

# The History of the Oldest Planetarium in the Netherlands: The *Sphaera Movens*, nicknamed the *Leyden Sphaera*

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## Abstract

A planetarium depicting the Copernican configuration of the planets was built in Rotterdam in around 1670. In 1710, this scientific instrument was presented to Leiden University. The *Sphaera incomparabilis*, as it was then known, underwent an intense refurbishment and was placed in the university library, where it could be admired until the beginning of the nineteenth century. After being housed for more than a century in the building of Leiden University Observatory, the instrument was presented to the new Museum for the History of Science and Medicine (the predecessor of the present Museum Boerhaave) in 1931. Recently, the planetarium was restored. This project triggered new research into the origin and history of the instrument, the results of which are presented in this paper.

## Reason for this Paper

Museum Boerhaave's collection contains a number of unique pieces, one of which immediately catches the eye: a planetarium taller than a person, nicknamed the *Leyden Sphaera* (Museum Boerhaave Inventory Number 9619).<sup>1</sup> This showpiece has had an eventful history, originating in Rotterdam where it was made in around 1670, before being moved to Leiden University forty years later. When the predecessor to the Museum Boerhaave opened in 1931, the University presented it with the *Sphaera*.

The central location of the planetarium in the present permanent exhibition always hindered a thorough investigation into its condition. A temporary experimental exhibition in the museum room meant the planetarium had to be dismantled, which was the perfect opportunity to carry out some further studies into the instrument. The results of these indicated that restoration was required; the movement needed cleaning, there was corrosion and no protective layer on the brass, and evidence of careless repairs which had been carried out in the distant past. Over a period of two years, the *Sphaera* was completely cleaned and restored where necessary. The planetarium is now proudly displayed in all its former glory in the museum (Fig. 1). The restoration offered us a great opportunity to take a closer



Fig. 1 *The Sphaera*, after the recent restoration in Museum Boerhaave, Leiden. Photos Museum Boerhaave.

look at the history and context of the *Sphaera*.

## Representing Copernicus: the motivation behind the planetarium

In 1543, Nicolaus Copernicus published his book *De revolutionibus orbium coelestium* ('On the Revolutions of the Heavenly Spheres'). In this book, he described a new vision of the solar system where the sun was at the centre, in contrast to the prevailing view that the Earth was at the centre of the universe. It took a century and precise observations by Johannes Kepler and Galileo Galilei before this heliocentric worldview began to find acceptance in Europe. This included the Netherlands, where it became widespread in both inside and outside academic circles.<sup>2</sup> From the middle of the seventeenth century, Copernican beliefs about the celestial motions became more or less commonplace among astronomy enthusiasts. One good example being Adriaen Vroesen, then mayor of Rotterdam, who decided to make mechanical images based on the heliocentric worldview.<sup>3</sup> He was not the first to try this, but certainly the most ambitious in the Netherlands. A Copernican mechanical planetarium had already been designed back in 1598 by Johannes Kepler.<sup>4</sup> A derivative, known as the 'tellurium', a tool that mimics the revolution of the earth around the sun, actually originated in the Netherlands. This mechanism was probably invented around 1600 by the mathematician Adriaen Anthoniszoon from Alkmaar, and was first described in the *Astronomia Instaurata* (Amsterdam, 1617), an edition of Copernicus' *Revolutionibus* published by the Groningen professor Nicolaus Mulerius.<sup>5</sup> Such devices were produced in series by the Amsterdam instrument maker and cartographer Willem Jansz, who later changed his surname to 'Blauw'. Jansz was a pupil of the famous astronomer Tycho Brahe, one of the first astronomers who developed precision instruments for celestial observation. Around 1650, however, the most sensational attempt was the 'Gottorpse Globe' in Fredriksborg (Schleswig Holstein), an impressive Copernican planetarium the size of a person, housed in a globe-shaped sphere with a diameter of 1.27 m displaying the signs of the zodiac.<sup>6</sup>

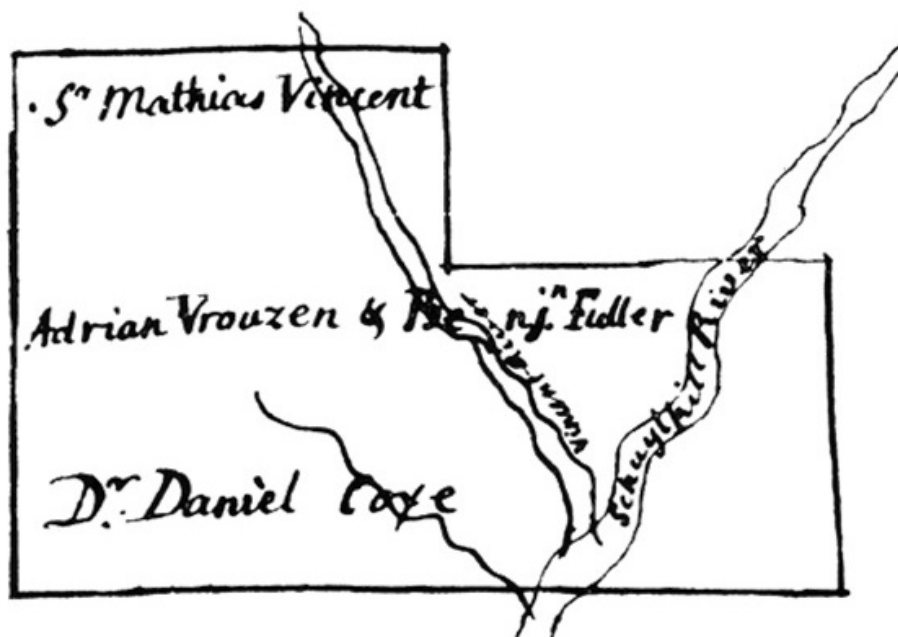


Fig. 2 Sketched map of Pennsylvania (USA) indicating the position of the land of Adrian Vrouzen & Benjamin Fidler (a misrepresentation of the name Furly). From a letter of William Franklin to his father Benjamin Franklin, 12 June 1772 [William B. Willcox, ed., *The Papers of Benjamin Franklin*, Vol. 19 (New Haven and London, 1975), pp. 170-172].

### The Initiator: Adriaen Vroesen

Adriaen Vroesen (1641-1706), the initiator of the Rotterdam planetarium, was a descendant of a Remonstrant family of Rotterdam mayors and aldermen. His father bore the same name, while his mother was Johanna Snel van Royen, the daughter of Adriaen's grandfather Willebrord Snel van Royen, better known as 'Snellius'.<sup>7</sup> Adriaen's connection with Snellius meant he could enrol for free at Leiden University in 1656 as a student of philosophy.<sup>8</sup> After completing his studies, Adriaen initially followed in the footsteps of the Vroesens, and abandoned academia for a career in administration. In 1662, when alderman of Schieland, he married Susanna Knaeu. Two years later he was appointed secretary of the Rotterdam City Council. When his father died in 1669, Adriaen was chosen as mayor of Rotterdam.

As a rich regent, Adriaen did not limit his activities to administrative affairs, but also made a mark in the social and cultural circles of his times. For example, he regularly visited 'De Lantaarn', the home of Englishman Benjamin Furly and intellectual centre of Rotterdam. Furly was the leader of the Quaker community in the Netherlands, and a successful merchant.<sup>9</sup> From 1665, Furly regularly organized discussions at his home, where natural philosophy was one of the items on the agenda. It is likely that Adriaen Vroesen was one of the members of Furly's 'society', and a commercial activity confirms the relationship between Vroesen and Furly. As a friend of William Penn, who

put his estate in Pennsylvania in America at the disposal of free-thinking people, Furly actively started recruiting new immigrants from 1682. Via Furly, Adriaen Vroesen also acquired a large area of land in Pennsylvania, adjacent to Furly's property, in the same year (Fig. 2).<sup>10</sup> He sold the land in 1704 through Benjohan Furly, Benjamin Furly's son<sup>11</sup>, so it is clear that Vroesen and Furly knew each other well. Vroesen also had access to the intellectual society in which Furly was involved. In Furly's house, the thinkers and sources of inspiration of the early Enlightenment met each other: Pierre Bayle, John Locke and his pupil Anthony Ashley Cooper, 3<sup>rd</sup> Earl of Shaftesbury, not forgetting others such as Philippus van Limborch, Jean Leclerc, Algernon Sydney, Tobias Ludwig Kohlhaus, Pieter Rabus, Hermanus Lufneue and Franciscus Mercurius Baron van Helmont. The latter proves once more the link between Furly and Vroesen; when staying with Vroesen in Schoonderloo in 1686, Van Helmont drew up his will. Both Furly and Vroesen were mentioned, with 500 guilders bequeathed to Furly, while Vroesen inherited his library and a ring, and Vroesen's wife Susanna Knaeu two silver flasks.<sup>12</sup> Van Helmont also reserved a quantity of money for the publication of one of his books, which usually dealt with alchemy, and where he instructed Vroesen to act as executor.<sup>13</sup> The catalogue of Furly's library, moreover, shows that Van Helmont did indeed leave him various objects after his death<sup>14</sup>, and Vroesen must have also received a part.<sup>15</sup>



Fig. 3 Photo of the - in 1940 destroyed - oil painting of Steven Tracy († 1703) by Adriaen van der Werff (who worked in Rotterdam between 1676 and 1696). Tracy is depicted with a celestial globe and his *Sphaera* on the background. (From: *Rotterdamsche Kunstkring: catalogus der tentoonstelling van oude schilderijen in particulier bezit (Rotterdam, 1907)*, no. 75. Photo RKD.

