

# Cartesian Cosmological Illustrations: a digital approach

Mihnea Dobre, Ovidiu Babeş, Ioana Bujor

(ICUB, University of Bucharest)

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## Cartesian Visual Cosmology: An Online Exhibition

### Introduction

This text presents the virtual platform developed and established in 2020 by our team. We designed an online virtual exhibition of Descartes's cosmological illustrations on an Omeka S installment (<https://cartesian.unibuc.ro/s/cosmologicalillustrations>; see Fig. 1). The current paper aims to explain some of the potential benefits of its use.

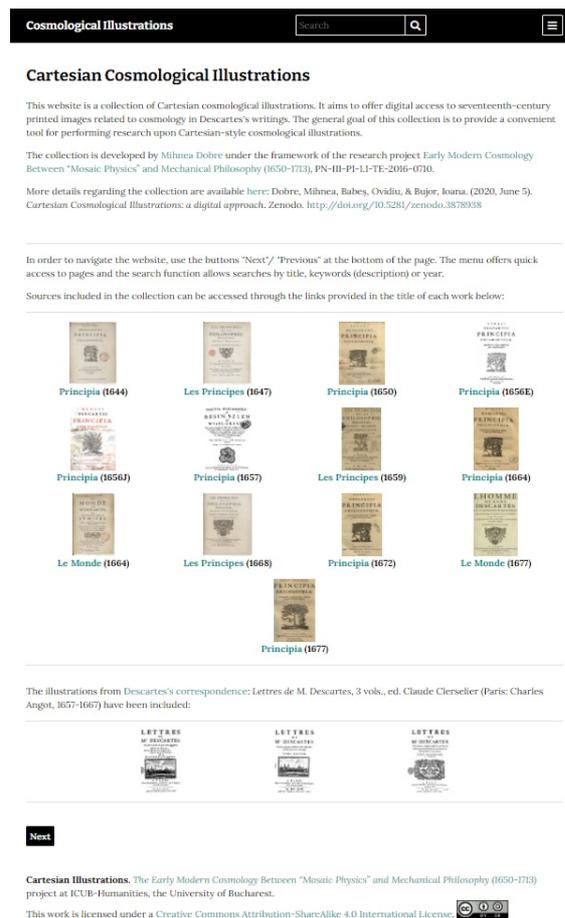


Fig. 1. The Home page of the exhibition. It lists some of the content included as to September 20, 2020.

The purpose of the exhibition is to stock the illustrations and provide a convenient way to compare the cosmological images included in René Descartes's cosmological writings, such as *Le monde*, *Principia philosophiae*, and his correspondence. Our platform includes images we labelled as cosmological from Descartes's work, with most of their versions, namely illustrations of all printed versions of Descartes's *Principia* and *Le monde*, published between 1644 and 1677. The platform was initially released in April 2020, significantly updated in mid-summer, and we intend to develop it further.

In Section I, we start by setting up some theoretical parameters of the relevance of cosmological illustrations for the history and philosophy of Cartesian cosmology in the seventeenth century. Without going into much detail or trying to give any definite account, we

<sup>1</sup> This is an updated version of the Zenodo preprint available here (Dobre, Babeş, and Bujor 2020).

aim to show that cosmological illustrations are significant in their own right, both for the seventeenth century spread of Cartesian cosmology and, generally, for their epistemic import.

We present the exhibition itself in Section II, where we focus on describing the corpus of images and on explaining our selection criteria for these as *cosmological* images. Then we move to the developmental stages of the platform along with its digital components, in order to explain the process by which images are stocked and curated. We further describe some digital tools included in the platform and argue that new insights into Cartesian cosmological imagery can be gained by using visualization techniques via the *Cosmological illustrations* platform. Lastly, we sketch several options we consider to develop the platform in the near future and present some preliminary findings about the illustrations of Cartesian cosmological works.

## I. Illustrations in Cartesian cosmology

Why did we choose *cosmological* images of Descartes's works? Is there anything special about illustrating cosmological topics? Is Descartes's natural philosophy more visual or illustrative than others of his time? To some extent, the answer to the latter questions is affirmative.<sup>2</sup> Cartesian natural philosophy relied heavily on drawings, diagrams, illustrations and other visual cues. It has been argued that Cartesian illustrations have a crucial epistemic function, not limited to depicting, but also to conveying explanatory and heuristic roles.<sup>3</sup> Cartesian images comprise a blend of functions such as realistic depictions, diagrammatic and geometrical reasoning, reductive explanations (such as those appealing to corpuscles) and so on. These sophisticated uses have been labelled 'philosophical images', *i.e.* a kind of embodied philosophical argument, and they feature prominently in Cartesian treatises.<sup>4</sup>

The style of cosmology which Descartes was engaged with also deserves some mention. His cosmology was part of a general physics which formed a systematic whole. Both of his cosmological treatises, *Le monde* and *Principia philosophiae*, had little to no mathematical details. Their intended audience was wide, not limited to practicing astronomers or academic natural philosophers. Many natural phenomena were explained with the help of images, engraved either amid the text or grouped together at the end of a treatise. Moreover,

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<sup>2</sup> See for example (Sepper 2000; Lüthy 2006; Strazzoni 2015).

<sup>3</sup> See (Zittel 2011; Schuster 2012; Lo 2014; Berger 2017; Dobre forthcoming).

<sup>4</sup> This has been discussed in the "Cartesian Images" conference (<https://hiw.kuleuven.be/dwmc/events/agenda/cartesian-images>) and the topic will be further elaborated in studies included in a forthcoming volume: *Cartesian Images. Depicting Natural Philosophy in the Seventeenth Century*, eds. Mattia Mantovani and Davide Cellamare, Brill series Medieval and Early Modern Philosophy and Science (Mantovani and Cellamare forthcoming).

the abundance of engraved images remained constant for the posthumous editions of Descartes's natural philosophy treatises printed throughout the seventeenth century.

