540 map, but he could not have used only this map. The 1540 map is still found in the 1552 edition.³²³

A look at the clock map shows that it also covers the Netherlands, in particular the Zuiderzee can be clearly seen (figure 40). If we are looking for a global map that could have served as a basis for Stimmer, we must also look for a coverage of the Netherlands. However, the Münster map of 1540 only shows part of the Netherlands. Other maps should be considered.

Among the mid-16th century maps of Germany, we can cite the Italian maps of Forlani, Bertelli³²⁴ and Lafreri which are based on a map of Gastaldi of 1552. But these maps are probably not the ones used by Stimmer, none of them show two tributaries at the bend of the Elbe. The Gastaldi map of 1570 does not even show any. Ortelius's atlas of 1570³²⁵ also contains a map of Germany³²⁶

(Venice), two excerpts (old and modern) from the map of Germany in the 1513 *Geography* [Ptolemaeus (1513)], an excerpt from a map of Germany published in Lyon in 1564, but which differs only in details from the map in the 1540 *Geography* [Ptolemaeus (1540)]. It also includes the 1564 map of Germany by Gastaldi mentioned above. Finally, for the maps that interest us, there is also a reproduction of the map of Germany from Ortelius's 1570 atlas [Ortelius (1570)].

³²⁰For an overview of the maps of the Rhenish Palatinate, which is part of the region depicted by Stimmer, see [Hellwig et al. (1984)]. It includes an excerpt from Ptolemy's 1513 *Geography* [Ptolemaeus (1513)], an excerpt from the 1522 *Geography* [Ptolemaeus (1522)], an excerpt from Münster's *Mappa Europæ* (1536) (the course of the Rhine from Basel to Mainz), an excerpt from Ptolemy's 1540 *Geography* by Münster [Ptolemaeus (1540)], excerpts from editions of Münster's *Geography* up to 1580 [Ptolemaeus (1545)], and an excerpt from a map by Gerard de Jode of 1569, covering the Rhine from Strasbourg to Cologne. This map is based on a 1555 map by Caspar Vopel.

³²¹On Etzlaub, see [Smith (1983), p. 90-91] and [Pilz (1977), p. 127-128]. Etzlaub also built a portable sundial in 1511, see [Bott and Montebello (1986), p. 434-435] and [Dackerman (2011), p. 322-323].

³²²See [Bagrow (1966), p. 149], [Smith (1983), p. 90-91], [Meurer (2007), p. 1193-1198], [Iwańczak (2009), p. 173-180] and [Dackerman (2011), p. 318-321]. South is at the top. This is one of the oldest maps that shows roads [Bartrum (2002), p. 103-104].

³²³[Ptolemaeus (1552)] See also an adaptation of this map in [Karrow (1993), p. 626-627].

³²⁴For the map of Forlani and Bertelli of 1562, without the branches of the Elbe, see [Karrow (1993), p. 628-629].

³²⁵[Ortelius (1570)]

³²⁶[Broecke (1996), p. 97] This map is also reproduced in [Paulusch (2019), p. 34-37].

(figure 47), but the two branches of the Elbe are not visible (or at least not as large as in Stimmer's representation). On the other hand, the Spree does not flow into the Baltic Sea.

Among the maps that I believe can best be considered as the origin of the clock map, there are the "*Nova Germaniae Descriptio*" of 1553 (figure 45) and the "*Nova Universæ Germaniae Descriptio*" by Gerard de Jode (1509-1591) of 1562 (figure 46). The 1553 map was designed by George Lily (died 1559) and engraved by Nicolas Béatrizet (NB).³²⁷ The 1562 map is based on a map by Heinrich Zell,³²⁸ but it is more accurate than Zell's 1560 map of Germany.³²⁹ The 1562 map also shows the Bohemian massif better than the 1553 map, but neither map contains all the details that Stimmer included.

These two maps are similar to the Gastaldi map of 1564 mentioned above, but they still differ in many details. To take just one example already cited, these two maps correctly show that the Spree is a sub-tributary of the Elbe, as does Stimmer's map, while the Gastaldi and Zell maps sent the Spree towards the Baltic Sea.

We can therefore assume that Stimmer used either one of these maps, or a map very close to them, perhaps supplementing it from time to time with certain regional maps. We will not list the regional maps either. A partial list of these can be found in Bagrow's history of cartography.³³⁰ Furthermore, in the 1552 edition of Ptolemy's *Geography* by Sebastian Münster,³³¹ there is a map of the Rhine in three plates, which Stimmer may have used for this part of his map. Stimmer could have used other regional maps, such as the map of Saxony by Criginger,³³² of Bavaria by Erhart Reich³³³ and others. That said, the maps of 1553 or 1562 cited above are almost sufficient for the work that Stimmer did.

For Holland, Stimmer could have used, for example, the very detailed map made around 1565 by Cornelis de Hooghe.³³⁴ The Ortelius Atlas of 1570³³⁵

³²⁷See Tramezini in [Bagrow (1966)] and [Heijden (1987), p. 25].

³²⁸Let me recall that Heinrich Zell is the author of the cartography of the geographical globe which was reconverted into the celestial globe of the clock (see § 3.1.2). Zell is also the author of a map of Prussia in 1542 [Horn (1950)]. He was the nephew of the reformer Matthew Zell (1477-1548), active in Strasbourg, and it is likely that Dasypodius knew both.

³²⁹The title of Zell's 1560 map, not reproduced here, is "*Ein neuwe und eygentliche Beschreibung des Teutschen Lands, nnen die fürnemen Fürstenthum, Herschafften, Graffschafften und Stett Tetscher Nation auch die umbligenden anstös anderer Herschafften und Königreich auff das fleißigest verzeychnet werden.*" The map is said to date from around 1544, but was not printed until 1560. The original is now lost, see [Meurer (2007), p. 1209-1210].

³³⁰[Bagrow (1966), p. 153] Bagrow cites a number of regional maps of Germany (Bohemia, Bavaria, etc.) between 1518 and 1584 [Bagrow (1966), p. 154].

³³¹[Ptolemaeus (1552)]

³³²This map was included in Ortelius' atlas in 1570 [Ortelius (1570)]. See [Broecke (1996), p. 137].

³³³This map was also included in Ortelius' atlas in 1570 [Ortelius (1570)]. See [Broecke (1996), p. 158-159].

³³⁴See [Karrow (1993), p. 630-631]. See also [Heijden (1987)] for maps of the Netherlands.

³³⁵[Ortelius (1570)] For the history of Ortelius' atlas maps and their sources,

also contains a map of the Netherlands that may have served as an addition to a general view.³³⁶

Finally, for Alsace, the 16th century was also the scene of a major cartographic evolution,³³⁷ up to the work of the architect Daniel Specklin (1536-1589).³³⁸ In the early 1570s, he prepared a very detailed map which was published in 1576.³³⁹ It is quite possible that Dasypodius was in contact with Specklin and was able to obtain preliminary surveys from him.

3.3.3 Digitization project

In order to advance the study of the astronomical clock map, it would be useful to carry out a fine digitization of the map and for this digitization to be done with the researchers (and not simply for them). This digitization should be able to be studied and compared with other maps.

This would involve identifying all the waterways, all the names of regions and cities (I identified “Strassburg,” but there are certainly others). This would also make it possible to analyze the panorama of Strasbourg and possibly identify the towers, fortifications, churches and houses. One question that arises is whether the scale of the map coincides with that of a printed map. There is no reason to enlarge or reduce the map in relation to an existing map and it may simply be a transfer to scale 1. It is also important to know whether Stimmer’s map is simply a circular excerpt³⁴⁰ of an existing flat map, or whether Stimmer has distorted an existing map. Unfortunately, I cannot answer these questions, because my requests to take better photographs in the clock room were left unanswered by the curators, and in particular by Mr. Panel, curator of the *Musée des arts décoratifs* and Mr. Lang, chief curator of the Strasbourg museums at the time of the completion of my work.

see [Broecke (1996)] and [Karrow (1993)].

³³⁶See [Broecke (1996), p. 99].

³³⁷See on this subject notably [Grenacher (1964)].

³³⁸On Specklin, see [Ohl des Marais (1929), p. 757-758].

³³⁹See [Casin et al. (2017), p. 140] for the 1576 map of Alsace.

³⁴⁰The fact that Strasbourg is not in the centre of the map may be explained by the main source map and the desire not to cut off a particular region, for example the Netherlands. Compromises must have been found and some regions are therefore incomplete. The Bohemian massif, for example, is not completely shown on the clock map, because it is at the edge of this map.