Was Vroesen inspired to build a planetarium by the events at Furly's home? It seems probable. It cannot be ascribed to the posthumous influence of his grandfather Snellius, because although the latter expressed sympathy for the Copernican system, he never showed real conviction.<sup>16</sup> It is also possible that the young Adriaen Vroesen went on the Grand Tour after completing his studies, and came across the Gottorp planetarium or a similar mechanism, such as the one designed by the Dane Ole Rømer who was active in Paris. Planetarium investigators King and Millburn have in any case pointed to a similarity in the basic design between the Rotterdam *Sphaera Armilaris Automatica* and the planetary mechanism by Rømer and his companion Horrebow.<sup>17</sup> Whatever exactly happened, it is clear that the *Sphaera* had to be a showpiece which commanded admiration: possibly for God's creation, but certainly also to reinforce Vroesen's leading position in Rotterdam.

### Other Contributors to the Sphaera

#### 1. Steven Tracy

Vroesen requested Steven Tracy (also known as Thraci; †1703) to actually build the *Sphaera*.<sup>18</sup> This Rotterdam clockmaker, who was born in Great Yarmouth in England, was a prominent instrument maker.<sup>19</sup> In 1769, the *Bataafsche Genootschap der Proefondervindelijke Wijsbegeerte te Rotterdam* (Batavian Society for Experimen-

tal Philosophy at Rotterdam'), which was established by Tracy's grandson Steven Hoogendijk, received a celestial globe made by Tracy, which was driven by an interior movement.<sup>20</sup> Tracy was so proud of his two devices that he had his portrait made by the elite Rotterdam painter Adriaen van der Werff, together with these instruments (Fig. 3). Furly also owned a 'very beautiful wall clock' with astronomical indications by Tracy.<sup>21</sup> Tracy's reputation as an 'observer and effector of mathematical celestial drawings' finally led the Rotterdam baker and historian Gerrit van Spaan to dedicate one of his many books to this 'ingenious artist' of Rotterdam in 1701.<sup>22</sup>

## Other contributors to the *Sphaera* 2. Nicolaes Stampioen

Another important designer of the *Sphaera* was Nicolaes Stampioen (1639-1721), surveyor, sheriff of Kralingen and 'fabricq' (meaning engineer) in Schieland.<sup>23</sup> In 1689, in the capacity of mathematician, he joined a scientific committee which advised the States General about the utility of a method to determine longitude at sea.<sup>24</sup> His grandfather, Jan Jansz Stampioen de Oude († 1660), had been a teacher in navigation in Rotterdam since 1617. He already made a *Coelestium planum* (celestial map) with an accurate picture of the starry sky in 1619, which map he published with a 'little booklet [...] for educational purposes'.<sup>25</sup> In 1626, Stampioen the elder also attended the *Collegium Mechanicum* of Isaac Beekman, the Rotterdam rector of the Latin School, which was set up for the exchange of scientific information 'for the benefit of carpenters, bricklayers, skippers and other freemen, and principally gentlemen and students'.<sup>26</sup> Nicolaes' father, Jan Jansz. Stampioen de Jonge, was a private tutor of mathematics, whose pupils included Stadtholder Willem II, and Christiaan Huygens. So, Nicolaes' interest in the mathematical sciences was no coincidence.

Nicolaes Stampioen provided the gearing ratios of Vroesen's *Sphaera*. For these calculations he used the *Nederduytsche Astronomia*, a Dutch book on astronomy written by the mathematician Rembrandtsz Dirck van Nierop, first published in 1653 (Fig. 4).<sup>27</sup> In her study on the *Leiden Sphaera* (which strictly speaking is not from Leiden but from Rotterdam!), Elly Dekker has discovered that many of the orbit periods used by the *Sphaera* are the same as those in Van Nierop's book. What is particularly noticeable is that the mistakenly incorrect (!) orbit period specified by Van Nierop for Ganymede, one of Jupiter's moons, is identical to those used by the makers of the *Sphaera*.<sup>28</sup>



Fig. 4 Title page of Dirck Rembrandtsz van Nierop, *Nederduytsche Astronomia* (Second edition, 1658). Photo KB (KB401 E1).

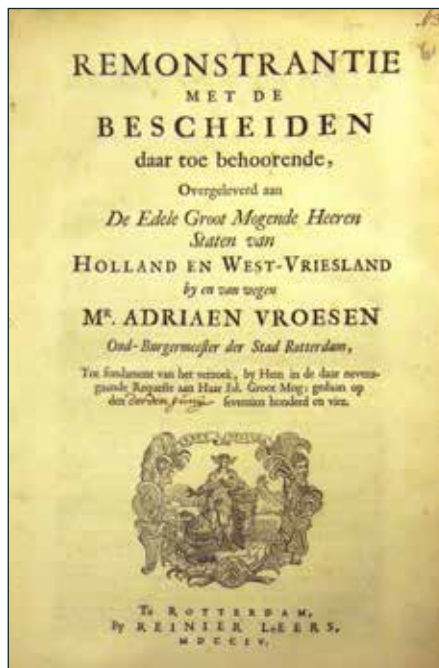


Fig. 5 Title page of Vroesen's official request for rehabilitation (1704). Photo Museum Rotterdam.

### Dating the *Sphaera Armilaris Automatica*

When exactly Tracy constructed the planetarium is unknown. Since most astronomical data used to design the *Sphaera*

correspond to those presented by Van Nierop, the mechanism can be dated *after* 1653. Further, the circumstance that in Tracy's specifications both Saturn's ring and Saturn's moon Titan are not mentioned, seems to indicate that the device was designed *before* Christiaan Huygens discovered these celestial phenomena in 1655.<sup>29</sup> Although these discoveries did not immediately become known worldwide, as would be the case now, Stampioen must have been aware of them via his network of contacts; after all, his deceased father had actually taught Huygens. Even so, the *Sphaera* must be more recent, given the fact that in 1655 Vroesen was only 14 years old.

A better time indication can be found in the archives of Rotterdam, which first mention the clockmaker Tracy in 1662.<sup>30</sup> Since Adriaen Vroesen took his seat in the

Rotterdam City Council in 1664, and Furly only started his meetings after his marriage in 1665, the instrument was probably made after the mid-1660s. On the other hand, the mechanism must almost certainly be made before 1672, the year known as the Dutch 'rampjaar' (disaster year), when the Dutch Republic was attacked by four countries and almost seized to exist. These events sparked a revolution in the country, resulting in the instalment of prince Willem III of Orange as Stadtholder. Many republicans were removed from government, and replaced by Orangists. The republican Vroesen was one of them. He lost his leading status as regent to the royalists.<sup>31</sup> To summarise, we can assume that the *Sphaera* was built around 1670.<sup>32</sup>

### The Fate of the Vroesens after 1672

After 1672, Vroesen left Rotterdam and sought refuge, first in Antwerp and later on a homestead in Schoonderloo, a village near Rotterdam. Little is known about Adriaens activities there, but the couple got three children.<sup>33</sup> Adriaen regularly acted as a guardian or caretaker for others<sup>34</sup>, changed his will<sup>35</sup>, complained about the 'karossgeld'<sup>36</sup>, acted together with Benjamin Furly

as an arbitrator in a dispute<sup>37</sup>, and possibly wrote a posthumously published critical theological treatise. Today this booklet can no longer be found, but once it was in Furlly's library.<sup>38</sup>

In 1702, after the death of Stadtholder-King Willem III, when the office of Stadtholder was again abolished in Holland, Vroesen saw new political opportunities. He requested the States of Holland and West Friesland, to re-appoint him to the city council of Rotterdam.<sup>39</sup> After the failure of that attempt, he submitted an official request for rehabilitation (Fig. 5).<sup>40</sup> In 1704 Vroesen was indeed awarded a pension by the city of Rotterdam.<sup>41</sup> At that time, Adriaen lived in The Hague, where he died in 1706. He was buried in his beloved Rotterdam.<sup>42</sup>