There is another part of Cartesian physics which crucially relied on images: the anatomy and physiology of the human body. The epistemic import of anatomical illustrations was explicitly underscored by Claude Clerselier, one of the first editors of Descartes's works, as early as 1664. Recently, this prompted a lively debate in the secondary literature about a set of illustrations included in Descartes's writings (Wilkin 2003; Zittel 2011; Nadler 2016). The debate concerned the medical images added to the manuscript of *L'Homme*, initially printed in Latin in 1662 and lavishly illustrated with realistic anatomical images in copper engravings.<sup>5</sup> The French edition, published in 1664, included a different set of illustrations prepared by two medicine professors – Gerhard van Gutschoven and Louis de La Forge – and supervised by Claude Clerselier. In the preface of *L'Homme*, Clerselier claimed that images in his edition play an *epistemic* role, unlike the more realistic drawings of the 1662 edition. It is beyond this paper to go into the details, but this matter might prompt a more general question about the role of illustrations in Descartes's philosophical writings, not limited to anatomy.<sup>6</sup>

Another richly illustrated field of Cartesian physics, *viz.* cosmology, lacks any analogous investigations or debates. Reasons for such neglect might be diverse (see for example the discussion in a forthcoming paper by Mihnea Dobre, “Depicting Cartesian Cosmology in the Seventeenth Century”) but discussing them is not a primary goal in this study. However, the virtual exhibition can set the stage for further debates about the visual apparatus of Cartesian physics and cosmology.

Our collection is an online tool that helps in bridging the gap in the study of Cartesian cosmological imagery in a more bottom-up fashion. This means that we collect and conveniently display cosmological images of most editions of Descartes's works in the seventeenth century.<sup>7</sup> The interested historian of science is therefore free to choose her own entry-point in the study of Cartesian cosmological imagery. Unlike the debate about Descartes's anatomical images, one does not need to start from a prior hypothesis about Cartesian images – such as Clerselier's claim that images *do have* an epistemic role – and test or refine it based on a corpus of images. One can proceed bottom-up and start from the corpus

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<sup>5</sup> For a detailed account of the seventeenth-century editions of Descartes's works, see (Otegem 2002).

<sup>6</sup> See for example the discussion in (Lüthy 2006; Schuster 2012; Lo 2014), already referred above.

<sup>7</sup> The illustrations are collected in Tropy, a digital tool for storing, sorting, and annotating with metadata collections of images. They are further exported to the Omeka platform, from where they are presented in the online collection. The selection of the corpus – *i.e.* seventeenth-century editions of Descartes's works – is based on the catalogue of Descartes publications in (Otegem 2002) and the availability of these resources in digital format. More details about the workflow and our selection are provided below.

of images and analyze them until some tentative conclusion is reached. By stocking almost all seventeenth century versions of Cartesian cosmological images, the historian can tackle several types of questions – for instance: Is any particular image modified or altered between subsequent editions of the same treatise? Is the same image repeatedly engraved in the same edition? If this is the case, how many times is it repeated? What kind of images feature predominantly in each treatise (e.g. of vortices, optical phenomena, corpuscles etc.)? How does the engraving technique (woodcut vs. copper plate) reflect on the usage and frequency of different cosmological images in different Cartesian treatises? Such questions can be addressed more easily with the *Cosmological illustrations* platform. Just to provide a sample, we will briefly discuss such a tentative conclusion in Section III.

## II. The online platform

### 1. *The corpus of images.*

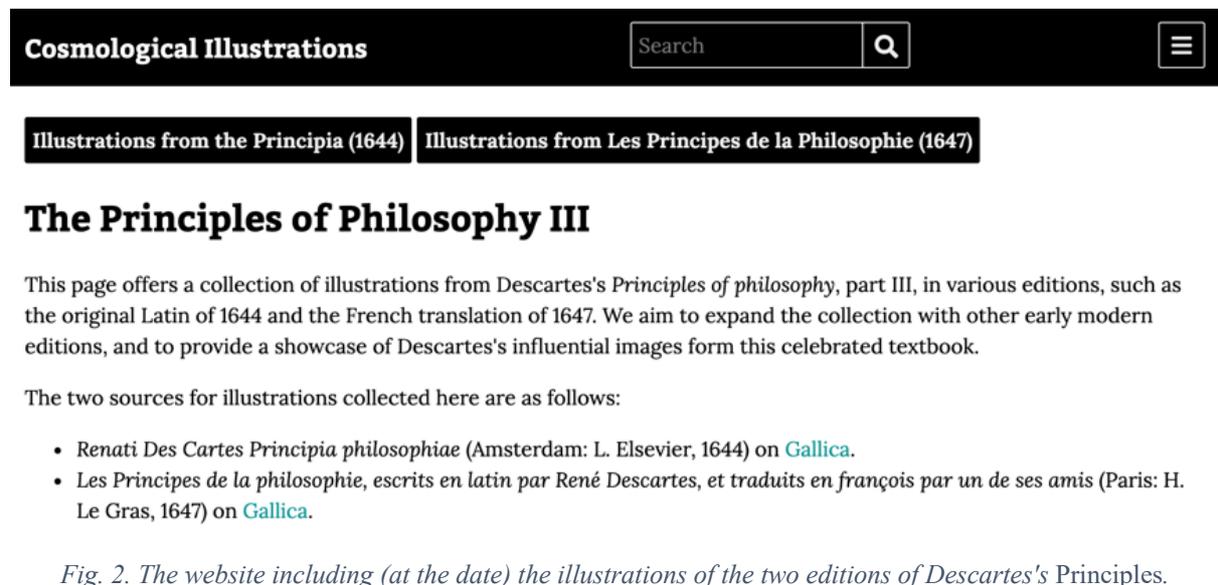
We begin the presentation of the *Cosmological illustrations* platform by a brief discussion about the corpus of selected images. Building a repository of Cartesian cosmological images requires some operational definition of what a *cosmological* image is, in order to choose which images to include and exclude from the selection.