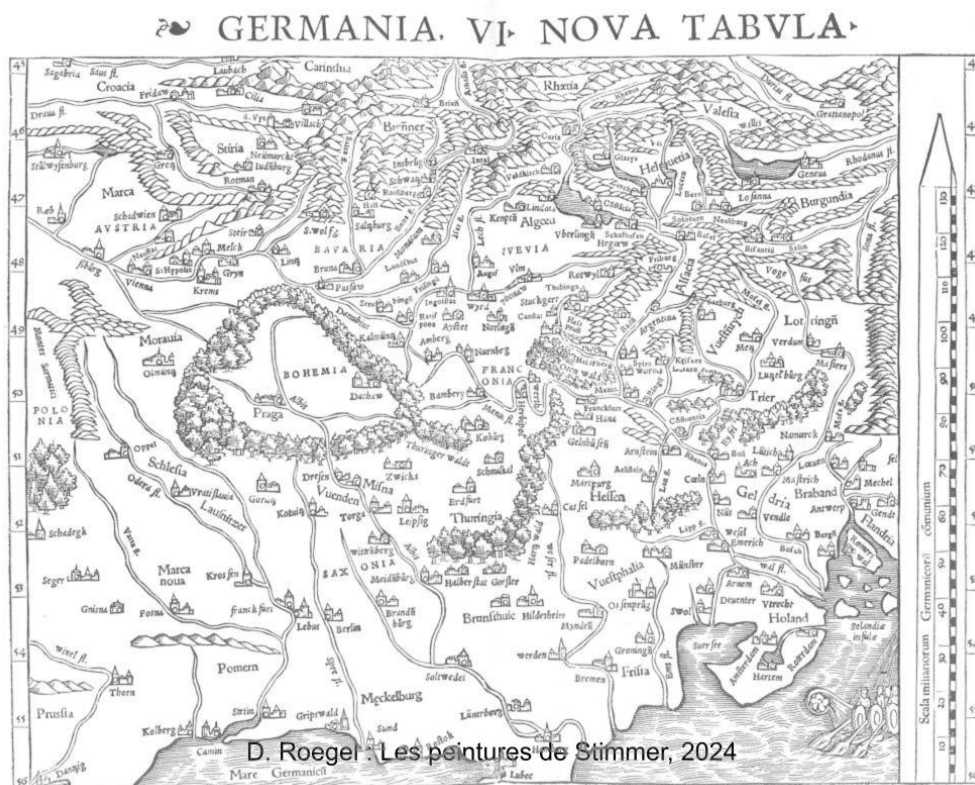


Figure 42: The map of Germany in Ptolemy's *Geography* published by Sebastian Münster (1540) [Ptolemaeus (1540)].



Figure 43: The map of Alsace in Ptolemy's *Geography* published by Sebastian Münster (1540) [Ptolemaeus (1540)].



Figure 47: Abraham Ortelius: excerpt from the map of Germany from *Theatrum orbis terrarum* (1587), identical to that of 1570 [Ortelius (1570)]

3.4 The Strasbourg panorama

In the lower right corner of the map of Germany (figures 38 and 40), Stimmer has inserted a panorama of the city of Strasbourg. This view of Strasbourg is given from the West and, unless I am mistaken, has not yet been the subject of in-depth studies.³⁴¹

As I do not have any high definition photographs of this panorama,³⁴² I will confine myself here to a few general and preliminary observations, leaving it to others to go further.

Despite the difficulties of accessing the panorama, we can distinguish a certain number of buildings. Thus, in the foreground, there is a tower (above the word “*Untergang*”) and this is undoubtedly the old “white tower” (or National tower), built between 1532 and 1534 and destroyed in 1870.³⁴³ Behind this gate, a little to the right, there is perhaps the Saint Marguerite convent. Finally, we can also make out the cathedral, the Saint-Thomas church and a few other buildings.

We may be surprised by the point of view adopted, but the point of view from the West, therefore with a view towards the East, is in fact quite natural, because when we are in front of the clock, we look towards the East. This is also certainly why the top of the map of Germany corresponds to the East and not to the North.³⁴⁴

It is interesting to compare Stimmer’s panorama with other representations of the city of Strasbourg. I will confine myself to general views.³⁴⁵ One of the oldest representations is that of Schedel in 1493 (figure 48).³⁴⁶ Schedel shows the city rather from the south. Moreover, on Schedel’s engraving, the text of the two pages (not present in my illustration) actually surrounds the scene and almost touches the spire of the cathedral.³⁴⁷

One of the first plans of the city of Strasbourg is the one made by Conrad Morant in 1548.³⁴⁸ This plan was included in the first volume of the *Civitates*

³⁴¹This view is not, for example, cited by Châtelet-Lange [Châtelet-Lange (2001)].

³⁴²I remind readers that the museums of Strasbourg have not responded to my requests for research photographs in the clock room. I have never even been allowed to step onto the platform on which the globe is located and which would have allowed me to get a closer look at the map of Germany and the panorama of Strasbourg.

³⁴³See Châtelet-Lange [Châtelet-Lange (2001), p. 110].

³⁴⁴We can note that the *Cabinet des estampes* of Strasbourg [Siffer (2022)] keeps a pen drawing, supposedly by Stimmer, and which represents a view of Strasbourg approximately from the current Saint-Paul church. (This drawing is also illustrated in [Himmelein (1986), p. 339] and in the 2024 exhibition catalogue [Dupeux and Huhardeaux Touchais (2024), p. 25].) It is therefore not the same viewpoint as the one on the astronomical clock, but it suggests that Stimmer may have made other drawings of the city, possibly to serve as a basis for his panorama.

³⁴⁵There is at least one engraving from 1477 representing the cathedral alone, published in Conrad Pfetisheim’s *Reimchronik*, see [Bischoff (2018), insert p. 192-193].

³⁴⁶[Schedel (1493a), Schedel (1493b)]. See [Colbus and Hébert (2009)].

³⁴⁷On the subject of the representation of cities in Schedel’s chronicles or in the atlas of Braun and Hogenberg, one can consult [Krings (1989)].

³⁴⁸[Châtelet-Lange (2001)]

orbis terrarum by Braun and Hogenberg published in 1572³⁴⁹ (figure 49). It was also taken up, with a slight adaptation, in Münster's *Cosmography* published in 1574.³⁵⁰

In the years that followed, we can note the new panorama of Strasbourg from the south in Münster's 1588 *Cosmography*³⁵¹ (figure 50), then the plans of Matthäus Merian (1593-1650) in 1643 and 1644 (figures 51 and 52).

As for the plans of other cities in the 15th and 16th centuries, I refer to Châtelet-Lange's excellent summary.³⁵² The author gives a brief history of city plans and cites in particular Florence's "chain map" (*Pianta della Catena*) from the 1480s and the plans of the *Peregrinatio in terram sanctam* by Bernhard von Breydenbach published in 1486 in Latin and German and which contained seven large views of cities. After the views of the chronicle of Schedel in 1493, it was in 1500 that the large view of Venice by Jacopo de' Barbari appeared. The author also cites views of Bruges around 1500, of Antwerp in 1515 and then a view of Augsburg in 1521 engraved by Hans Weiditz. A very large engraving (62 × 350 cm) was then made for Aix-la-Chapelle. Châtelet-Lange draws attention to the fact that if the point of view adopted is low, one will tend rather towards a pictorial work, while if the point of view is high, there will be a search for topographical precision. A view of Amsterdam in 1538 made by Cornelis Anthonisz details all the streets. The author also cites a view of Louvain in 1540. For France, Châtelet-Lange reports the views of Paris (notably the "gouache plan," the "tapestry plan" giving a bird's eye view around 1535, both lost, and the plan called of Basel giving a view around 1550) and Lyon (scenographic plan around 1550) and notes that we do not find, for any of these cities, views from a low point of view, such as for example the views in Schedel's chronicle. Finally, let me point out that as part of his work with Philipp Apian, Jost Amman also produced a view of Munich around 1567.³⁵³

³⁴⁹[Braun and Hogenberg (1572)] A reproduction is given in [Casin et al. (2017), p. 178-179]. See also [Meurer (2007), p. 1234-1235]. As Châtelet-Lange indicates, the 1572 version was re-engraved on copper and removed the viewpoint of the platform of the cathedral [Châtelet-Lange (2001), p. 28-29].