Adriaen Vroesen's philosophical milieu gets more depth when we also focus our attention to his son Jan Vroesen. In 1685, at the start of his law studies in Utrecht, Pierre Bayle, writes for him a letter of recommendation to the Utrecht professor Johannes Georgius Graevius. In this epistle, Bayle praises Vroesen's son as 'un jeune homme très brillant et très noble'.<sup>43</sup> The letter shows that Bayle taught the 13-year-old young man as 'précepteur' in philosophy. These lessons were undoubtedly paid for by his father Adriaen, meaning that also Adriaen had contact with Bayle. Apart from that Bayle's philosophical lessons were not in vain. Jan Vroesen Adriaenzoon would later emerge as one of the authors of the famous *Traité des trois Imposteurs*, which was published in The Hague in 1712 after *La Vie et l'Esprit de Mr. Benoît de Spinoza*, a biography of Baruch de Spinoza. This much-debated treatise, a copy of which was kept in Furlly's library, has been described as 'one of the most radical anti-religious clandestine works that circulated in the eighteenth century'.<sup>44</sup> It is yet another indication of the critical-intellectual environment in which the Vroesen family was submerged.<sup>45</sup>

Incidentally, son Jan Vroesen's radical religious scepticism also questioned the purpose and meaning envisioned by father Adriaen Vroesen for his *Sphaera*. Had the mechanism perhaps some theological - or even deistic - meaning? After all, it is known that especially in the 1660s a fierce theological debate was going on in the Dutch Republic about the reality of the Copernican system. At stake in these discussions was the authority of the Bible, in which could be read clearly that the earth stood still and the sun moved.<sup>46</sup> That planetariums could play a role in theological discussions has recently been argued in the case of the



Fig. 6 Portrait of Bastiaen Schepers (1650-1704) as 'bewindhebber' (director) of the Dutch East India Company VOC. Photo Museum Rotterdam.

*Sphaera Perfecta*, a planetarium made in 1735 by Amsterdam instrument maker Jan van den Dam<sup>47</sup>, who evidently was inspired by the - then *Leiden* - *Sphaera*. Unfortunately, there are no sources which could provide more information on this topic, but it is clear that Vroesen's *Sphaera* originated in an environment where, to cite Margaret Jacob and Jonathan Israel, the Radical Enlightenment matured at an early stage.<sup>48</sup>

### The Sphaera in the Hands of Bastiaen Schepers

No mention of Vroesen's planetarium can be found before 7 June 1710, when in a meeting of the trustees of Leiden University is stated that,

'Mr Noorthey, council of the City of Rotterdam, made known to the aforementioned that a certain astronomical instrument, namely a *sphaera movens* showing celestial movements, had been donated to the University'.<sup>49</sup>

This Daniel Noorthey was not so much acting as administrator of the City of Rotterdam, but he was the representative of Geertruy Timmers, his aunt and mother in law, at that time already a widow for quite some time of Bastiaen Schepers (1650-1704), former governor of the Dutch East India Company (VOC) for the Rotterdam chamber. It appeared that in 1710 Vroesen's *Sphaera* was in the possession of the Schepers family.<sup>50</sup> How they acquired the planetarium is not recorded. When many years later (in 1726) the trustees of Leiden University approached Vroesen's heirs with inquiries, asking if they could provide more background about the instrument, the Vro-

esens' heir noted that Jan Vroesen's 'father had been the main inventor of the *Sphaera movens*, [...], after whose death it ended up in the hands of Mr. Sebastiaen Schepers'.<sup>51</sup> This story must be untrue, because Bastiaen (Sebastiaen) Schepers died in 1704, two years before the death of Adriaen Vroesen. Moreover, Schepers' father - the old Admiral Willem Bastiaensz Schepers (1619-1704) - had been largely responsible for Vroesen's forced departure from the Rotterdam city council in 1672. Admiral Schepers even took over Vroesen's former position in this city council, later to be followed by his son and grandsons. So, the Orangist admiral Schepers was the *de facto* successor to the republican oriented Vroesen.<sup>52</sup>

Initially, the trustees of Leiden University confused Schepers the father with Schepers the son; in August 1710, at a subsequent meeting of the trustees, it was erroneously announced that the *Sphaera* was a donation 'from the children and heirs of Lieutenant-Admiral Willem Bastiaensz Schepers'.<sup>53</sup> This was, however, corrected later. The donation was actually made after the death of Bastiaen Schepers the son, who died shortly after his father, and who, on closer inspection, was completely different oriented compared to his seafaring father (Fig. 6). The Latin inscription placed in 1711 on the base of the planetarium clearly recognises the instrument's origins. Translated into English, it reads: 'This instrument, a very famous piece of jewellery, was acquired by Leiden Academy through the generosity of the very honourable widow and children of the highly esteemed Mr Sebastiaen Schepers'. In 1741, this provenance was confirmed by the university librarian Van Royen, who noted at the time that:

'Mrs Timmers, widow of Mr Sebastiaen Schepers, Councillor of the City of Rotterdam, has honoured the aforementioned [Leiden University Library] with a donation, with which it can shine above all the libraries of the world, namely the *Sphaera movens*, a mechanism to whom the honour of its invention and unmentionable costs are ascribed to Lord Mayor Adriaen Vroezen, where the glory of its conservation and generosity to allow it to be viewed by the public is thanks to Mr Schepers and his heirs'.<sup>54</sup>

It was Bastiaen Schepers, therefore, who at some point had acquired the planetarium, and probably also suggested that the instrument be donated to Leiden University after his death. After all, this was his *alma mater*, when he successively had studied philosophy and law in the years 1668-1673.<sup>55</sup> His friendship with the Leiden Professor of Law, Johann Friedrich Böckelmann (1632-

1681), also dated from that time. In 1679, the latter dedicated his innovative textbook *Compendium Institutionum Justiniani*, among others, to his 'very good friend' Bastiaen Schepers.<sup>56</sup>

Even though Bastiaen Schepers and Adriaen Vroesen came from families with opposing political tendencies, their intellectual interest was similar. Both men studied philosophy in Leiden, and both were acquainted with Pierre Bayle, because Bastiaen Schepers also belonged to Bayle's liberal circle.<sup>57</sup> Bastiaen was also a patron for one of Bayle's former students at the Illustre School in Rotterdam, the young philosopher and physician Bernard Mandeville (1670-1733), son of a Rotterdam doctor. Mandeville would be later acclaimed in England as the author of the social-critical book *Fable of the Bees* (1705/1714). To acknowledge the support given by Bastiaen Schepers, Mandeville dedicated his Leiden medical thesis to him in 1691.<sup>58</sup>

In 1692, Schepers befell the same fate as Adriaen Vroesen when he was deposed by the stadtholder as council member, city secretary and pensionary of Rotterdam; this because of Schepers' alleged involvement in riots that had plagued the city two years earlier. It was suspected, probably rightly, that he and several others (including Mandeville the elder and his son), had conspired against the bailiff of the city, Jacob van Zuylen van Nievelt.<sup>59</sup> The latter's corrupt policies met with considerable resistance, both among the common people and the more liberal regents.<sup>60</sup> In 1690, an intervention of the bailiff led to an assault on his home, after which Van Zuylen initially was removed from office. However, thanks to the protection of the Stadtholder-King Willem III, Van Zuylen recovered his position, and in the purge that followed liberalist free-thinking in Rotterdam was severely restricted. Not only Schepers and a number of supporters had to step down from their offices, Pierre Bayle lost his professorship at the Illustrious School of Rotterdam. Bayle even was no longer allowed to give private lessons, such as those previously given to Jean Vroesen. However, this measure allowed Bayle to concentrate on his monumental *Dictionnaire Historique et Critique*. In this almost encyclopedic work Bayle also discussed the Copernican system of the planets, but unfortunately, does not mention Vroesen's mechanical model, although Bayle must have known the instrument.<sup>61</sup> Anyhow, it was also in 1692 that Adriaen Vroesen disposed of his country estate in Schoonderloo, probably because he moved to The Hague.<sup>62</sup> It seems that Rotterdam and the surrounding area no longer

had anything to offer to liberal thinkers.

The events of 1692 had no lasting effects on Bastiaen Schepers. Thanks to the influence of Schepers' father, the admiral who brought stadtholder Willem III to his crown in England 1688, Bastiaen Schepers was rehabilitated to his post as councillor in 1698, to be followed in 1702 by his elevation to governor of the Dutch East India Company.<sup>63</sup>

### A Showpiece in Schepers' Library?

When and how Vroesen's *Sphaera* came into the hands of Bastiaen Schepers is unknown. However, since a pedestal was missing when the *Sphaera* was donated in 1710, it is likely that the *Sphaera* was a permanent fixture in Schepers' library in his house in Rotterdam Hoogstraat, where he lived from about 1688 to about 1700.<sup>64</sup> In 1696, this library and various 'other curiosities' of Schepers were praised as an important place to visit by Italian globe-maker Vincent Coronelli.<sup>65</sup> Unfortunately, he mentions no details, but it is most likely that the *Sphaera* was placed in a library or collection of curiosities. In the *Museum Museorum*, a guide on how to layout private and public collections, published in 1704, it is stated that a *Sphaera armillaris copernicana*, such as the one in Gotorp, would be a valuable addition to a 'Kunstkammer'.<sup>66</sup> A possible scenario is that when Schepers bought his house on Hoogstraat, Vroesen's *Sphaera* was already there; in fact, Adriaen Vroesen also lived in Hoogstraat in Rotterdam at the time of his marriage in 1662.<sup>67</sup> Vroesen probably disposed of this house in 1687, shortly before Schepers moved to Hoogstraat.<sup>68</sup> The privacy of a house can also explain why the *Sphaera* is not described anywhere before it arrived at Leiden University. The fact that the structure of the planetarium indicates that the timepiece originally had a 4-metre long pendulum provides evidence that the instrument originally was installed high in a building.<sup>69</sup>

Further, it is worth noting that Nicolaes Stampioen, the mathematician who carried out the calculations for the *Sphaera*, worked for Bastiaen Schepers and his family from 1701 to 1708. Stampioen took over the tasks of steward and secretary of the Schieland Hoogheemraadschap (water board) for the still very young son Willem Bastiaensz Schepers (1684-1750).<sup>70</sup> Perhaps this involvement with the Schepers family was the reason why in 1710 Stampioen was not involved in handing over the then rather delapidated *Sphaera* to Leiden University.

