THE DIDACTIC, PERSUASIVE AND SCIENTIFIC USES OF ILLUSTRATIONS AFTER DESCARTES

ANDREA STRAZZONI

For anyone willing to understand the ways of teaching philosophy in early modern age, some selection in the scope of analysis is required. First of all, it is to be distinguished the teaching of philosophy in lectures given at scholarly institutions and aimed at an audience of students, from the broader dissemination of philosophical ideas through different contexts and audiences. In other words, one has to distinguish between the didactics or pedagogy of philosophy, and the dissemination of philosophical ideas as such. Yet, this distinction seems to collapse as one approaches the emergence of those ground-breaking ideas, unheard both to students and to more experienced readers, which signalled the emergence of early modernity. Accordingly, the study of the teaching of philosophy in early modern age calls for a clarification of its very object. This paper, presented in a shorter version at the international conference *Dal commentario al manuale: l'insegnamento della filosofia in età moderna*, aims at this clarification by focusing on the functions fulfilled by images in printed sources, showing how and why new ideas were conveyed by illustrations besides by words alone.

Historians and philosophers have neglected the philosophical relevance of the use of illustrations in books for a long time. The first, remarkable exception has been the *Album of Science* of John E. Murdoch, being the first focused on the ways images convey the arguments expressed in text[1]. More recently, Cristoph Lüthy and Alexis Smets have highlighted some problems underlying the study of illustrations in philosophical treatises, suggesting «an approach that takes into consideration the epistemological, ontological and pedagogical assumptions that surrounded their production»[2]. While paying attention to these issues, an aim of this paper is to highlight the role of illustrations in the dissemination of new philosophical and scientific paradigms in early modernity, namely, of Cartesianism and Newtonianism. However, different functions can be ascribed to pictures in early modern philosophical books: for example, pictures acted as philosophical means, filling the gap between the premise of a theory and its actual contents. This is the very case of Descartes's *Principia philosophiae*, where illustrations «constitute one of the facets of Descartes's 'clear and distinct ideas', serve as a bridge between logical deduction and rhetorical persuasion, and are therefore also caught up in the tension between metaphysics and mechanical physics that characterizes the *Principia*», as Lüthy has shown[3]. Moreover, illustrations acted as promoting or propagandistic means, being superfluous in the explanation of the theories expressed in text but useful to present them in a more persuasive or fas-

---

[1] MURDOCH 1984.

[2] LÜTHY-SMETS 2009, see p. 400. For an overview of recent literature on the role of images in the scientific revolution, see VANPAEMEL 2011, 241-242.

[3] LÜTHY 2006, 103. See also p. 107: «Descartes's illustrations play their prominent role, constituting […] a fragile bridge between the mode of deduction and that of persuasion. […] the abstract limpidity of Descartes's deductions begins to yield to the suggestive clarity of visual imagery».

cinating way. Eventually, pictures could have a more proper didactic function, aiming to help the reader in understanding theories expressed by text, yet without any "wondering" function. Actually, the boundaries between such functions are hard to be distinguished, insofar the same picture could serve for all these purposes, and philosophical, persuasive and didactic functions are all subordinated to the aim of conveying an idea or a theory which can be brought to reader's mind in different ways. For instance, in Descartes's works one can find the imagery of a theory supposedly based on pure reason[4]. Still, the use of illustrations and the introduction of new scientific and philosophical models are unmistakeably related. Insofar illustrations were used to support different approaches in philosophy and in its dissemination, their functions are to be evaluated in the context of their production, determining their presence and typologies in physical treatises, where they figured as allegorical title pages, illustrations of experiments, phenomena, analogue or comparable processes and features, invisible structures, data maps, idealized or geometrical features of nature, all depicted with different degrees of abstraction[5]. Therefore, one has to consider the particular function of each picture by paying attention to the kind and the aim of the text in which it is used, as well as to the theory of knowledge of its author, by evaluating the discrepancies between his metaphysical assumptions and the legitimacy of the use of pictures in presenting his theories. Moreover, the actual entailments of their contents in respect to those declared in texts are to be taken into account.