³⁵⁰[Ptolemaeus (1574)]

³⁵¹[Ptolemaeus (1588)] On the subject of Münster's *Cosmography*, see in particular [McLean (2007)] and [Putten (2018)]. The view of Strasbourg published in 1588 is adapted from a drawing by Daniel Specklin engraved in 1587 by Matthias Greuter.

³⁵²[Châtelet-Lange (2001), p. 25-30]

³⁵³[Wolff (1989), p. 104-105]

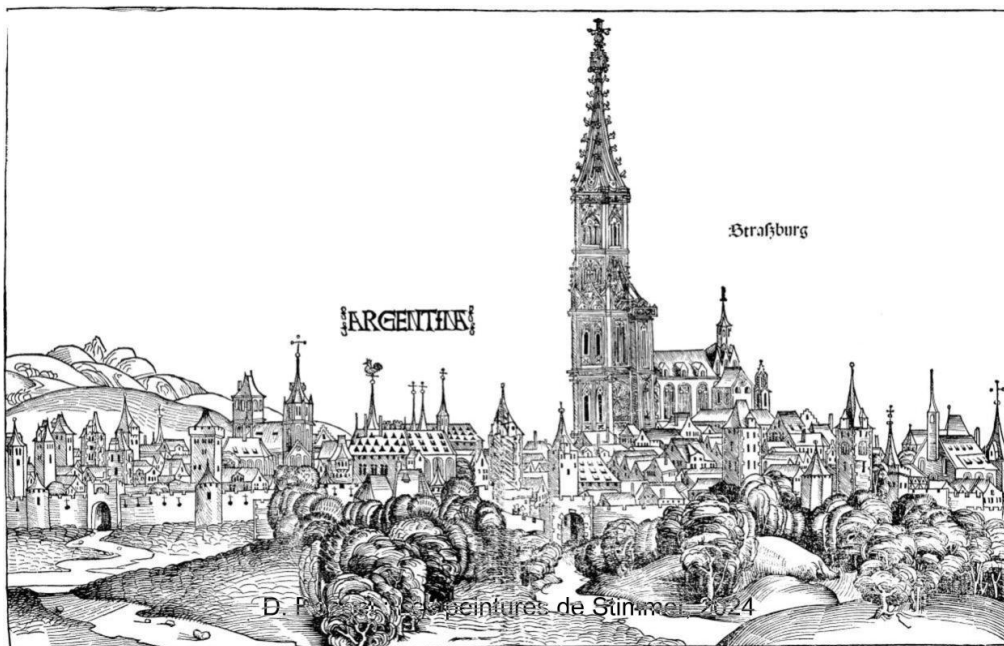


Figure 48: The panorama of Strasbourg in Schedel's chronicle (1493) [Schedel (1493a), Schedel (1493b)], seen from the south.



Figure 49: The map of Strasbourg in the first volume of *Civitates orbis terrarum* by Braun & Hogenberg (1572) [Braun and Hogenberg (1572)]. North is at the top.

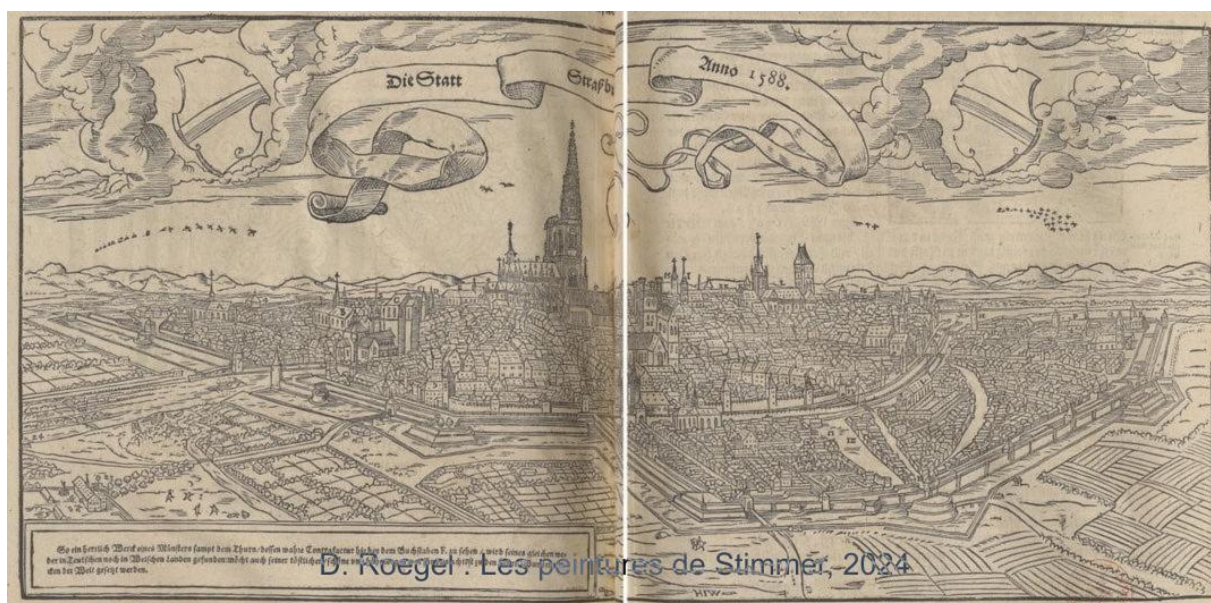


Figure 50: The view of Strasbourg from the North in 1588 in Münster's *Cosmography* (here the edition published in 1598) [Ptolemaeus (1588)].



Figure 51: Matthäus Merian's plan of Strasbourg (1643).

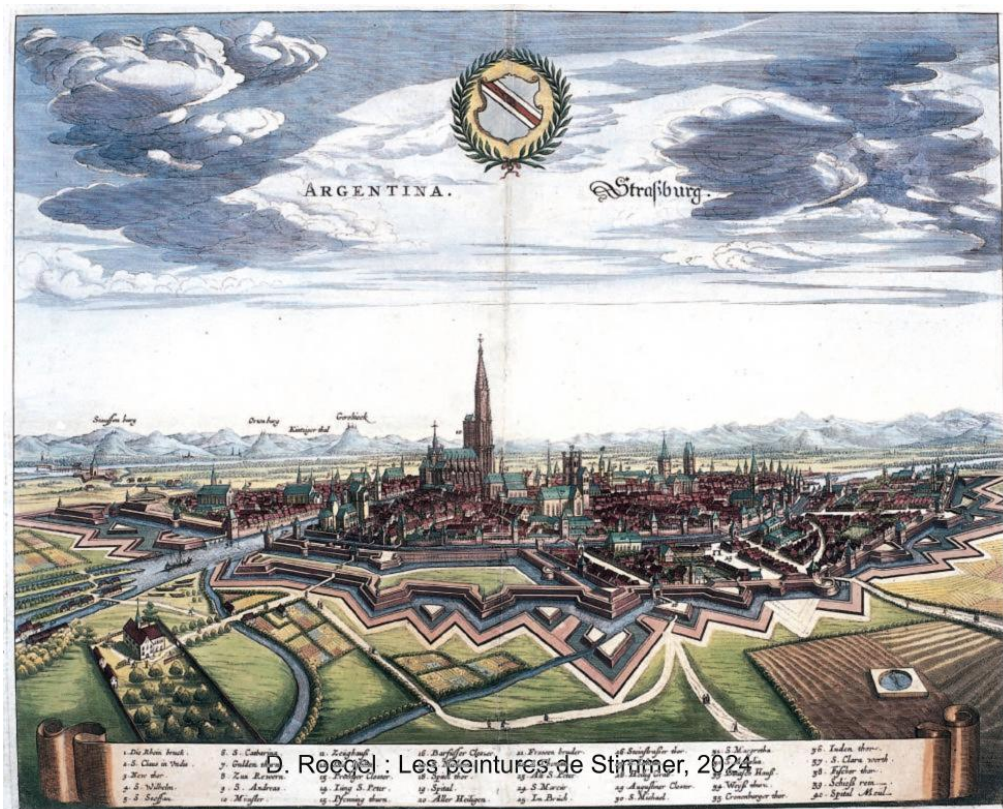


Figure 52: The view of Strasbourg from the North by Matthäus Merian (1644). Merian's engraving is clearly very inspired by the one from 1588.