### The Sphaera at Leiden University

The Leiden trustees sent the instrument maker Jan van Musschenbroek with a registrar to Rotterdam in order to collect the *Sphaera* and to give Schepers' domestic staff three double gold ducats as a gesture for their support.<sup>71</sup> At the meeting held on 8 November 1710, the trustees recorded that the *Sphaera* had been provisionally placed in the university library because there was no room in the *Theatrum Astronomicum* (the name used at the time for the observatory on top of the Academy building at the Rapenburg). Mayor Coenraad Ruysch, administrator of the *Theatrum*, Jan van Musschenbroek, and 'others, experienced in astronomical studies', were asked to make a plan and budget for restoring the *Sphaera*.<sup>72</sup>

A month later, the university commissioned the clockmaker Bernard van der Cloesen († 1736) from The Hague to restore the planetarium. This clockmaker was selected because he had been used previously 'by Mr Huygens' for 'making astronomical instruments'.<sup>73</sup> An unnamed carpenter was also commissioned to produce a suitable pedestal, since, as already mentioned, the planetarium's original was missing. Van der Cloesen restored the instrument to its former glory in his workshop in The Hague. In 1712, the planetarium was transported to the library, after which it could be admired by the public. It was placed in a glass case, to which only Wolfert Senguerdius, the professor of philosophy, and Jan van Musschenbroek, the administrator of the scientific instruments, had the key.<sup>74</sup> Neat Latin adorning the foot of the pedestal still indicates what had happened:

'Although left badly damaged by the passage of time and the carelessness of the inexperienced, the skilled instrument maker Bernard van der Cloesen recently restored it, going beyond the original condition and actually introducing some improvements, so that the instrument now really seems to have reached the peak of perfection'.<sup>75</sup>

Gratitude is also expressed on the other side of the pedestal to two others who helped in the restoration of the planetarium. The first was Leiden mayor Coenraad Ruysch (1650-1731), who supervised the entire restoration and who also advanced the costs. He was famous as a 'benefactor of the liberal arts', and acted as scientific patron until his death in 1731. From 1726 to 1731, for example, Ruysch financed the publication of the meteorological observations of Coenraad Zumbach de Koesfelt, who was only too pleased to dedicate this publication to this 'promoter of all the arts and honourable sciences'.<sup>76</sup>



Fig. 7 The short description of the Sphaera published for the first time in 1714. Photo University Library Leiden.

Until now, it had never been noticed that, besides Ruysch, another person with 'experience in astronomical study' contributed to the restoration plans. This person's name is absent in the resolutions of the Leiden trustees, but is explicitly mentioned on the base of the *Sphaera*. It concerns 'the outstanding mathematician Johannes Ham, Council of Arnhem, very noble and very wise representative of the Mighty States-General of the United Netherlands'.<sup>77</sup> This Johannes Ham (1654-1725) was an alumnus of Leiden University, where he was registered from 1671 to 1680, first studying philosophy then later medicine. In later life, he was listed as a doctor, as well as a mayor in Arnhem. Ham was no ordinary student, and remarkably he is the same man who was the first in the world to discover the

spermatozoa in 1677.<sup>78</sup> In August of that year, Ham visited the renowned microscopist Antony van Leeuwenhoek in Delft, to whom he revealed his own microscopic discovery. Van Leeuwenhoek immediately made the discovery public by sending a letter to the Royal Society. This same Ham is thus immortalised on the base of the *Sphaera*, only this time honoured for his mathematical monitoring of the work of Van der Cloesen.

After all this work, the instrument was given a new name, proudly stated on the pedestal: *Sphaera Incomparabilis*. Leiden University also abundantly advertised the device by issuing a pamphlet about the *Sphaera Automatica* from 1714 onwards<sup>79</sup>, which for the convenience of the many

foreign visitors was published not only in Latin and Dutch (Fig. 7) but also in English and French. The text was later also included in some German and Danish books.<sup>80</sup> In addition, a new catalogue of the university library with an engraving and description of the new acquisition was issued in 1716.<sup>81</sup> Countless travel journals show that the 'Magnificent Copernican Machine' in the Leiden library was famed internationally, and remained so throughout the eighteenth century.<sup>82</sup> In 1717, for example, the German professor Johann Gottlieb Deichsel admired how the *Sphaera* had been set up in its new glass case to the right of the librarian's desk<sup>83</sup>, while in 1777 the Danish astronomer Thomas Bugge wrote of the planetarium, 'this is a very beautiful piece'.<sup>84</sup> It is not surprising that many exaggerated stories about this showpiece began to circulate at the time. Englishman John Ratcliff, for example, wrote in 1734 during his visit to the Leiden library that this 'noble instrument' had once been personally examined by the Russian Tsar Peter the Great; he had been so clumsy with it that it had stood idle for a long time afterwards, but fortunately it had now been repaired and kept in a glass case.<sup>85</sup> In 1770, Russian prince Alexandre Kurakin admiringly reported in his travel journal that he had heard that the construction of the *Sphaera* cost 70,000 guilders.<sup>86</sup> It is clear that Vroesen did not cut any corners at the time he made the *Sphaera*, but that amount of money would have been easily enough to buy three country estates at the time.

The planetarium was admired by library visitors throughout the eighteenth century. It was initially maintained by Jacobus van der Cloese[n] (1692-1767 - the son of Bernard), and later by Bernard's grandson Bernard van der Cloesen the younger (1726-1780). After his death, management of the device was transferred, first to Leiden clockmaker Louis Pasche (1782-1793), and then to the scientific instrument maker Felix Meylan (1793-after 1809).<sup>87</sup> In total, between 1710 and 1810, the maintenance of the *Sphaera* cost the university about eight thousand guilders, a very considerable sum at the time.<sup>88</sup>

In 1823, the *Sphaera* was moved from the university library to the attic of the new Leiden observatory (still on top of the Academy Building), where the later director of the observatory, Frederik Kaiser, discovered it on his appointment in 1826 in an 'extremely neglected' state.<sup>89</sup> Kaiser considered the *Sphaera* to be fairly useless for astronomy. His comment in a later annual report of Leiden Observatory leaves no room for misunderstanding: 'This piece