Descartes dealt with cosmological topics in two of his works, *Le monde* (written cca. 1630-1633) and *Principia philosophiae* (published in 1644). Even if *Le monde* was written a decade earlier than *Principia*, it was only published after Descartes's death, in 1664. Both printed works were heavily illustrated. The first part of *Le monde* (or *Le traité de la lumière*) explicitly deals with the formation of the world, the order of the heavenly bodies and the laws of motion in the universe. In the third part of the *Principia*, Descartes introduced the famous cosmological theory of the vortex. According to his theory, the whole universe was composed of giant vortices formed around fixed stars; the solar system being one such vortex. The analogy of the vortex also held for lesser systems, such as the system of the Earth, which kept the Moon in its orbit.

The engraved images of both sections of *Le monde* and the *Principia* were crucial explanatory devices of Descartes's cosmology. Therefore, we included in the online platform all illustrations of the *Traité de la lumière* and of the third part of the *Principia*. For Descartes, understanding the nature of celestial movements meant (at least partially) having a proper mental picture of vortical movements. The vortex analogy was reinforced by other analogical explanations, some of which were also illustrated. Corpuscles, river flows, liquid containers or slings were all used as illustrated analogies supporting the vortical explanations of celestial

motions. As such, we consider all these images as *cosmological* images – *i.e.* having a bearing on the cosmology of Descartes, even if they do not depict celestial vortices *per se*. We did not, however, include the images in the second and fourth parts of the *Principia*.<sup>8</sup> We decided (at least provisionally) to exclude these images because they either deal only with very general issues in physics (second part) or particular phenomena such as the formation of the Earth, magnetism, or meteorological problems (fourth part). As the online platform develops, however, we consider including them and expanding the collection to all Cartesian images.

Following this pragmatic approach described above, in April 2020 we started to collect cosmological images from Descartes’s two major Cosmological works. The initial release of the website included direct digital access to the cosmological illustrations printed in three editions of Descartes’s works: (1) the original Latin edition of the *Principia philosophiae* of 1644; (2) the French translation of (1), *Les Principes de la philosophie* (1647); (3) the 1664 edition of *Le monde de Mr Descartes, ou Le traité de la lumière et des autres principaux objets des sens*. Upon collecting these images, we came across some notable changes – differences between the illustrations used in the *Principia* (1644) and *Les Principes* (1647) – see Fig. 2. Whereas the first includes 44 illustrations – with some of them repeated often throughout the treatise – the latter only contains 10 illustrations. The quality of the print differs due to the engraving (woodcut vs. copper plate), but other changes in drawings are also noticeable.



<sup>8</sup> At least not until November 2020.

Since then, our team aimed at collecting and displaying *all* the illustrations in the editions of the *Principia* and *Le monde* published between 1644 and 1677 (see Fig. 3). The purpose was to establish if there are any more noteworthy variations of the cosmological images published in the treatises. Up to September, our team managed to collect the cosmological illustrations of 11 editions of the *Principia*, and 2 editions of the *Le monde*. They are as follows:<sup>9</sup>

- *Renati Des Cartes Principia philosophiae* (Amsterdam: L. Elzevier, 1644) on [Gallica](#).
- *Les Principes de la philosophie, escrits en latin par René Descartes, et traduits en françois par un de ses amis* (Paris: H. Le Gras, 1647) on [Gallica](#).
- *Principia philosophiae* (Amsterdam: L. Elzevier, 1650) on [Archive.org](#).
- *Principia philosophiæ* (Amsterdam: Louis Elzevier; Daniel Elzevier, 1656) from the [Archive.org](#).
- *Principia philosophiæ* (Amsterdam: Johannem Jansonium, 1656) from [Archive.org](#).
- *Principia philosophiæ of Beginselen der Wysbegeerte* (Amsterdam: Jan Rieuwertz, 1657) from [the library of the University of Ghent](#) (via Google Books).
- *Les Principes de la Philosophie* (Paris: Henry and Nicolas Le Gras, 1659) on [La Bibliothèque numérique patrimoniale des universités Toulosianes](#).
- *Renati Des-Cartes Principia Philosophiae* (Amsterdam: Daniel Elzevier, 1664) on [Munich Digitization Center \(MDZ\)](#).
- *Les Principes de la philosophie* (Paris: Theodore Girard, 1668) from [Gallica](#).
- *Principia Philosophiae* (Amsterdam: Daniel Elzevier, 1672) from [Archive.org](#).
- *Principia Philosophiae* (Amsterdam: Daniel Elzevier, 1677) from the [Archive.org](#).
- *Le monde de Mr Descartes, ou Le traité de la lumière et des autres principaux objets des sens. Avec un discours de l'action des corps et un autre des fièvres, composez selon les principes du même auteur* (Paris: T. Girard, 1664) on [BIU Santé \(Paris\)](#).
- *L'Homme de René Descartes et la formation du foetus, Avec les Remarques de Louis de la Forge. A quoy l'on a ajouté Le Monde ou Traité de la Lumiere du mesme Auteur*. Edited by Claude Clerselier. 2nd ed. (Paris: Theodore Girard, 1677) from [Archive.org](#).

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<sup>9</sup> The list follows (Otegem 2002). We include in this list the online repository for the source of each digital copy we used in the collection. We were unable to locate digital copies of three other early modern prints: *Les Principes de la philosophie* (Paris: Henry Le Gras and Edme Pepingué, 1651); *Principia Philosophiae* (London: J. Hart, 1664) and *Principia Philosophiae* (Amsterdam: E. van Weyerstraten; Johannes Janssonius van Waesberge, 1664).