3.5 The astrolabe and the allegories of the seasons

At the place of the current Copernican orrery there was an astrolabe-dial representing the mean geocentric motions of the known planets, as well as of the sun and the moon. There were therefore seven hands (Mercury, Venus, Mars, Jupiter, Saturn, the Sun and the Moon), to which it was also necessary to add the dragon's hand representing the position of the lunar nodes (figure 53).

The astrolabe spandrels showed four allegories of the seasons. These allegories have been preserved in the current clock, because Schwilgué essentially cut out the back of the old astrolabe-dial to install the orrery. It should be noted that Schwilgué could have only covered the astrolabe with the orrery, limiting himself to a few additional holes for its fixing, but he preferred to replace the entire back.

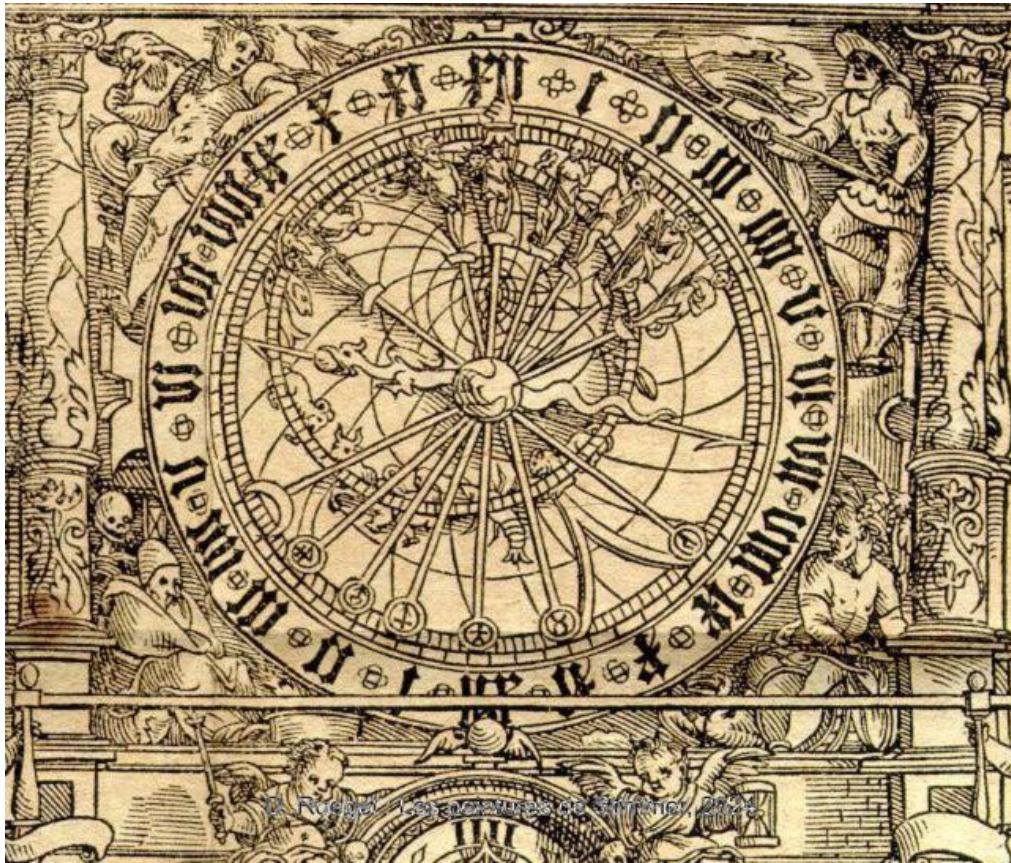


Figure 53: The paintings of the seasons (excerpt from the average engraving of the clock by Stimmer).

3.5.1 The dial of the astrolabe

I will not comment much on this dial here. Some of the hands have disappeared, but only the background is of interest to us. However, this background consists essentially of graduations,³⁵⁴ almost entirely erased at the periphery, because between the removal of the dial and its exhibition in the clock room of the museum of decorative arts, the background of the astrolabe (tympanum) was placed on the ground with the celestial globe in the middle (see figure 11) and the footsteps of visitors gradually erased the lines. This background was not really an artistic work, but a geometric tracing that is beyond the scope of the present study.³⁵⁵

The outer edge of the astrolabe bore the hourly inscriptions I to XII, twice, but these inscriptions have been covered by the zodiac signs of the current astronomical clock. It is possible that the old inscriptions are still present under the current layer.

3.5.2 The seasons

By cutting out only the back of the astrolabe (tympanum) in the 19th century, Schwilgué was able to preserve the paintings of the spandrels and in particular the encroachments of these paintings on the dial. Indeed several elements deliberately go beyond the edge of the dial and it would have been difficult to preserve them if the entire dial had been cut out.

The four spandrels therefore represent allegories of the seasons.³⁵⁶ Spring is represented by the adolescent at the top left and he holds an eagle in his right hand. Summer is represented at the top right by the man holding a reaper's fork. Autumn is represented at the bottom right by an older man resting from the fruit of his labor. Finally, winter is represented at the bottom left, warming itself, and for which death patiently awaits.

The circular representation of the seasons is not rare and is found for example in 1512 in a figure from Regiomontanus's *Kalendarium*.³⁵⁷ This illustration still appears in the *Temporal* printed in 1528 in Strasbourg³⁵⁸ or in later editions such as that of 1560³⁵⁹ (figure 54).

The allegory of Spring contains a lizard. A salamander is found for that of Summer. The allegory of autumn (figure 56) also includes a pelican and a pair of mallards (the male in the foreground and the female behind him). Stimmer must have gone to see a real pelican, perhaps in a zoological garden or in a lord's

³⁵⁴[Bach et al. (1992), p. 68-96]

³⁵⁵See [Oestmann (2020), p. 142-179] for a detailed description.

³⁵⁶See [Dengler (2011), p. 157-159].

³⁵⁷[Regiomontanus (1512)]

³⁵⁸[Regiomontanus (1528)]

³⁵⁹[Regiomontanus (1560)] The engravings are by Hans Brosamer (c1495-1554), at least for most of them, but the one representing the cosmos could be by Heinrich Vogtherr the Elder [Muller (1997), p. 257-258], although based on the one of 1512.

castle. Such gardens or menageries already existed in the 16th century³⁶⁰ and we know, for example, that Dürer had gone to the zoological garden in Brussels. Pelicans appearing in engravings could not have been sufficient to create such a realistic portrait. These elements must also have been used to create the sculpture of the pelican under the globe.

Finally, we can note that the little dog in the allegory of winter (figure 56) is exactly the same as the one that Stimmer engraved in the creation of Eve in the *Flavius Josephus* of 1574³⁶¹ but also in the *Titus Livius*.³⁶² The allegory of summer also evokes the harvester Cincinnatus in the same *Titus Livius*.³⁶³

The allegories of the seasons were taken up in an engraving by Stimmer for a work on agriculture published in 1579 by Jobin, the *Siben Bücher von dem Feldebau* by Charles Estienne³⁶⁴ (figure 55). This time, it is not the astrolabe that is in the center, but the Earth surrounded by the twelve winds. It will be noted that these winds are personified by varying heads, and those at the bottom are even those of corpses. What the winds blow also varies. In any case, the spandrels contain almost the same representations as on the clock. The differences are quite minor. The old man's dog has, for example, disappeared and we cannot distinguish either the ducks, nor the lizard and the salamander. Stimmer's engraving appears in later editions of this work at least until 1598, but no longer in the 1607 edition where it is replaced by another similar engraving, but recast. For example, winter is no longer at the bottom left.

It should be noted that the intervention report produced during the restoration of the clock case at the end of 2018 describes the restoration of the spandrels of the four seasons.³⁶⁵ It appears that these four spandrels were directly painted on the sandstone. The restorers note in particular that there are at the level of the spandrels several old openings filled with lead and which can be seen in low light.

Finally, let me say a few words about the tradition of representations of the seasons. In her thesis, Meetz³⁶⁶ gave an overview of it. Thus, around 1531, Georg Pencz made preparatory drawings for stained glass windows, one per season.³⁶⁷ For each drawing, a character who also represents the age of the man is pulled by a chariot and medallions give the three signs of the zodiac associated with that season. Virgil Solis also represented processions in the 1530s for each of the seasons.³⁶⁸ The representation of processions is very frequent and Meetz gives several examples. But more frequently, it is the months themselves that are represented.