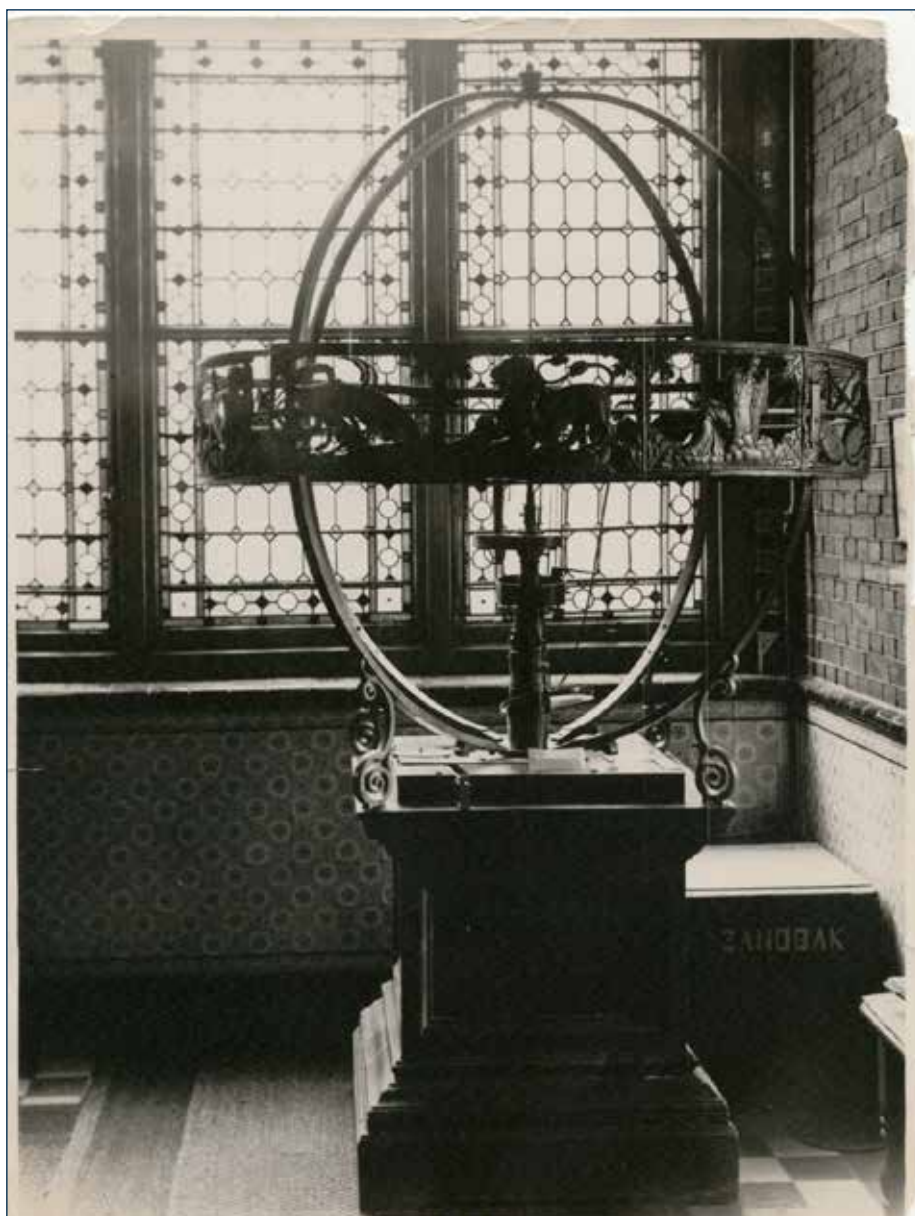


Fig. 8 *The Leyden Sphaera as exhibited in 1931 in the 'Nederlandsch Historisch Natuurwetenschappelijk Museum' at the Steenstraat in Leiden. Photo Museum Boerhaave.*

of equipment [the *Sphaera*] is especially remarkable for the fact that, without having any use, it has swallowed up over half a century all the funds that in Leiden could have been expended on astronomy'.<sup>90</sup> So, in the decades of Kaiser's directorship, the instrument remained hidden on the attic of the Academy Building. However, in 1868 Kaiser's attitude changed. Eight years before, he finally had succeeded to obtain a new observatory building, built on a bulwark in the *Hortus Botanicus*. This achievement had made him curious to the history of his institute. Kaiser started to search the university archives to be able to write a complete history of Leiden Observatory since 1632. In this way, he also became interested in the old astronomical instruments.<sup>91</sup> So,

in April 1868 he returned to the Academy Building to inspect what he had left there. Kaiser had kept the *Sphaera* and the other abandoned instruments in the old observatory because – as he explained – he 'did not have the proper means for transport and could not make the instrument presentable'.<sup>92</sup> In a small handwritten note Kaiser reported what he had seen on the attic:

'I found the room full of papers, lying on piles on the ground. [...] I found the planetarium moved to another corner and far more mutilated than before. The small globe of the Earth and many other pieces were missing. From a nearby telescope, as well as from the planetarium, all screws that could be turned out

by hand had been removed.'<sup>93</sup>

Kaiser now quickly decided to bring the old apparatus to the new observatory building, and have them restored and cleaned, but this time for solely historical reasons. It is a textbook example of what Michael Thompson has described in his *Rubbish Theory: The Creation and Destruction of Value* (1979).<sup>94</sup> In this book Thompson argues that obsolete objects can regain a value only when they first are dumped from their original function, regarded as being superseded and worthless. This is exactly what has happened with the *Leiden Sphaera* after it had fallen into disgrace. So, to quote Kaiser again:

'On 7 and 8 April 1868 the carpenter has transported these heavy pieces to the new observatory. [...] The planetarium's pedestal must be touched with paint, for which the English painter has been summoned. The copper parts must be polished, [an activity] with which Valk and De Lange can be entertained for a long time.'<sup>95</sup>

After its refurbishment, the *Sphaera* was installed in the entrance hall of the new Leiden Observatory. However, the instrument was neglected there once more. According to a commentator from 1928, it had become 'a sad symbol of a lack of reverence for ancestry'.<sup>96</sup> But as, after all, the instrument had 'the greatest artistic value' of all the Dutch planetariums, it was fortunate that there was again 'talk of restoration'.<sup>97</sup> Shortly thereafter, in 1930, the rare device was given on loan to the Netherlands Museum for the History of Science and Medicine (later Museum Boerhaave), which opened its doors in 1931 (Fig. 8).<sup>98</sup> From that time on, the *Sphaera* once again became a showpiece, albeit it now with a historical significance, rather than an astronomical one.

### Old Traces of Restoration

Before the current restoration could start, the *Sphaera* had to be completely dismantled. The parts that were exposed revealed the usage, repairs and renovations undergone by the device. Some elements, however, could not be dated, and there were issues with the modifications carried out in the period before the planetarium moved to the museum. The archives of Leiden University show that some necessary changes were made to the *Sphaera* immediately after it was moved in 1710. Van der Cloesen Senior, for example, was commissioned to 'put the instrument on a pedestal, as was originally envisaged and made'.<sup>99</sup> He budgeted 350 guilders for the work, but this turned out to be insufficient because the planetarium had 'become dislodged and in



Fig. 9 Old and new dials: Tracy versus Van der Cloesen. Photos Museum Boerhaave.

disorder'. In the summer of 1712, Ruysch reported that he had spent no less than 1,232 guilders on the instrument; 624 guilders were for Van der Cloesen (who would eventually receive 700), 576 guilders for the carpenter (for making the base and a glass cabinet), and finally a modest 32 guilders for the painter.<sup>100</sup>

After the recent dismantling of the instrument, it was clear that the dial and engraving were originally of a different design (Fig. 9). Van der Cloesen had made a new dial to cover Tracy's original. Initially, the movement was that of a 'night clock', where the hours run between the quarters and minutes. Tracy's dial is depicted on the engraving from 1711. Van der Cloesen also modified the movement of the planetarium by fitting a much shorter 25-cm pendulum.<sup>101</sup> This meant that he had to change the ratios of the gearing, otherwise a year would pass in just three months. With Van der Cloesen's modifications, the clockwork could run continuously for 8 days after winding. Hereafter Van der Cloesen made a new engraving in the middle of the new dial. Eventually he prepared drawings of the entire system of gearing in 1727. These diagrams were reviewed and

approved by Willem Jacob 's Gravesande, the astronomy professor.<sup>102</sup> The fact that the trustees ordered some copies of these drawings, made by mathematics lecturer Willem La Bordus, indicates how proud they were of the instrument. Throughout the following century, no expense or effort was spared on maintenance. Keeping the movement going was particularly difficult, since the clockwork was not up to the task

Fig. 10 In 1711 the digits for the 17<sup>th</sup> century are flattened on the back of the plates to provide new digits for the 18<sup>th</sup> century. Photos Museum Boerhaave.

of moving the planets, so it required lots of modifications and replacement parts. The gearing showed significant signs of wear, bearing witness to the device's long period of functioning. In Tracy's day, watchmakers made cog wheels by hand. Later, machines were invented which could both distribute the teeth and mill them, and the difference with the handmade gearings can be clearly seen. It bears witness to the various makers who have worked on the device and have repaired its movement. The hand mechanism, for instance, seems to have been made by a different watchmaker than the running mechanism. The latter also contains nineteenth-century parts, such as the escapement.<sup>103</sup> The drive and attachment of Jupiter were also adapted, with addition-





al reinforcement such as an extra bracket. The oval orbit of Saturn also suffered damage over the years, as is evident by a significant amount of soldering. Further, the university print from 1711 depicts Saturn with a ring, and the accompanying text reads:

‘The five moons of Saturn also do not move here and are connected to the same ring; which is also fixed here; this could not be otherwise because of the smallness of the space, nor is it necessary’.<sup>104</sup>

Giovanni Domenico Cassini discovered Saturn’s fifth moon, Thetys, in 1684, so the five moons in the ring were certainly not made by Tracy. Photographs from the 1970s show a rough ring with five spheres, probably an addition from the restoration after World War II. Finally, the annual dial shows a nice way of being economic. At the rear, the dates have been changed; the sixes of the years 1600-1690 have been beaten flat and were then changed into sevens (Fig. 10). This made the movement suitable for the eighteenth century!