Fig. 3. The website's interface of image collections from the 11 editions of the *Principia*. Each thumbnail is a collection of images from the respective edition.

Aside from the 13 editions of the two treatises (11 of the *Principia* and 2 of *Le monde*), we decided to expand the exhibition with images from Descartes's *Correspondence*, as edited by Clerselier. The images of all three volumes of the early modern edition (*Lettres de M. Descartes*, ed. Claude Clerselier (Paris: Charles Angot, 1657-1667)) are also available on the platform (see Fig. 4).<sup>10</sup>

<sup>10</sup> Unlike the images from *Le monde* and the *Principles* presented above, the set of illustrations from Descartes's correspondence needs further work on the metadata (currently only partly annotated).

The illustrations from [Descartes's correspondence](#): *Lettres de M. Descartes*, 3 vols., ed. Claude Clerselier (Paris: Charles Angot, 1657-1667) have been included:

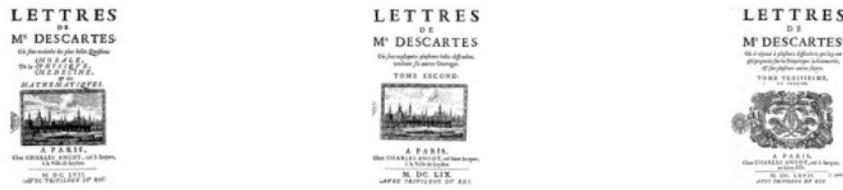


Fig. 4. The thumbnails of the Title pages of each volume of Clerselier's edition of Descartes's correspondence.

Granted, not all images in Descartes's correspondence are cosmological. Still, for the time being, we have included all illustrations from the three-volume *Lettres*. This opens a pressing question for us, as we have to decide either to keep all images and include additional ones (e.g. from the *Principia* parts two and four), or to enforce more strict selection criteria in the correspondence, and store only those images that can be labelled as cosmological (i.e. and to alter, thus the operational definition of cosmological images presented above).

Our provisional aim up to this point has been to stock the cosmological images from editions of the *Principia* and *Le monde* published in a given period of the seventeenth century. We are still missing several editions (see the note, above), but depending on the selected timespan – currently restricted to 1644-1677 – of Descartes's publications included in the collection, the number can grow. The three editions mentioned here are not available online and due to the international travel restrictions imposed by the COVID-19 pandemic, we were unable to access these editions directly.

Generally, a working principle we followed in our selection of sources was to restrict the use of resources only to those already available in the public domain. In addition to pragmatic reasons related to access, we also aimed to promote open access sources and to offer a showcase of the possibilities opened by a digital approach of the subject.

## 2. Description of the digital platform – sources, structure, tools.

The digital workflow is described in this section. First, illustrations are selected from open sources – i.e. digital editions available in the public domain and accessible on Gallica (<https://gallica.bnf.fr/>) and other digital repositories (e.g. Munich Digitization Center, La Bibliothèque numérique patrimoniale des universités Toulousianes) – which are subsequently collected, catalogued, and annotated with metadata in a local database in [Tropy](#) (see Fig. 5).

Metadata for items are annotated in the Dublin Core standard. The categories listed for each item can be classified into three types, according to their purpose:

- (1) *descriptive metadata*, which includes: (a) factual and historical elements of identification such as Title, Creator (*i.e.* Descartes), Date (*e.g.* 1644, 1647, 1664), Language (French, Latin), Publisher (*e.g.* L. Elsevier), Coverage (*e.g.* Amsterdam, Paris), and Type (it refers to the engraving: woodcut or copper plate), along with (b) two elements generated in the project: Identifier (a unique number generated as a string which includes the year of the edition, abbreviated form of the publication title, section or chapter number, the order of the illustration inside the specific edition, and – in some cases – a letter to designate a repeated illustration; for example, the string “44PP3.1” will refer to the first illustration in the *Principia philosophia* of 1644, part III) and Description (*e.g.* vortex, corpuscles etc. – for the moment, the description field is rather limited and consists in key words or phrases).
- (2) *structural metadata* that helps us create a relational database by the category “Relation” (cross-references to other resources on the platform).
- (3) *administrative metadata*, such as Source (this category includes both the title of the book and the external source of the image; *e.g.* Gallica, BIU), Format (for the moment, print, as all illustrations are from printed books).

|   | Title                    | Identifier | Creator   | Date | Type    | Descr  |
|---|--------------------------|------------|-----------|------|---------|--------|
| 1 | PP III 23 (1644)         | 44PP3.1    | Descartes | 1644 | woodcut | vortex |
| 2 | PP III 70 (1644)         | 44PP3.10   | Descartes | 1644 | woodcut | vortex |
| 3 | PP III 70 (1644) rep. 70 | 44PP3.10a  | Descartes | 1644 | woodcut | vortex |
| 4 | PP III 72 (1644) rep. 70 | 44PP3.10b  | Descartes | 1644 | woodcut | vortex |
| 5 | PP III 73 (1644) rep. 70 | 44PP3.10c  | Descartes | 1644 | woodcut | vortex |
| 6 | PP III 74 (1644) rep. 70 | 44PP3.10d  | Descartes | 1644 | woodcut | vortex |
| 7 | PP III 76 (1644) rep. 70 | 44PP3.10e  | Descartes | 1644 | woodcut | vortex |
| 8 | PP III 78 (1644) rep. 70 | 44PP3.10f  | Descartes | 1644 | woodcut | vortex |
| 9 | PP III 80 (1644) rep. 70 | 44PP3.10g  | Descartes | 1644 | woodcut | vortex |

Fig. 5. A screenshot with the list of illustrations from Descartes’s *Principia* of 1644, as they are catalogued in Tropy.