³⁶⁰[Baratay and Hardouin-Fugier (1998)]

³⁶¹[Flavius Josèphe (1574)]

³⁶²[Livius and Florus (1574)], see [Beaujean and Tanner (2014b), p. 68].

³⁶³[Livius and Florus (1574), p. 131], see [Beaujean and Tanner (2014b), p. 78].

³⁶⁴[Estienne (1579)] See [Beaujean and Tanner (2014c), p. 91 and 93].

³⁶⁵[Sutter and Gérard (2019), p. 116-129]

³⁶⁶[Meetz (2003)]

³⁶⁷[Meetz (2003), fig. 1-4]

³⁶⁸[Meetz (2003), fig. 5-8]

In the Italian illustrated novel *Hypnerotomachia Poliphili* (The Dream of Poliphilus, 1499)³⁶⁹ by Francesco Colonna, which some have called “the most beautiful book in the world,” we also find four allegories of the seasons³⁷⁰ but these have little connection with those of the clock.

Shortly before Stimmer, the Liège painter Lambert Lombard (c1505-1566) made four copperplate engravings representing the seasons.³⁷¹ Each season is personified by a god or goddess: Venus for spring, Ceres for summer, Bacchus for autumn (with a barrel behind him), and Aeolus for winter warming himself by a bowl. In 1563, Philip Galle (1537-1612) engraved the four seasons. Spring is represented by a young boy holding a bow in his right hand and an eagle in his left hand. The three associated signs of the zodiac are attached to each engraving. Winter is also represented by an old man warming himself. Of course, in the 1560s, it was also Pieter Brueghel the Elder (c. 1525-1569) who made paintings of the seasons, but these were large paintings with many figures, not more intimate allegories.

Meetz also cites four copperplate engravings by Philip Galle after Johann Stradanus³⁷² from the 1570s. The scenes are more restricted than in Brueghel, but still more expansive than those of Lombard or Galle from 1563. Autumn is the season of fruit harvest and for winter, we also have an old man warming himself by a fire in a house.

Finally, Daniel Lindtmayer (1552-1606/7), an artist from Schaffhausen influenced by Stimmer, also produced in 1586 a painting representing winter in the form of an old man warming himself by a fire, with a dog and in the snow.³⁷³ This painting was probably part of a set of the four seasons.

³⁶⁹[Colonna (1499)]

³⁷⁰[Meetz (2003), fig. 63-66]

³⁷¹[Meetz (2003), fig. 73-76]

³⁷²[Meetz (2003), fig. 124-127]

³⁷³[Thöne (1972), p. 56]



Figure 54: Excerpt from the *Temporal* of 1560 [Regiomontanus (1560)]. This woodcut is already present in the 1528 edition [Regiomontanus (1528)] and even in the 1512 *Kalendarium* [Regiomontanus (1512)].

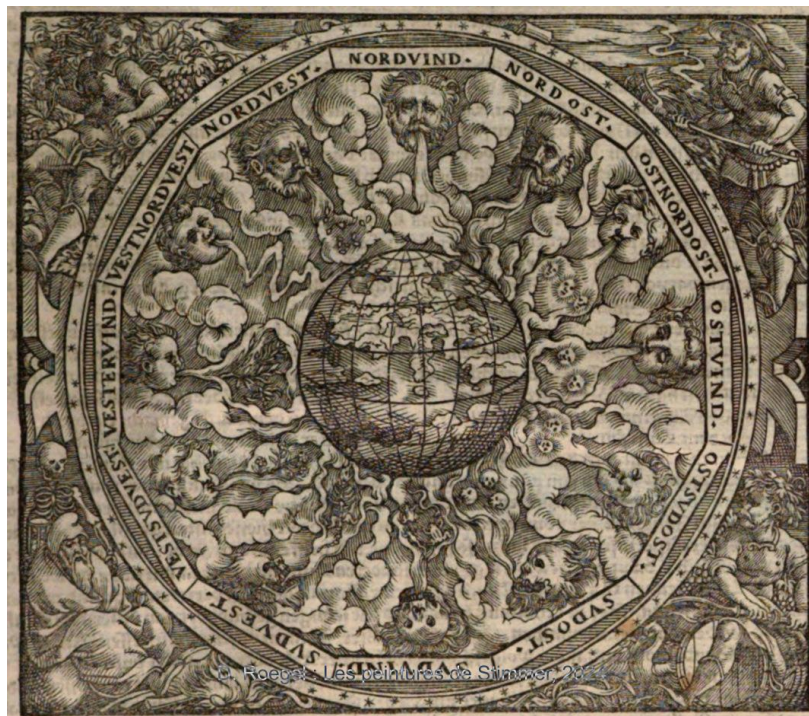


Figure 55: Stimmer: the allegories of the seasons around the twelve winds [Estienne (1579)].

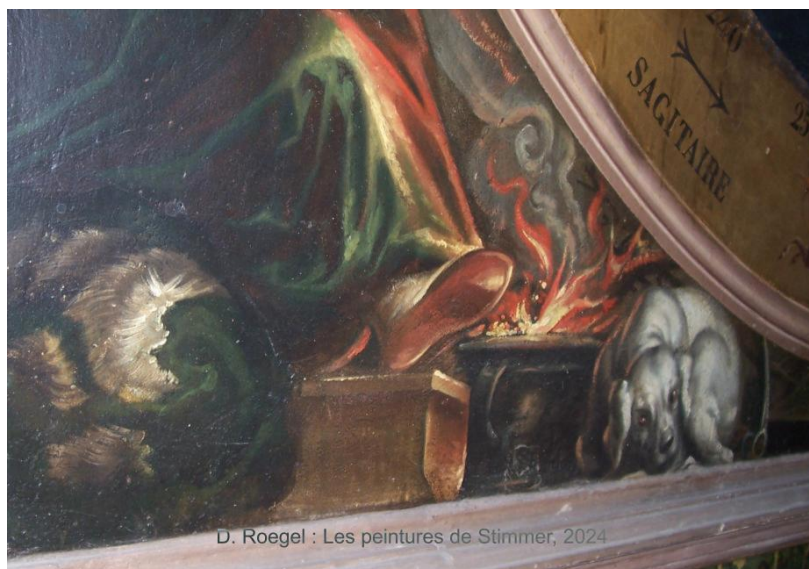
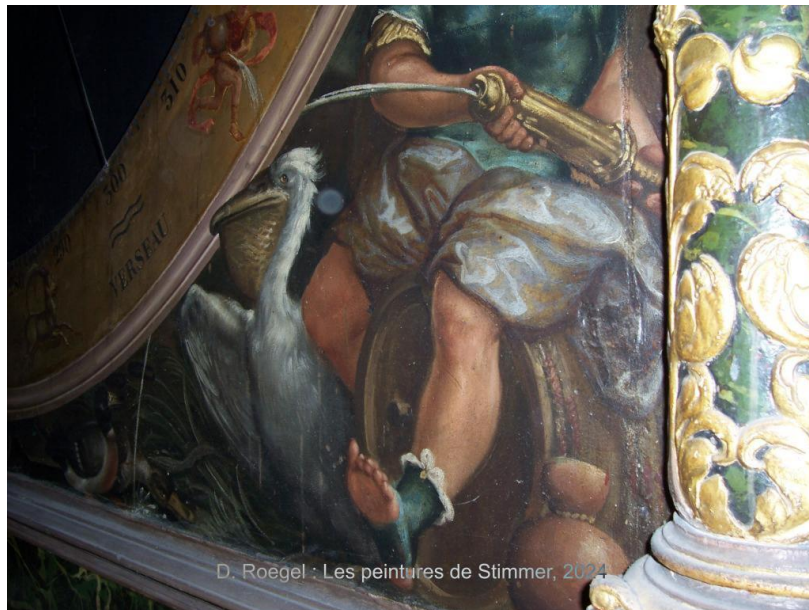


Figure 56: Details of the allegories of autumn (top) and winter (bottom).