In the 1920s, just before the *Sphaera* was transferred to the museum, an employee at Leiden Observatory also carried out some repairs. This is indicated by an inscription below the central axis, which reads ‘made in May 1927 J.H. Karsten’. On 11 December 1944, during World War II, a bomb from the Royal Air Force hit the museum. Arie de Valk, the former head of restoration at the Museum Boerhaave, saw the heavily damaged *Sphaera* through a hole in the bombed-out wall as a child: the planetarium’s big rings were bent, and the zodiac had become dislocated. When De Valk joined the museum in 1952, the *Sphaera* was already repaired by a certain ‘Algra’, an apprentice instrument maker at the Kamerling Onnes physics laboratory. This was revealed by the recent investigation of the zodiac; the figures are now mounted on a modern welded frame, and are no longer in their original mount. Obviously, this Algra did not have access to the right information, since photos of the planetarium before the war show that the constellations were placed in the correct orientation, whereas in the new frame they are mounted in the opposite direction.

### The Recent Restoration

During the years that the *Sphaera* stood in the Museum Boerhaave, it has undergone several maintenance interventions, such as waxing and protecting bare metal parts from rust. In addition, the wooden pedestal was restored by Atelier Mösenbacher some years ago, which resulted in the texts on the

panels becoming readable again. In 2013, it was time for a more thorough approach, during which the Museum Boerhaave was, as always, very careful. This work amounted to cleaning, removing rust, and making engravings and materials visible again. A natural shellac was used to protect metal parts from corrosion, and the restoration department replaced some missing parts. For example, the ring with moons around Venus was redesigned, and the missing part of the Gemini constellation was fabricated. However, the wrong direction of the signs of the zodiac was not corrected. More important than what it says about the history of the *Sphaera*, this was because it would have been necessary to make a whole new mount for the fragile constellations. Some old welds were also reinforced because of their vulnerability.<sup>105</sup> The result is a magnificent planetarium where all the engravings are once more clearly legible.

### Epilogue

Recent historical research has revealed that the *Sphaera* originated in a fascinating Rotterdam intellectual environment where the Radical Enlightenment matured at an early stage. It is a miracle that the instrument still exists today, following so many years in Rotterdam, at Leiden University and at the Museum, especially considering the bombardment in the Second World War. The restoration in 2013 revealed that the *Sphaera* can be read like a book. The wear and tear marks and changes made to the planetary system and the dials provide a wonderful overview of how the planetarium was used, right from its beginnings to the present day. What stands out is the incredible craftsmanship of the various instrument makers, as evidenced by the cast central tubes and the handmade gearing. It is also clear that several skilled craftsmen worked on the device, not only famous clockmakers, like Tracy and the three Van der Cloesens, but also unknown makers of brass parts, copersmiths and painters.

### Acknowledgements

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### Notes and References

1. A detailed description of the planetarium can be found in: Elly Dekker, *The Leiden Sphere. An exceptional seventeenth-century planetarium* (Leiden, 1986). Translation by R.D. Smith of E. Dekker, *De Leidsche Sphaera. Een uitzonderlijk planetarium uit de zeventiende eeuw*, (Leiden, 1985). The name *Leiden Sphaera* is strictly regarded incorrect. This designation is introduced by J.H. van Swinden in his book *Beschryving van een konst-stuk, verbeeldende een volledig bewegelyk hemels-gestel, uitgedagt en vervaardigd door Eise Eisinga* (Franeker, 1780) p. 47.
2. For more details, see: Rienk Vermij, *The Calvinist Copernicans* (Amsterdam, 2002).
3. Elly Dekker, ‘Sterrenkunde in de zeventiende eeuw’, *De zeventiende eeuw*, 2 (1985), pp. 84-98.
4. Henry C. King & John R. Millburn, *Geared to the Stars. The Evolution of Planetariums, Orreries, and Astronomical Clocks* (Toronto/Bristol, 1978), chapters 6 & 13.
5. Djoeke van Netten, ‘Astronomia Instaurata? The Third Edition of Copernicus’ *De Revolutionibus* (Amsterdam, 1617)’, *Journal for the History of Astronomy*, 43 (2012), pp. 75-91.
6. King & Millburn, *Geared to the Stars*, note 4), pp. 102-103. In the eighteenth century, this globe would be surpassed by an even larger revolving globe in Gottorp, into which spectators could even enter. It is now on display in the Kunstkammer in St. Petersburg.
7. H.C.H. Moquette, ‘lemma Adriaan Vroesen’, in: P.C. Molhuysen, ed., *Nieuw Nederlandsch Biografisch Woordenboek* (Leiden, 1911-1934; hereafter indicated as *NNBW*), 3, col. 1364-1365. E.A. Engelbrecht, *De vroedschap van Rotterdam, 1572-1795* (Rotterdam, 1973), no. 177.
8. W.N. du Rieu, *Album Studiosorum Academiae Lugduno-Batavae 1575-1875* (Haga Com., 1875), p. 452 (5 October 1656).
9. For more on Furly, see: Sarah Hutton, *Benjamin Furly 1646-1714: a Quaker merchant and his milieu* (Florence, 2007); JA van Reijn, ‘Benjamin Furly. Engels koopman (en meer!) te Rotterdam, 1636-1714, *Rotterdamsch jaarboekje*, 9 (1985), pp. 219-246; William Isaac Hull, *Benjamin Furly and Quakerism in Rotterdam* (Madison, 1941) and Julius Friedrich Sachse, *Benjamin Furly, an English merchant at Rotterdam, who promoted the first German emigration to America* (Philadelphia, 1895).
10. Manuscript groups at the Pennsylvania State Archives no. 5: Deeds and Patents Collection A. Penn Deeds, 1681-1790, page. 4: 7 March 1682: ‘500 acres of Land to Adriaen

Vroesen Rotterdam’.

11. Hull, *Furly*, note 9, p. 173.

12. Rotterdam City Archives, inventory number 3857 (DLFS Delfshaven), Deed 35/202, dated March 21 1686.

13. To which of Franciscus Mercurius van Helmont’s books this refers is not known. In 1690, he published *Eenige gedagten rakende de Natuurkunde* (Amsterdam: Hendrick Jansen, 1690); As Van Helmont died in 1699, he has published this book himself.

14. *Bibliotheca Furliana* (Rotterdam, 1714): ‘Curiositas’, numbers 13-17.

15. See also the notarial Deed dated 14 January 1688, where Francis Mercury van Helmont writes about a dinner at Benjamin Furly’s home in the presence of Adriaen Vroesen and his wife and two daughters, together with Furly’s close friend Arent Sonnemans and his two daughters. Text published in full in Hutton, *Furly*, note 9, p. 27.

16. Liesbeth C. de Wreede, *Willebrord Snellius (1580-1626): a humanist reshaping the mathematical sciences* (Ph.D. dissertation Utrecht 2007). See also Vermij, *Calvinist Copernicans*, note. 2, pp. 43-45.

17. King & Millburn, *Geared to the Stars*, note 4, p. 213.

18. C. de Waard, ‘lemma Steven Traci’, in: *NNBW*, 1 (1911), column 1498. Tracy’s eponymous son Steven Tracy the Younger (born 1675) was also a watchmaker. He moved to England in 1695, where he appointed his father as sole heir to his will. ONA Rotterdam, inventory number 1065 (nots. van der Hoven), deed 63/254, dated 9 October 1695.

19. For example, there is a carpenter’s square by Tracy in the Museum Boerhaave collection (inventory number V09051. Recently, a solar ring made by Tracy surfaced (now in a private collection). A clock dating from around 1680, signed by Steven Tracy was auctioned at Sotheby’s in Amsterdam on 20 May 2003.

20. H.K. de Haas, ‘Over hetgeen in de oorlogsdagen van 10 mei 1940 van het Bataafsche Genootschap der Proefondervindelijke Wijsbegeerte door oorlogsgeweld is vernietigd’, *Nieuwe verhandelingen van het Bataafsche Genootschap der Proefondervindelijke Wijsbegeerte te Rotterdam. Tweede reeks*, 12 (Rotterdam, 1946) pp. 3-19, especially pp. 6-7.

21. *Bibliotheca Furliana*, note 14: Curiositas, no. 13: ‘A very beautiful wall clock in an ebony wooden case, with eight-day movement, chiming every half hour, composed of two dials, with quarters; indicating the day of the month, the age of the moon, high water at various places, with copper weights, made by

S. Tracy’.

22. G. van Spaan, *Gedenkwaardige geschiedenissen volgens den rang der jaren, van het begin des werelds tot het einde van’t jaar zeventien-honderd* (Rotterdam, 1701).

23. J. MacLean, ‘Stampioen’, *De Nederlandsche Leeuw*, 74 (1957), pp. 323-328. Nicolaes Stampioen also produced maps (for example, see National Archives inventory numbers 2027 and 2385), and also advised on water-related issues in 1699 (See Rivierenland Regional Archive, Laagdijskheemraden archive Culemborg, Section 1.1.4.4).

24. The members of the longitude-committee of the States-General were Christiaan Huygens, the Leiden professor Burchard de Volder and the mathematicians Abraham de Graaff and Liewe Willems Graef.