Once the local Tropy collection is complete, it is exported to the Omeka S platform. The metadata is verified again on the online platform and some relational content is added (*e.g.* link to the original source on Gallica; the “Relation” category, creating cross-references

between items included in the exhibition). The information included in the metadata is thus curated twice in the process: first, when it is added to the local database, in Tropy, and the second time, when the item is already online, as part of the exhibition.

Furthermore, in order to build a shared team database, the data stored in Tropy was exported as multiple CSV files, organized by edition. These files were imported into a large Excel worksheet which gathers the existing information about the collection of illustrations uploaded on the website and generates a detailed database. The resulted table provides a complete description of every item based on the categories of metadata mentioned previously; see Fig. 6.

|   | A                        | B         | C    | D       | E                          | F          | G      | H       | I        |
|---|--------------------------|-----------|------|---------|----------------------------|------------|--------|---------|----------|
| 1 | Title                    | Creator   | Date | Type    | Source                     | Identifier | Rights | Subject | Language |
| 2 | PP III 23 (1644)         | Descartes | 1644 | woodcut | Principia Philosophiae III | 44PP3.1    |        |         | Latin    |
| 3 | PP III 70 (1644)         | Descartes | 1644 | woodcut | Principia Philosophiae III | 44PP3.10   |        |         | Latin    |
| 4 | PP III 71 (1644) rep. 70 | Descartes | 1644 | woodcut | Principia Philosophiae III | 44PP3.10a  |        |         | Latin    |
| 5 | PP III 72 (1644) rep. 70 | Descartes | 1644 | woodcut | Principia Philosophiae III | 44PP3.10b  |        |         | Latin    |

|   | A                        | J      | K           | L           | M           | N         | O        | P            |
|---|--------------------------|--------|-------------|-------------|-------------|-----------|----------|--------------|
| 1 | Title                    | Format | Contributor | Description | Publisher   | Coverage  | Relation | Tags (Tropy) |
| 2 | PP III 23 (1644)         | Print  |             | vortex      | L. Elsevier | Amsterdam |          |              |
| 3 | PP III 70 (1644)         | Print  |             | vortex      | L. Elsevier | Amsterdam |          |              |
| 4 | PP III 71 (1644) rep. 70 | Print  |             | vortex      | L. Elsevier | Amsterdam | 44PP3.10 |              |

Fig. 6. The first items from the exported Tropy database with the information included in the metadata.

With the expected growth of our collection in the future, careful attention must be used to effectively organize data. Hence, our workflow – described above – supplies a practical method to classify, catalog, and offer descriptions of a visual archive which can be later used when testing digital tools. The general question arising at this point concerns the use and the benefits of creating a database of this kind. We regard this as a really important component for a number of reasons:

- (1) It allows the team to have remote access to a relational database;
- (2) It is a reliable way of backing-up the information in order to manage the platform in a secure way;
- (3) Processes such as tracking and checking the issues on the website can be done easily using the same document;
- (4) It represents a key-element for testing and implementing digital tools (some of them being discussed below).

During the past few months, together with the expansion of the collected items, we increased the emphasis on the relational content, to investigate the *modus operandi* of the “Relation” category. This became a central instrument for testing several digital tools. For example, in order to examine the relation between publishers and new editions of Descartes’s works, we used [Palladio](#), a web-based platform for creating visualizations. We introduced the

table with sources in Palladio and generated a graph, which offers – to provide only one example – a convenient visualization of Theodore Girard’s role in the publication of both *Le monde* and the *Principia* (see Fig. 7). Such and similar findings are supported by the database we are currently constructing as the groundwork of the online exhibition.

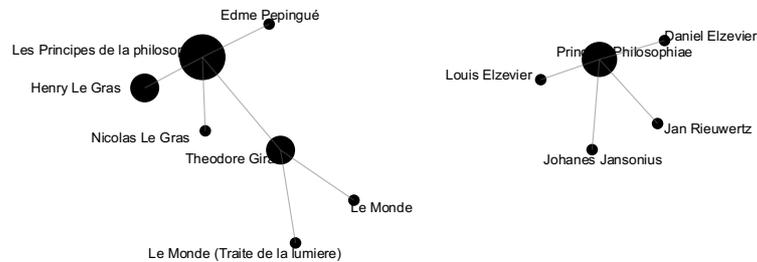


Fig. 7. Relations between publishers and editions. The network image was generated in Palladio.

The second phase implied testing possible ways to compare the illustrations uploaded on the platform. A feature that one can benefit from the development of the virtual exhibition is that a researcher interested in the study of Cartesian imagery can conduct an in-depth analysis to identify invariables, correlations and fluctuations: (a) within the same edition (*e.g.* can we identify similar illustrations? What are the ways in which they differ?), (b) between two or more editions (*e.g.* are there any images that occur in more than one edition? For what purpose?) and, why not, (c) between Descartes’s cosmological writings and other authors from the early modern period (*e.g.* can we compare the way in which the universe was depicted in the seventeenth century? Are there any conclusions that can be drawn from this?). In the consequent stages of its development, the website can surely grow in sync with our own research or with the general interests expressed by the academic community, and address some of these open questions.

## Comparisons (Principles)

This is a test page to verify some possible user scenarios. When one examines the page with the illustrations in the third part of the Principles, one should notice the repeated use of some images. We captured this in the "Relation" metadata field, as we provided links to the initial image of a repeated set. Most of the repeated images are with the vortex (e.g., in our collection, there are 108 occurrence of the illustrations from the PP III 22/ 23/ 24 and 92 occurrences of the illustration from PP III 68/ 69/ 70). A convenient way to study differences between editions included in this collection is to use the Mirador Viewer and adjust the layout (Change Layout button) to column view:

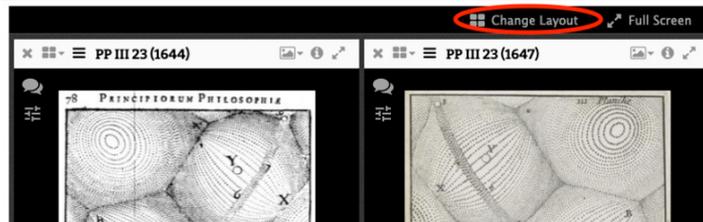


Fig. 8. The image presents one possible user scenario: to perform comparisons with the use of the Mirador Viewer.