3.6 Eclipses

Stimmer's engravings of the clock give us a good idea of the two eclipse panels that were located in the place of the current display cases of the computus and the solar and lunar equations (figure 57). These panels indicated the lunar and solar eclipses to come for about thirty years.³⁷⁴ But the original panels no longer exist, as they were replaced by two new panels in 1613 and these panels, as well as the pair that succeeded them, are kept in the clock room of the *Musée des arts décoratifs*.³⁷⁵

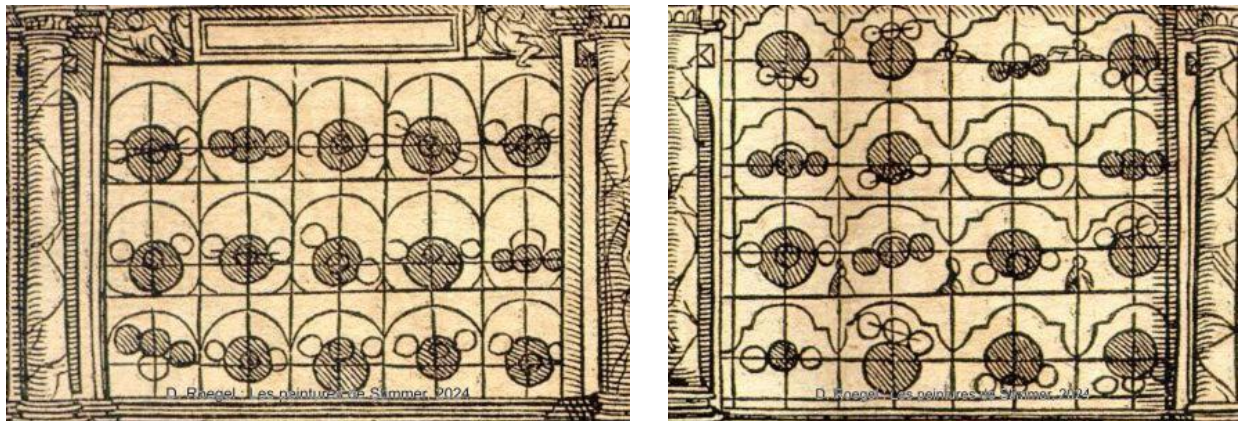


Figure 57: Excerpts from the medium woodcut of the clock by Stimmer published in [Frischlin (1598)].

Although the original panels of the clock no longer exist, it is not impossible that the same wooden plates were reused in 1613. Some elements of the panels, such as the frames, may be by Stimmer, and the original form certainly influenced later forms.

Stimmer's engravings do not simply show imaginary views of the eclipses, but reproduce the circumstances as given by Dasypodius.³⁷⁶ By carefully examining the dates and times of the eclipses given by Dasypodius, we see that these dates and times, as well as the respective positions of the sun and the moon, were in no way calculated by Dasypodius as he implied,³⁷⁷ but that Dasypodius merely

³⁷⁴[Bach et al. (1992), p. 64-68]

³⁷⁵I made a request for photographs of these panels. The curator of the *Musée des arts décoratifs*, as well as the chief curator of the Strasbourg museums never responded to my requests, claiming that my requests were abusive.

³⁷⁶[Dasypodius (1580a), Dasypodius (1580b)]

³⁷⁷Dasypodius writes "(...) *die finternussen Soñ und Monns so in künfftigen Jaren werden, die wir mit all em fleiß außgerechnet und Calculiert, auch in den zweyen neben tafelen auffgerissen, mit ihrer grösse auch anfang mittel und ende, welche zwo tafflen auch durch Tobiam Stimmer schön mit aller hand gemeldts gezieret seyndt.*" [Dasypodius (1580a),

took up the calculations of eclipses by Cyprián Karásek Lvovický (1524-1574) (Cyprianus Leovitus in Latin, Leowitz in German), a Bohemian astronomer and mathematician.³⁷⁸

Leowitz had published in 1556 ephemerides giving the eclipses for the period from 1554 to 1606 in Augsburg.³⁷⁹ These ephemerides were based on the Alfonsine tables and not on the Prutenic tables. Augsburg and Strasbourg having almost the same latitude, Leowitz's ephemerides were approximately transposable for Strasbourg, knowing that in any case no one would be able to verify the times of the eclipses. The difference in longitude between Augsburg (*Augusta Vindelicorum Imperialis*) and Strasbourg (*Argentina Imperialis*) is given as 16 minutes by Leowitz and we can observe that the times of the eclipses given by Dasypodius are exactly those of Leowitz minus 16 minutes. For example, the lunar eclipse of December 8, 1592 (Julian) is given by Leowitz at 20:23 and Dasypodius gives 20:07. The moments of the beginning and end of the eclipses were also obtained by Dasypodius from the durations given by Leowitz, by distributing these durations equally before and after the maxima.³⁸⁰ The magnitudes of the eclipses were also taken from Leowitz without any modification. Finally, it can be noted that in the lists published by Dasypodius in 1580, some eclipses are mentioned but not shown. These are exactly those indicated in Leowitz's small notes.

The question of the sources of Dasypodius' eclipses is therefore one of the simplest we have to deal with. Contrary to what has been written, Dasypodius did not calculate the eclipses indicated by the astronomical clock. He essentially took the moments indicated by Leowitz by subtracting 16 minutes from them. Leowitz's durations were divided by two and used to determine the beginnings and ends of the eclipses. The drawings of the eclipse configurations were copied from those of Leowitz. That said, even if one can see an act of plagiarism there, in particular because Dasypodius does not cite his sources, one can still consider that Dasypodius would certainly have been able to calculate these eclipses as

p. 32]. Ungerer [Ungerer and Ungerer (1922)], then Bach [Bach et al. (1992)] and Oestmann [Oestmann (2020)] took Dasypodius at his word. As we have already indicated above, Fanny Kieffer [Dupeux and Huhardeaux Touchais (2024), p. 152] wrongly claims that the eclipses were calculated by Dasypodius on the basis of the Prutenic tables, which is doubly false. (The clock researchers were not closely involved in the 2024 exhibition, let me recall.)

³⁷⁸On Leowitz, one can consult [Pilz (1977), p. 224-226], [Oestmann (2002)] and [Zsoldos (2018)]. Cholasta's note [Cholasta (2004)], on the other hand, contains only some superficial second-hand information. I have chosen to retain the birth year 1524 given by Oestmann [Oestmann (2002)].

³⁷⁹[Leowitz (1556)]

³⁸⁰It can however be observed that Leowitz gives two calculations, one made from the Alfonsine tables (with many errors) and another from the tables of Peurbach, and Dasypodius took the durations of the eclipses from this second calculation. There was therefore a certain mixture of inconsistent sources. It can also be noted that the durations of eclipses can sometimes vary by 1 to 2 minutes between the values given by Leowitz and those of Dasypodius, but the reasons for these differences are not clear.

Leowitz did. But why redo calculations that have already been done? It is also very likely that Dasypodius corresponded with Leowitz, even though there is no trace of this correspondence. Leowitz may have been aware of the construction of the Strasbourg clock, but probably did not see its completion, since he died in 1574.

As for the dates of the eclipses, one should be careful that the dates given by Leowitz are all in the Julian calendar. The lunar eclipse indicated for December 8, 1592 (Julian) (figure 59 above) actually occurred on December 18 (Gregorian). The solar eclipse announced for May 20, 1593 (Julian) (figure 59 below) occurred on May 30, 1593 (Gregorian).

However, the engravings on the clock are not all identical. The large engraving shows four rows of five eclipses for the left panel and four rows of four eclipses for the right panel. I believe that the medium engraving is not quite accurate and that there were actually four rows of eclipses on the left, just like on the 1613 panel that replaced it. The right panel may have had five rows of four eclipses and not four rows as on the engravings.

The left panel probably showed the eclipses from December 8, 1573 (Julian) to December 19, 1591. The right panel probably began on June 14, 1592 and perhaps went to May 14, 1603. It is not certain whether the right panel went to October 2, 1605, the last eclipse indicated by Dasypodius in 1580. In some cases, it is possible to recognize the eclipses on the engravings, by comparison with Leowitz's figures, but the figures were not always transcribed precisely. For example, on the right panel of the middle engraving, the second and third eclipses in the first row seem to be those of 1592 and 1593, illustrated further on. That said, one can also notice that the representations seem to have placed the orient on the right and not on the left, as is the case on later panels.

Since the following panels start in 1613, we can deduce that it took about ten years for the eclipses to be recalculated (or copied from another source), but that's another story. . .



Figure 58: The eclipse panel which was at the position of the current computus from 1613 on [Ungerer and Ungerer (1922)]. The upper part of the frame is perhaps by Stimmer.