25. C. de Waard, ‘lemma Jan Jansz. Stampioen’, in: *NNBW*, 2 (1912) col. 1356-1358.

26. C. de Waard, *Journal tenu par Isaac Beeckman de 1604 à 1634. Volume 2: 1619-1627* (La Haye, 1942), p. 455.

27. Klaas Hoogendoorn, ‘Bibliography of the works of Dirck Rembrantsz van Nierop’, in: Marlise Rijks, ed., *The Correspondence of Dirck Rembrantsz van Nierop (1610-1682)* (The Hague, 2012), pp. 343-385.

28. Dekker, *The Leiden Sphera*, note 1, pp. 11, 36.

29. Steven Tracy’s undated specifications for building a ‘*Sphaera Movens*’ have been preserved in the archives of Leiden University. See P.C. Molhuysen, *Bronnen tot de geschiedenis der Leidsche Universiteit*, 4 (The Hague, 1913) pp. 126\*-127\* (No. 974).

30. Dekker, *The Leiden Sphera*, note 1, p. 9, citing ONA Rotterdam 815/2.

31. H.C.H. Moquette, ‘Gehate Rotterdamsche regenten in 1672’, *Rotterdamsch Jaarboekje* (1919) pp. 65-77.

32. Elly Dekker sets the date as ‘before 1680’. Dekker, *The Leiden Sphera*, note 1, p. 12.

33. ONA Rotterdam, inventory 1247, no. 923 (nots. Daniël de Olyslager), deed 11/68, dated 7 April 1706.

34. Namely Jean (1672), Adriaen (1675) and Susanna Henriette (1683). The couple’s previous children were Agate (1666) and Adriaennus (1668). DTB Delfshaven & Rotterdam.

35. See, for example ONA Rotterdam, inventory number 923 (nots. Basteels), Deed 18/71, dated 7 February 1677 [together with Arent Sonnemans]; *idem*, 3858 (nots. Post) Deed 2/22, dated 3 January 1688; National Archives, Hof van Holland Archive, inventory

number 3461, Deed 61 (willing decree), dated 21 December 1691.

36. ONA Rotterdam, inventory number 923 (nots. Philips Basteels), Deed 418/1530, dated 21 Aug 1679. For an earlier testament, see: ONA Rotterdam 919 (nots. Philips Basteels), Deed 183/507, dated 22 October 1665.

37. DLFS Delfshaven, inventory number 3857, Deed 89/402, dated 17 November 1686. ‘Karossengeld’ was a tax on the use of carriages.

38. *Bibliotheca Furliana* (Rotterdam 1714), p. 357 (no. 44): *Ernstig onderzoek wegens de mogelykheid of onmogelykheid der Goddelyke openbaringen. Opgesteld door een schrander Heer A.V.* (Rotterdam, 1708).

39. A. Vroesen, *Memorie en vertoog aan de edele groot achtbare heeren burgermeesteren en regeerders, mitsgaders raden en vroedschappen der stad Rotterdam overgeleverd, by en van wegen mrs. Gerard Gael en Adriaen Vroesen, oud-burgermeesteren derzelver stede; dienende tot reïteratie, en nadere adstructie van het verzoek, by hare missive van dato den 14. augusti 1702. aan haar ed. groot achtb. gedaan* (UBA, sign. OTM: OG 77-74).

40. Vroesen, *Remonstrantie met de bescheiden daar toe behoorende, overgeleverd aan de [...] heeren Staten van Holland en West-Vriesland* (Rotterdam: R. Leers, 1704). (KB sign. KW 401 E 1 1660-1710 [61]).

41. See Rotterdam City Archive, manuscript collection, inventory number 1840: Remonstrance of Adriaen Vroesen, 1704.

42. DTB Rotterdam, 24 september 1706. Adriaen’s wife Susanna also died in The Hague, and was buried in Rotterdam on 11 February 1707.

43. Pierre Bayle to Jean-George Graevius, 8 June 1685 (Correspondence of Pierre Bayle, No. 428). Another letter states: ‘Il a beaucoup d’erudition pour son age; il aime les belles lettres, et il a fait de grands progres dans la philosophie et dans la jurisprudence’. Pierre Bayle to Gilles Ménage, 10 December 1687 (Correspondence of Pierre Bayle, no. 706). The deliverers of Bayle’s correspondence accidentally identified Jan Vroesen (1672-1725) with his older brother Adriaen, who died soon after birth. A second son called Adriaen was born in 1675, but also died young. After having spent some time in Paris in 1687, Jan Vroesen eventually graduated in Utrecht in 1693 with a thesis titled: ‘De Pactis inter emptorem et venditorem compositis’. Between 1701-1703 he apparently worked as a diplomat. O. Schutte provides biographical information about Jan Vroesen in *Repertorium der Nederlandse vertegenwoordigers residerende in het buitenland 1584-1810* (’s Gravenhage, 1976)

p. 27.

44. Sylvia Berti, Françoise Charles-Daubert and Richard H. Popkin, *Heterodoxy, Spinozism, and free thought in early-eighteenth-century Europe*, *International Archives of the History of Ideas*, **148** (1996) p. viii; *idem*, ‘Jan Vroesen, autore del “Traite des trois imposteurs”’, *Rivista storica italiana*, **10:2** (1991), pp. 528-543; *idem*, ‘Scepticism and the “Traité des trois imposteurs”’, in: R.H. Popkin & A.J. Vanderjagt, *Scepticism and Irreligion in the Seventeenth and Eighteenth Centuries* (Leiden 1993) pp. 216-229. Also, see: Georges Minois, *The Atheist’s Bible: The Most Dangerous Book That Never Existed* (Chicago, 2012).

45. This is further backed up by the fact that in 1710 the Dutch editor of the French translation (by Justus van Effen) of *Sensus Communis. An Essay on the Freedom of Wit and Humour in a Letter to a Friend* (1709), a book written by the English moral philosopher Anthony Ashley Cooper, 3<sup>rd</sup> Earl of Shaftesbury, is dedicated to Jean Vroesen. Shaftesbury stayed in Rotterdam in 1698-1699 and 1703-1704. Jean Vroesen may even have been the ‘friend’ to whom the ‘letter’ was originally addressed.

46. Vermij, *The Calvinist Copernicans*, note 2.

47. Huib J. Zuidervaart & Charlotte C.S. Rulkens, ‘De Amsterdamse mathematicus Jan van den Dam (1706-1770) en zijn vernuftige planetaria’, *Jaarboek van het Genootschap Amstelodamum*, **106** (2014) pp. 120-163.

48. See Margaret C. Jacob, *The Radical Enlightenment: Pantheists, Freemasons and Republicans* (London and Boston, 1981, 2003<sup>2</sup>); Jonathan I. Israel, *Radical Enlightenment. Philosophy and the Making of Modernity 1650-1750* (Oxford, 2001).

49. Molhuysen, *Bronnen* **4**, note 29, p. 248.

50. Daniel Noorthey (1670-1721) was the son of Jacob Noorthey and Maria Schepers. His mother was an older sister of Bastiaen Schepers, who was therefore Daniel’s uncle. In 1691, Daniel dedicated his Leiden *Disputatio de Testamentis* to Bastiaen Schepers, among others. After Schepers’ death, Daniel Noorthey married Bastiaen’s daughter in 1705, who was his first cousin Maria Jacoba Schepers (1682-1744). Her mother was Geertruy Timmers.

51. Molhuysen, *Bronnen* **4**, note 29, p. 30: Remark of Jan van Couwenhoven, heir of the late Jan Vroesen Adriaenszoon.

52. Engelbrecht, *Vroedschap Rotterdam*, note 7, nos. 184 and 229. See also the report of the events, attributed to Adriaen’s brother Wilibrort Vroesen, *Waaragtig verhaal van de*

*muiterij binnen de stad Rotterdam, die tegens de regeering ontstaan is, mitsgaders van het geen [...] voorgevallen is, zedert de maand juni 1672. By iemand die van gemelde muiterij kennis gehad heeft* (n.p. 1785).

53. Molhuysen, *Bronnen* **4**, note 29) p. 248.

54. *Ibid.*, **5**, p. 121.

55. Du Rieu, *Album Studiosorum*, note 8) pp. 549, 569: enrolment 13 Sep 1668 (philosophy) and 13 June 1671 (law). Bastiaen Schepers completed his doctorate in Leiden on 24 November in 1673 with a legal thesis, titled: *De consuetudine* (Lugd. Bat.: Elsevier, 1673).

56. J.F. Böckelmann, *Compendium Institutionum Justiniani sive elementa juris civilis in brevem et facilem ordinem redacta*. (Lugd. Bat., 1679; numerous reprints). The other Leiden student to whom the book was dedicated was the young Count Arnold Maurits Willem van Bentheim-Tecklenburg (1663-1701) from Steinfurt, Böckelmann’s birthplace, who came to study at Leiden University in 1676.