To study differences between editions or even similar sets of illustrations repeated throughout one publication, in August 2020 we started testing the module [Mirador Viewer](#) for Omeka (see Fig. 8).<sup>11</sup> Mirador is a useful open-source image comparison tool, which is mainly used by scholars in medieval studies with the aim of digitally comparing and analysing manuscripts exhibited in different libraries. Originally developed by a team at Stanford, it was soon recognized that Mirador's usage can be extended to many academic fields and even cultural institutions can benefit from it (e.g. museums, archives, cultural organizations).

One main advantage of Mirador is that it is very configurable. Thus, it allows the user to add multiple illustrations (up to 25) which are displayed in the same case (so there is no need to open multiple tabs). The additional slots can be configured in various vertical or horizontal grid views (by selecting "Change Layout" option, see Fig. 8). Each image can be examined in terms of several options: zoom in/out, rotate left/right, contrast of colours (adjustments of brightness/contrast/saturation); in addition, the user can view information regarding the metadata of the added object(s). The viewer is designed for any 2D object and does not provide 3D features, which fits well within the general use of our collection. A detailed guide for using the Mirador Viewer can be accessed at the MIT Libraries, ["Using the IIF Mirador Viewer"](#); for a thorough review on its use from a scholarly medieval perspective, see for example (Sanderson et al. 2015; Zundert 2018).

However, there is one drawback we identified while testing Mirador on our platform. Counterintuitively, the user is unable to choose and to add new objects (even from those

<sup>11</sup> Initially, we opened our tests with an alternative, the module [Universal Viewer](#) for Omeka S.

uploaded on the website) in order to generate his own showcases of comparisons. Hence, one can only analyse the repeated use of images from the possible user scenarios that were already provided on the website. At the moment, we offer two cases for comparisons, both of them comprising in the famous illustrations of Descartes’s vortices. As this is a work-in-progress, we are working on fixing this issue. Additionally yet related to problems within the collection, an [error report form](#) has been added to the website, to register corrections or suggestions of improvement, including possible comparisons that are of interest for researchers.

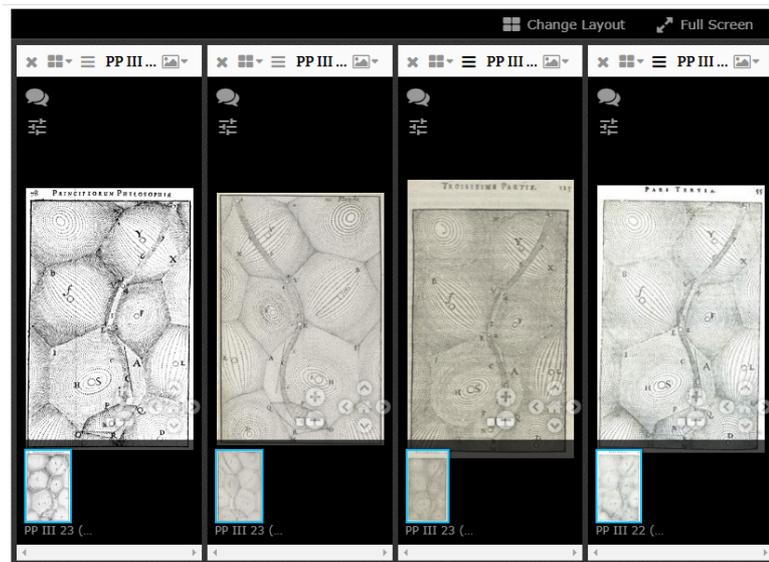


Fig. 9. An example of a showcase using Mirador. The illustrations being compared are from the Principia III.

The two sets of comparisons currently available on the platform – illustrations usually printed as part of the PP III 22/23/24 and PP III 68/69/70 – include images depicting the Cartesian vortex. Our choice is motivated by the prevalence of the vortex images in the third part of the *Principia*: there are 108 occurrences of the illustrations from the PP III 22/23/24 and 92 occurrences of the illustration from PP III 68/69/70, out of the general total of 425 illustrations we collected from this section of Descartes’s treatise.

In terms of forms of visualizations, we included a timeline, which was generated with an open-source tool: [TimelineJS](#), developed by a team of developers from The Northwestern University Knight Lab. It allows us to produce a timeline with the sources included in the collection and made available on the website. The result was posted on our “About” page (<https://cartesian.unibuc.ro/s/cosmologicalillustrations/page/about>) and it can be previewed below (see Fig. 10).



Fig. 10. Timeline with the early modern editions of Descartes's writings.