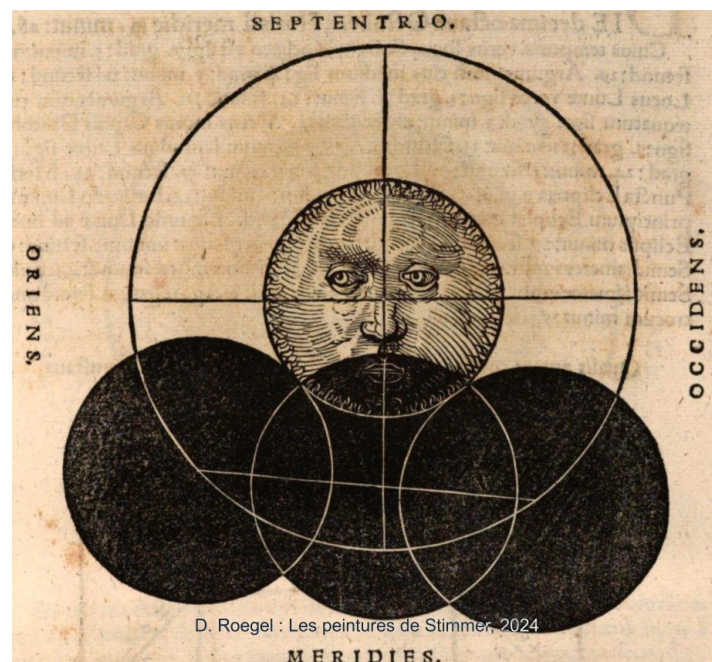
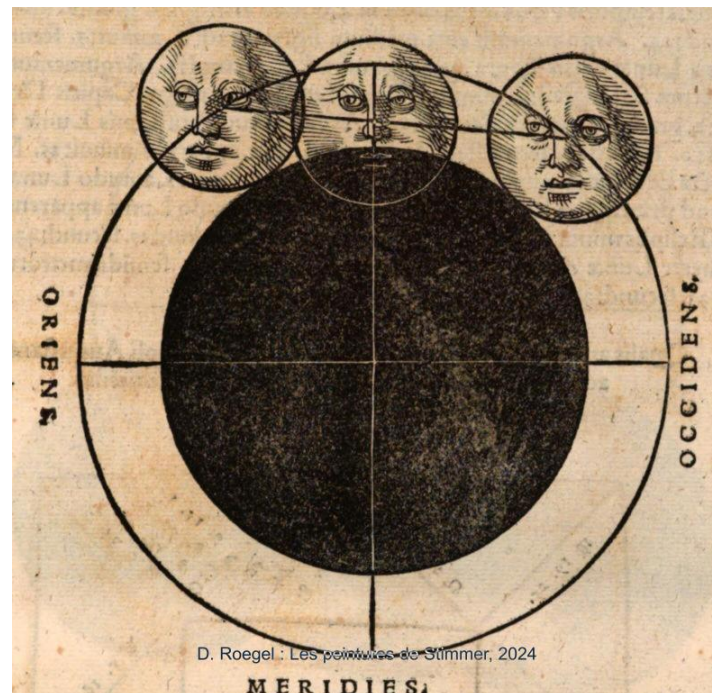


Figure 59: Eclipses of December 18, 1592 (top) and May 30, 1593 (bottom) (Gregorian calendar) given by Leowitz [Leowitz (1556)].

3.7 Time and lunar dials

The old time dial of the clock, certainly painted by Stimmer, had only one hand making one revolution per hour. It is exhibited in the clock room of the *Musée des arts décoratifs*³⁸¹ (figure 60). The quarters are marked from I to IIII. The minutes are also marked by sixty small boxes alternately black and yellow, which change sides every five minutes.

Figure 7 shows the situation of the time dial on the old clock, as represented on Grieshaber's large drawing. Today, the old dial has obviously come out of its frame.

This dial seems to have inspired the engraving of Dietterlin's hydraulic clock in his *Architectura* (1598) (figure 62).³⁸²

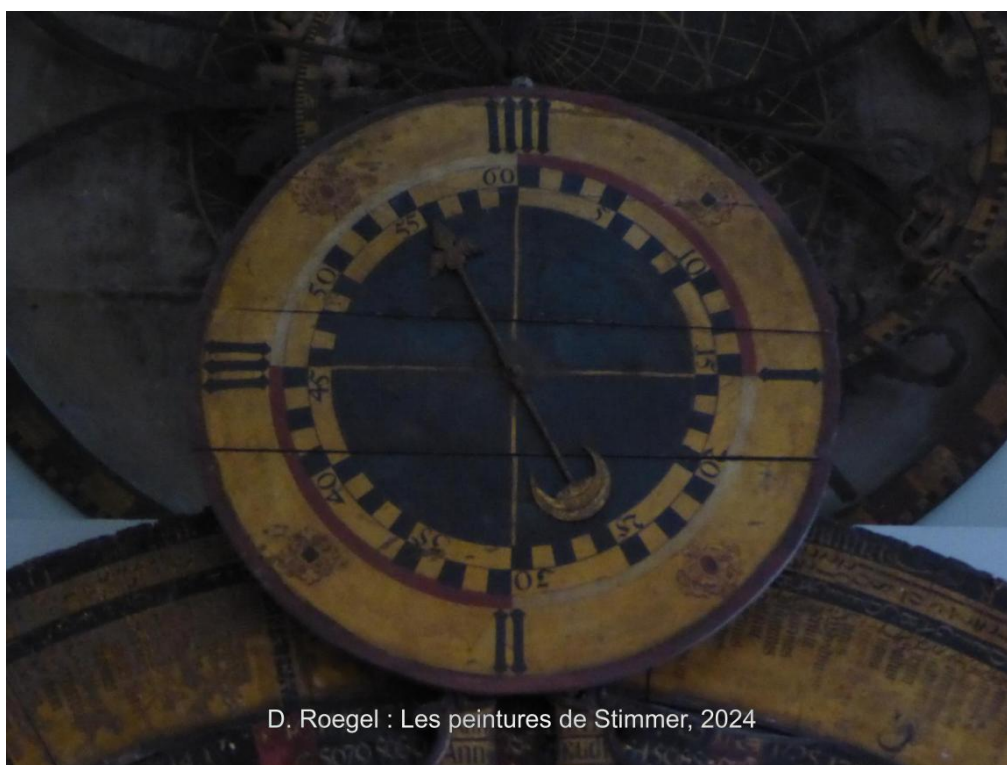
As for the moon dial, it is a classic dial with two diametrically opposed moons making one revolution in 59 days. It is also exhibited in the clock room (figure 61).³⁸³ When first installed in 1924, it was positioned above the astrolabe, but today it has been moved to one of the walls of the room.

Only one moon is fully visible at a given time and when one of the moons disappears on the right, the other appears on the left. The dial is graduated in two times 29 and a half days and the hand is sometimes in one half-scale, sometimes in the other. The hand is superimposed on one of the moons, the one hidden in the figure.

³⁸¹[Martin et al. (2020)]

³⁸²See also on this topic Elizabeth J. Petcu's chapter in the 2024 exhibition catalogue [Dupeux and Huhardeaux Touchais (2024), p. 201-215], and particularly pages 207 and 210.

³⁸³In the intervention report of the restoration of the clock case in 2018, it is interesting to note that the restorers illustrate the old moon dial by talking about the astrolabe [Sutter and Gérard (2019), p. 154]. Furthermore, in the 2024 exhibition catalogue, Kieffer presents the moon dial as the mechanism of the Sun and the Moon, while there is neither a real mechanism nor a Sun [Dupeux and Huhardeaux Touchais (2024), p. 152].



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Figure 60: The time dial.



Figure 61: The moon dial.