57. E. Labrousse et al, ed., *Correspondance de Pierre Bayle*, 9 (Oxford, 2012), pp. 222-226. See also the on-line edition at <http://emlo-portal.bodleian.ox.ac.uk/collections/?catalogue=pierre-bayle>

58. André Hanou, ‘Mandeville en zijn Fabel van de bijen’, *Mededelingen van de Stichting Jacob Campo Weyerman*, **31** (2008), pp. 89-106, esp. p. 91.

59. G. Mees Azn, *Het Rotterdamse oproer van 1690* (Amsterdam, 1869). R. Dekker, “‘Schijnheilig atheïst’”. Bernard Mandeville als pamfletist tijdens het Costermanoproer in Rotterdam in 1690’, *Holland. regionaal-historisch tijdschrift*, **26:1** (1994), pp. 1-17.

60. For Bastiaen Schepers involvement in the 1690 riots, see: RM Dekker, ‘Het Costermanoproer in 1690, complot of spontane beweging?’, *Rotterdams Jaarboekje* (1981), pp. 192-207.

61. See H.H.M. van Lieshout, *Van boek tot bibliotheek. De wordingsgeschiedenis van de Dictionaire Historique et Critique van Pierre Bayle (1689-1706)* (Ph.D. diss. Nijmegen, Grave 1992). For Bayle’s remarks about Copernicus, see his *Oeuvres diverses*, 4 (La Haye, 1731), pp. 398-403.

62. F.J. Kleyn, *Beschrijving en geschiedenis van Delfshaven, benevens die van Schoonderloo en het slot Spange* (Delfshaven, 1873).

63. For the Rotterdam publisher Barent Bos, this appointment was probably reason to dedicate the Dutch translation by Pieter Rabus of the book *Kerkelyke History* (Rotterdam, 1702) by Sulpicius Severus to Bastiaen Schepers. In

gratitude for such orders, it was normal to receive financial compensation.

64. From 1701 until his death in 1704, Bastiaen Schepers lived in a house in Haringvliet designed by Adriaen van der Werff. See L.J.C.J. Van Ravesteyn, *Rotterdam tot het einde van de achttiende eeuw. De ontwikkeling der stad* (Rotterdam, 1933), p. 199. Also, see: *Oprechte Haerlemsche Courant*, 17 maart 1701.

65. Vincenzo Coronelli, *Viaggio d’Italia in Inghilterra*, **2** (Venetia 1697), p. 59: ‘La Biblioteca, ed altre rarità di M. Schepers, [...] sono assai curiose’. Vincenzo Coronelli (1650-1718) enjoys a high reputation for his world-famous globes.

66. Michael Bernhard Valentini, *Museum Museorum* (Frankfurt am Main, 1704), p. 15.

67. DTB Rotterdam, Marriage 26 December 1662.

68. Engelbrecht, *Vroedschap van Rotterdam*, note 7, No. 229 only Schepers’ residence in Haringvliet where he lived after 1700. His residence in Hoogstraat is indicated in the Rotterdam DTB registers. According to Engelbrecht, Vroesen’s house on Hoogstraat was on the north side (sold 18 Feb. 1687).

69. Dekker, *The Leiden Sphera*, note 1, p. 33.

70. Stampioen also performed these duties earlier for Hendrik Caspar Selkart when he was still a minor (from 1693 to 1701). See: E. van Wiersum, ‘Ergerlijk-komisch nepotisme’, *Rotterdams Jaarboekje* (1946), pp. 43-48, esp. p. 45.

71. Molhuysen, *Bronnen* **4**, note 29, p. 248.

72. *Ibid.*

73. *Ibid.*, p. 249.

74. Molhuysen, *Bronnen* **4**, note 29, p. 131: ‘Instruction for Mr Senguerdius’.

75. Dekker, *The Leiden Sphera*, note 1, p. 20.

76. See Zumbachs commission to Ruysch in his *Ephemerides et observationes. Meteorologicae of Beschreivinge van Weer en Wind* (Leiden, 1730). See HJ Zuidervaart, *Van Konstgenoten’ en Hemelse Fenomenen Nederlandse Sterrenkunde in de Achttiende Eeuw* (Rotterdam, 1999), pp. 367, 528.

77. Dekker, *The Leiden Sphera*, note 1, p. 21

78. J.W.J. Lammers ‘Johan Ham, de ontdekker van de zaaddiertjes’, *Nederlands Tijdschrift voor Geneeskunde*, **118:21** (1974), pp. 784-788. Also, see: Schutte, *op. cit.*, note 43, p. 207.

79. The first edition in 1714 had a print run of 600 copies. See PG Hoftijzer, *Pieter van der Aa Leids drukker en boekverkoper* (Hil-

versum, 1999), p. 57

80. See the 'Korte Beschryving van de Armillare Sphera van Copernicus' (Short Description of the Armillare Sphera of Copernicus): <http://adcs.home.xs4all.nl/blaeu/leidse/leidse-1711.html> (consulted September 2016): A German description appeared among others in C. Lindner, *Gründliche Anleitung zum nützlichen Gebrauche der Erd- u. Himmels-Kugeln* (Nuremberg, 1726) 28-32, and in the German translation of B. Fontenelle, *Gesprache von mehr als einer Welt* (Leipzig, 1738).

81. *Catalogus librorum tam impressorum quam manuscriptorum bibliothecae publicae Universitatis Lugduno-Batavae* (Leiden: P. van der Aa, 1716), pp. 499-500. Discussed in the *Acta Eruditorum* (1716), pp. 540-545, esp. p. 544.

82. J.P. Willebrandt, *Historische Berichte und practische Anmerkungen auf Reisen in Deutschland, in die Niederlande, in Frankreich, England, Dännemark, Böhmen und Ungarn* (Frankfurt, 1761), p. 92.

83. J.G. Deichsel, 'Reise durch Deutschland nach Holland und England in den Jahren 1717-1719, 2e Abschnitt'. in: Johann Bernouilli, *Archiv zur neuern Geschichte, Geographie, Natur und Menschenkenntniss, 7* (1787), p. 186.

84. K. Møller Pedersen & P. de Clercq, *An Observer of Observatories. The Journal of Thomas Bugge's Tour of Germany, Holland and England in 1777* (Aarhus, 2010), p. 49.

85. A. Kurakin, 'Souvenirs d'un voyage en Hollande et en Angleterre à sa sortie de l'Université de Leyde durant les années 1770-1772', in: *Archiv knjazja F.A.Kurakina kn.* (Saratov, 1894), pp. 331-425, esp. p. 343.

86. 'In one part of it [Library] stands a noble instrument of the Orrery kind, whereby all the motions of the planets may be seen perform'd within a large Armillary Sphere. Peter Czar of Muscovy examined it with so much wayward curiosity as to render it quite useless: it has since been repaired by [empty space] & lock'd up in a Glass case'. Unpublished travel journal, Cambridge UL, MSS ADD 4216, f.58. Thanks, are due to Ruben Verwaal who found this document in Cambridge.

87. M. Rooseboom, *Bijdrage tot de geschiedenis der instrumentmakerskunst in de Noordelijke Nederlanden* (Leiden, 1950), pp. 12, 101, 112.

88. *Ibid.*

89. F. Kaiser, 'Geschichte der Astronomie und der Sternwarte an der Universität in Leiden', *Annalen der Sternwarte in Leiden*, 1 (1865), pp. ix-x, liv. For Kaiser, see H.J. Zuidervart

et al, *Frederik Kaiser (1808-1872): schep- per van de 'nieuwe' Leidse Sterrewacht* (The Hague, 2012) [Special issue of *Studium*, 4:1 (2012).].

90. F. Kaiser, *Verslag van den staat der Sterrewacht te leiden en van de aldaar volbragte werkzaamheden in het tijdvak van den eersten julij 1867 tot de laatste dagen der maand junij 1868* (Leiden, 1868), p. 16.

91. *Ibid.*, pp. 6-9.

92. *Ibid.*

93. English translation from a handwritten note from Kaiser's personal archive, dated 1868, now preserved in the Leiden University Library.

94. Michael Thompson, *Rubbish Theory. The Creation and Destruction of Value* (Oxford, 1979).

95. Kaiser's personal note dated 1868 (see note. 92).

96. W.E. van Wijk, 'Lijst van in Nederland vervaardigde planetaria', in: E. Havinga et al, (eds.), *Planetariumboek Eise Eisinga* (Arnhem, 1929), pp. 351-381, esp. pp. 354-355.

97. *Ibid.*

98. C.A. Crommelin, 'Het Nederlandsch Historisch Natuurwetenschappelijk Museum', *Oudheidkundig Jaarboek*, 10:1 (June, 1930), pp. 10-25, esp. p. 17.

99. Molhuysen, *Bronnen* 4, note 29, p. 254.

100. *Ibid.*, p. 260.

101. Dekker, *The Leiden Sphera*, note 1, p. 33.

102. Molhuysen, *Bronnen* 4, note 29, pp. 30, 34.

103. Dekker, *The Leiden Sphera*, note 1, pp. 32-33.

104. 'Korte Beschryving', note 80.

105. More details can be found in Museum Boerhaave's restoration report.

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