The timeline was made using a Google spreadsheet (see Fig. 11). The [Knight Lab website](#) provides the users a four-step guide to creating a timeline, including a template which must be filled in and later, configured where needed. The only requirement is the source spreadsheet to be accessible by publishing it as “Web Page.” Moreover, there are several optional settings on the website which can be used to change the timeline’s style (e.g. language, fonts, starting slide, zoom level). Once these steps are completed, the automatically generated link is shared on the platform.

| Year (1) | End Year (2) | Display Date (3) | Headline (4)  | Text (5)   | Media (6)   | Media Credit (7) | Type (8) | Background (9)  |
|----------|--------------|------------------|---|--|---|------------------|----------|---|
|          |              |                  | <b>The Principles of Philosophy</b><br>Renati Des Cartes Principia philosophiae                                 | This website is a collection of Cartesian cosmological illustrations. It aims to offer digital access to seventeenth-century printed images related to cosmology in Descartes's writings. The general goal of this collection is to provide a convenient tool for performing research upon Cartesian-style cosmological illustrations. |   |                  | title    | <a href="https://cdn.pixabay.com">https://cdn.pixabay.com</a> |
| 1644     | 1644         |                  | Les Principes de la philosophie, écrits en latin par René Descartes, et traduits en français par un de ses amis | Paris: H. Le Gras. 10 illustrations. See them here: <a href="https://cartesian.unibuc.ro/s/cosmologicaillustrations/item-set/94">https://cartesian.unibuc.ro/s/cosmologicaillustrations/item-set/94</a> .  | <a href="https://cartesian.unibuc.ro">https://cartesian.unibuc.ro</a> | Gallica          |          | <a href="https://cdn.pixabay.com">https://cdn.pixabay.com</a> |
| 1647     | 1647         |                  |   | Amsterdam: L. Elzevier. 43 illustrations. See them here: <a href="https://cartesian.unibuc.ro/s/cosmologicaillustrations/item-set/753">https://cartesian.unibuc.ro/s/cosmologicaillustrations/item-set/753</a> .   | <a href="https://cartesian.unibuc.ro">https://cartesian.unibuc.ro</a> | Archive.org      |          | <a href="https://cdn.pixabay.com">https://cdn.pixabay.com</a> |
| 1650     | 1650         |                  | Principia philosophiae  |  | <a href="https://cartesian.unibuc.ro">https://cartesian.unibuc.ro</a> |                  |          | <a href="https://cdn.pixabay.com">https://cdn.pixabay.com</a> |

Fig. 11. A screenshot with the first rows of the spreadsheet template used to generate the timeline from Fig. 10.

This is, in brief, the technical part which includes an overview of the digital tools connected to the platform. As described, the platform can be used in multiple ways by scholars of early modern cosmological imagery and these are just some of the open possibilities of the collection.

### 3. Extending the platform and some tentative findings.

As suggested in Section I, the platform can help a more bottom-up approach to the investigation of Cartesian cosmological imagery. To provide an example, we describe here a preliminary finding about the two famous illustrations of the vortex, discussed above in the context of the Mirador module (Fig. 8, Fig. 9). After looking into the 11 early modern editions of Descartes's *Principles*, we noticed that some images were used much more frequently than others. This is the case of the two images of the vortex universe, which are repeated throughout the 1644 edition multiple times (see Fig. 12 and Fig. 13).

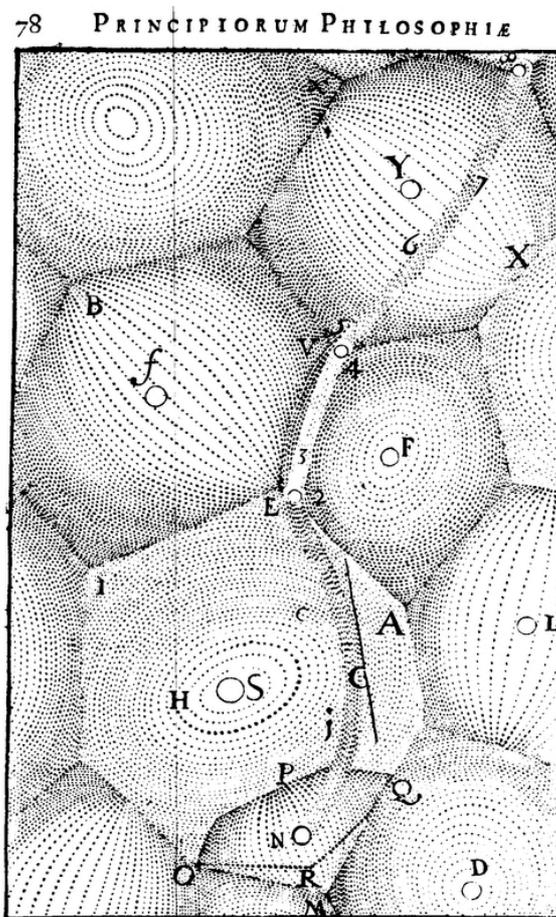


Fig. 12. Illustration on Principia III 23.

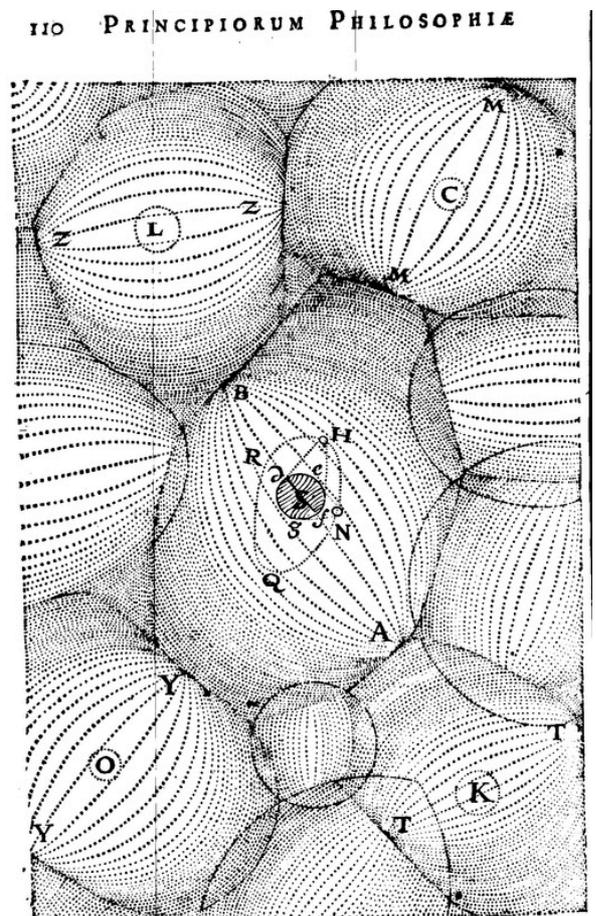


Fig. 13. Illustration on Principia III 70.