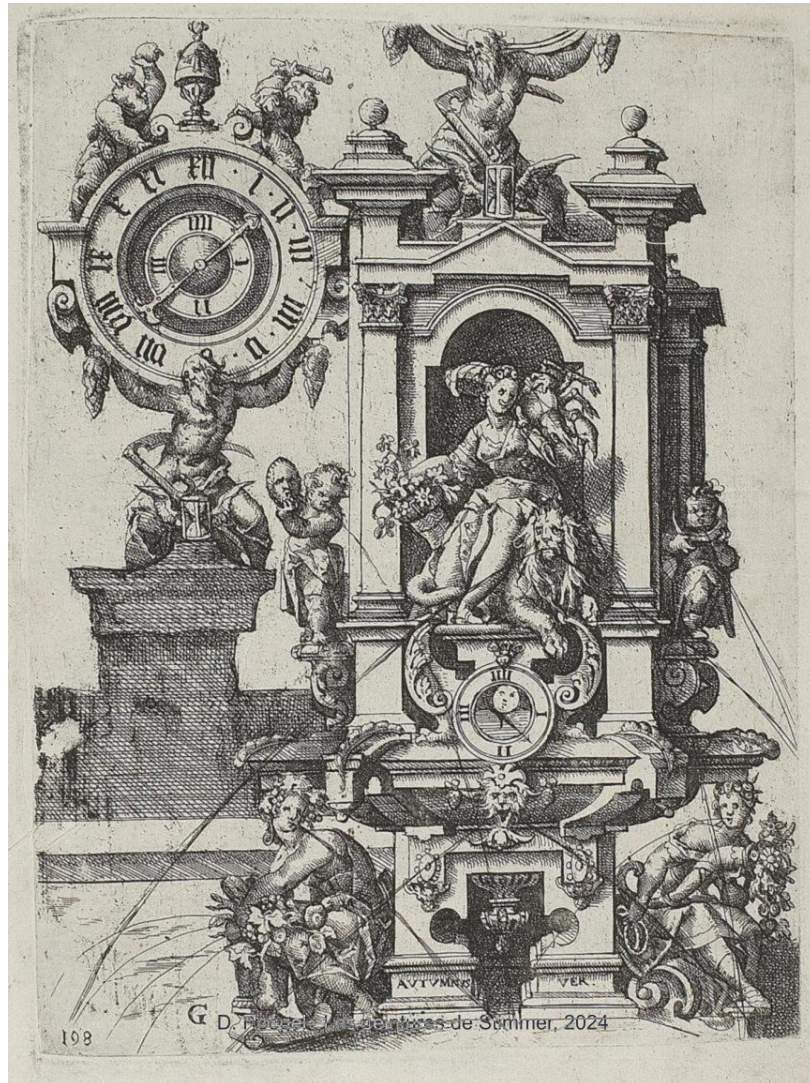


Figure 62: The engraving of the hydraulic clock of Dietterlin's *Architectura* (1598) [Dietterlin (1598)] inspired by the time dial of the astronomical clock.

3.8 The Atlas of the sundials

The pediment of the south transept of the Strasbourg Cathedral contains three sundials³⁸⁴ made at the time of the construction of the astronomical clock (figure 63).

As already mentioned above, Stimmer is said to have painted a fresco at the level of the upper sundial, but nothing remains of it. It was a kneeling Atlas, supporting the world, flanked by two naked women with flowing veils, in which Bendel saw possible allegories of winds.³⁸⁵ I refer to figure 8 from which I reproduce here only an excerpt (figure 64).

The representations predating the astronomical clock, for example an engraving published by Jobin around 1570, do not show any sundials.

The sundials were restored around 2017-2018 and marked with golden lines (figure 63), while there is no evidence that this was the case originally.³⁸⁶ After this restoration, the DRAC claimed that there had never been a fresco, which is obviously absurd.³⁸⁷ The DRAC's arguments, namely the absence of traces of polychromy, to justify the past non-existence of the fresco seem very weak to me. After more than four centuries of exposure to bad weather and erosion, it is not certain that traces of the fresco could still remain, especially if the fresco was deliberately erased at some point.

As for the tradition associated with this fresco, we must look for representations of Atlas supporting the world. The oldest representation in art is probably that of the Farnese Atlas, a statue discovered in Rome in 1575 (figure 65).³⁸⁸ The representations of Atlas in the 16th century and before that of the clock are not so numerous. They are almost always associated with Hercules, and show

³⁸⁴The first published study of these dials is that of Werkmeister in 1912 [Werkmeister (1912)].

For a more modern analysis of the drawings of these dials, please refer to my study [Roegel (2007)]. More recently, in 2014, Jean-Marie Poncelet and Pierre Juillot carried out *in situ* surveys on behalf of the *Œuvre Notre-Dame* [Poncelet and Juillot (2014)]. The authors kindly provided me with their report, which the *Œuvre Notre-Dame* has always refused to do. The architect of the cathedral, Mr. Caillault, as well as the administration of the DRAC at the time in charge of the cathedral (Mr. Louis Panel), have always denied my requests for access to the scaffolding to examine the dials, while allowing dozens of other unqualified people to enter. The mayor at the time, Mr. Ries, had vaguely given me his agreement for access, but the somewhat sibylline terms he used suggest that he was opposed to it.

³⁸⁵See [Bendel (1940), p. 69], [Thöne (1936), p. 31], [Bengel (2011), p. 87-89], [Oestmann (2000), p. 123-124] and [Oestmann (2020), p. 182-186].

³⁸⁶The restoration of these dials was only announced when the scaffolding hiding them was removed, proof that a good part of heritage management is just staging. On February 15, 2018, the *Dernières Nouvelles d'Alsace* even headlined one of their articles with "The resurrection of the sundials of Dasypodius," but resurrection implies a prior death, which has never been proven by the DRAC.

³⁸⁷This example is just one among others that show that the DRAC has every interest in closely involving researchers in heritage interventions. That said, despite several requests from me, the DRAC Grand-Est refused to provide me with the restoration report of the sundials by the company ARCOA [Atelier ARCOA (2017)].

³⁸⁸See for example [Hofmann and Nawrocki (2019), p. 20].



Figure 63: The sundials in 2008 (top) and 2022 (bottom).



Figure 64: Enlargement of a detail of Isaac Brunn's 1615 engraving.

the moment when Hercules supports the world, while Atlas repairs it. We can for instance cite the fresco "Hercules and Atlas" by Bernardino Luini, painted between 1513 and 1515 and coming from the Palazzo Landriani in Milan. This is also the scene painted by Lucas Cranach the Elder and his son (after 1537). This scene was again depicted by Heinrich Aldegrever in 1550 (figure 67) or in 1554-1555 (figure 66) after a painting by Frans Floris.³⁸⁹

In the years 1530-1534, Michelangelo also made an unfinished sculpture, the Slave Atlas. Finally, I mention another representation slightly later than that of Stimmer, that of the fresco of Hercules holding the globe in the Camerino Farnese room of the Palazzo Farnese in Rome, painted by Annibale Carracci between 1595 and 1597.

But none of the representations I have just mentioned show women around Atlas or Hercules. In Stimmer's fresco, the one holding the globe must be Atlas and not Hercules. The women surrounding Atlas are certainly not allegories of the winds as Bendel thought, but most certainly two of the Hesperides. And the kneeling Atlas usually corresponds to the moment when Atlas takes the world on his shoulders, a bit like when one lifts dumbbells. One begins with one knee on the ground.

In a future version of this document, I hope to have the sundial restoration report. Despite several requests from me, the DRAC has refused to communicate this report.

³⁸⁹[Velde (1965)]



Figure 65: The Farnese atlas.



Figure 66: Engraving showing Hercules supporting the globe, while Atlas repairs it, 1563 (after a lost painting by Frans Floris (c1516-1570) of 1554-1555).



Figure 67: Heinrich Aldegrever: Hercules helps Atlas to support the sky, burin engraving, 1550.

4 Conclusion

Although Tobias Stimmer's paintings for the Strasbourg astronomical clock are often overlooked, because the visitors focus on the automata and the more recent mechanical parts from the 19th century, the analysis of Stimmer's work on the 16th century clock, now kept in the *Musée des arts décoratifs* in Strasbourg, is particularly insightful, even from an astronomical point of view.

For instance, the celestial globe raises a number of questions and I have tentatively suggested that Stimmer was inspired by a Mercator globe from 1551, and also by printed representations from 1534. It does also seem that Dasypodius and Stimmer used the Prutenic tables' precession theory for the locations of the stars.

Another noteworthy part of the 16th century clock is the central map of Germany, as well as the Strasbourg panorama. This part doesn't seem to have been studied up to now, and its analysis is particularly interesting and also raises a number of questions.

Finally, the analysis of the eclipse tables reveals that Dasypodius did not compute the circumstances of the eclipses, contrary to what his writings imply. The eclipse times have merely been copied from Cyprianus Leovitius' ephemerides and slightly adapted. These ephemerides were in turn based on the Alfonsine tables, so that the clock did in fact mix data from the Alfonsine and the Prutenic tables.

Unfortunately, my work is still unfinished and not as complete as I wished, because a number of studies have been blocked by the museum's curatorial staff. I have not been able to get a close look at the 16th century calendar, nor at the globe, or the central map of Germany. Requests for good photographs of the eclipse panels were left unanswered by the curators.

Perhaps someone else will be allowed to complete my work some day.

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