Fig. 12 depicts multiple adjacent vortices along with the path of a comet between these vortices (the path traced by N upwards). Fig. 13 also depicts multiple adjacent vortices, only this time detailing the the path of heavenly bodies in the vortex of the Sun (labeled S). In the 1644 edition of *principia*, Fig. 12 is repeated (engraved) 10 times, while Fig. 13 is repeated 11 times. Discursively, repeated engravings of the same image makes sense: Many of Descartes’s explanations refer to whole vortices, the order of planets within them or the behavior of comets. As the explanations refer to the same image, it was convenient for the reader to have the same image available at different pages, next to the text discussing it.

Browsing through multiple editions of the *Principia*, we noticed, however, that the images above were different in terms of frequency . For instance, in the 1668 edition printed by T. Girard, the image in Fig. 12 was repeated 14 times (compared to 10), while the image in Fig. 13 was only repeated 7 times (compared to 11). This means that the image in Fig. 12 became much more frequent within the text. The repetition of other images also varies. The chart on Fig. 14 shows the number of images in 5 editions of the *Principia*, which allows us to highlight a significant change in the use of the two sets selected for our example.

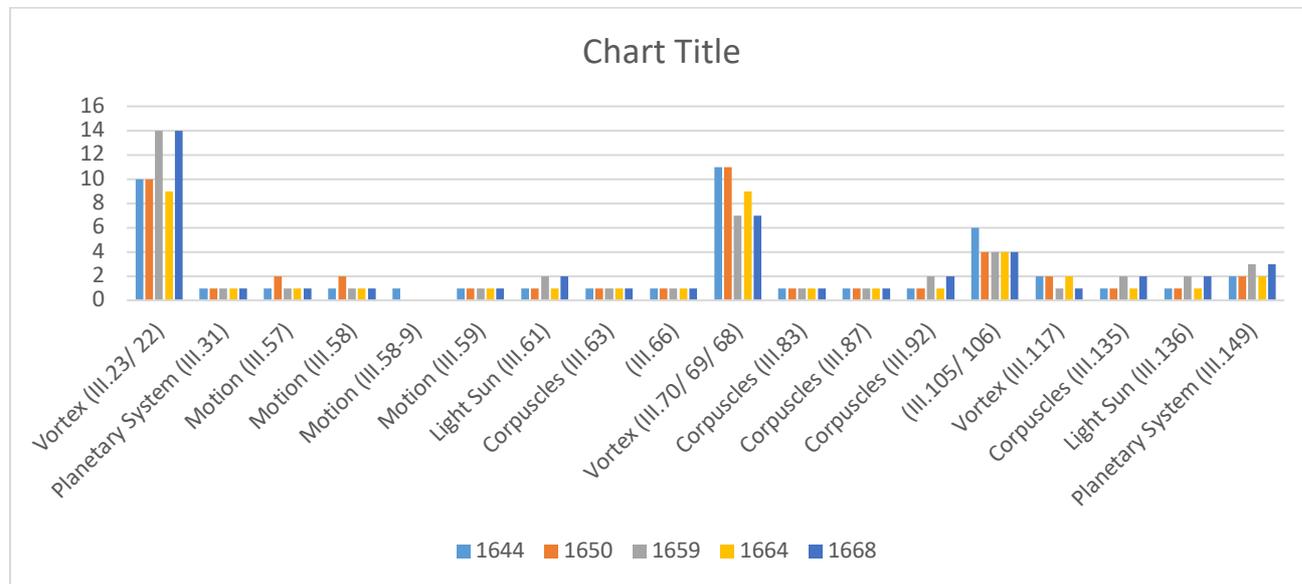


Fig. 14. Sample images from Principia III (horizontal) related to the number of repetitions of each of them (vertical). The editions of Principia are shown in light blue, orange, gray, yellow and dark blue.

A question arises: If the text of the *Principia* has little to no changes between subsequent editions, how come there is such variation between the repetitions of some images (cf. images in Fig. 12 and Fig. 13)? Or, generally, what causes the repeated engravings of some

(but not other) images? In any case, just by looking at the frequency of images in print, we can get a clear idea of why some images – like the above – became the standard depictions of the Cartesian vortex theory throughout history of science.

### III. A closing comment

The exhibition is intended to grow. We welcome collaborations that might include new items for the collection. At the same time, we consider the possibility to develop this platform as a central repository of early modern *Cartesian illustrations*: cosmological, physiological, mathematical diagrams, optical analogies, and any other type of images included in Descartes's writings. The collection can expand with images from other Cartesian authors – and this would fit well within the current research project, [\*Making Modern Science: tracing the dynamics of a 'Cartesian Newtonian textbook' during the Scientific Revolution\*](#) (CartesianPhysics), of our team – but that would require more resources than currently available. For the moment, we hope that the website "[Cartesian Cosmological Illustrations](#)" is a useful tool for scholars working on early modern cosmologies, in general, and Cartesian images, in particular.

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## Digital tools

Mirador Viewer, <https://projectmirador.org/>

MIT Libraries, <https://libraries.mit.edu/music/sequentiary/using-the-iiif-mirador-viewer/>

Omeka S, <https://omeka.org/s/>

Palladio, <http://hdlab.stanford.edu/palladio/>

TimelineJS (Knight Lab), <https://timeline.knightlab.com/>

Tropy, <https://tropy.org/>

Universal Viewer, <https://omeka.org/s/modules/UniversalViewer/>