Actually, the Dutch philosophical context of the Seventeenth and

---

[4] See the previous note.
[5] On the various kinds of scientific illustrations, see HACKMANN 1993.

Eighteenth century offers a special viewpoint for this kind of historical analysis. Owing to the fact that Cartesian philosophy was introduced in the curriculum of Dutch universities in a consistent manner, Dutch scholars used illustrations in philosophical textbooks in different ways. Indeed, ways in teaching the new philosophy have different entailments in the figurative apparatus supporting its acceptance. Being taught for the first time at Utrecht and Leiden universities[6], Cartesian philosophy found its means of dissemination, besides in the circulation of the very works of Descartes, in private lectures, *praelectiones* and public disputations, as well as in textbooks based on their contents. Hence, a comparative analysis of the interpretations of Cartesian philosophy provided by the first Dutch Cartesian scholars can offer an overview on the functions of illustrations in the teaching and dissemination of Cartesian ideas.

In comparison with Aristotelian treatises, Descartes's books were the first philosophical writings provided with a huge illustrative apparatus[7]. Since Descartes purported a mechanical view of physics, his conceptualization of nature by means of geometrical principles could find a pictorial representation, whereas Aristotle's essentialist physics could not be put in picture[8]. Indeed, the use of pictures in early modernity can be noticed in natural philosophy as this concerns representable physical features, while disciplines as logic, metaphysics or ethics could not be conveyed by

---

[6] On the relevant context, see VERBEEK 1992.

[7] On the use of illustrations by Descartes, see, besides Lüthy's articles, BAIGRIE 1996; ZITTEL 2005; ZITTEL 2009; VAN OTEGEM 2005. On the use of imagery in the establishment of a Cartesian curriculum, see VANPAEMEL 2011, analysing the role of Cartesian engravings in the reform of studies at the University of Louvain in the 1670s.

[8] MURDOCH 1984, X; LÜTHY 2006, 97-98. For what it concerns the Dutch context, one cannot find any illustration in the widely spread manuals of Franco Burgersdijk.

imaginative means, with the exception of the use of some graph or geometrical sample[9]. Also, purporting Descartes's theories a groundbreaking view in philosophy required some persuasive mean, allowed by the progresses in printing techniques. Eventually, as Lüthy has shown, in Descartes's books images have a relevant philosophical significance as they replace the supposedly rational clarity and distinction with visual representations[10]. Still, the use of illustrations in philosophical textbooks was not limited to Descartes's treatises. One can find an extensive use of images in other books aimed to disseminate and teach Cartesian philosophy, helped by an original illustrative apparatus. An analysis of the Cartesian treatises of natural philosophy appeared in the Dutch Republic, therefore, would disclose the different uses Dutch philosophers made both of their own illustrations and of those of Descartes, often reprinted with the same types and included in their books.

1. The propagandistic function

It might seem paradoxical, but indirect information on the role of illustrations is provided by the texts of Adriaan Heereboord (1614-1661), which are deprived of any image. Active at Leiden University since 1643, during his lectures – covering all the fields of philosophy – Heereboord compared the opinions of different philosophers instead of developing a

[9] Some scheme or organization of text in trees and graphs can be found in the manuals of Ramistic logic, in Clauberg's *Ontosophia* (CLAUBERG 1664B), in Geulincx's *Logica restituta* (GEULINCX 1892, 165-454). Moreover, Spinoza uses three geometrical figures in his *Ethica*: still, these concern extension and the ideas of geometry (see SPINOZA 1677, 13, 47, 55).
[10] *Supra*, n. 3.

comprehensive philosophical corpus. Thus, he integrated Cartesian arguments with Scholastic theories, as well as with those of Bacon and of the Catholic and Reformed thinkers of the Renaissance[11]. The absence of pictures in his works can be explained both by the fact that Heereboord was not concerned with the introduction of a new paradigm as the replacement of an older one, and by the proceeding of his arguments, as these consist on the confrontation of the ideas of different authors. Eventually, the role of pictures in Cartesian context can be appreciated in contrast to Heereboord's views on philosophy: that is, in the use Henricus Regius (1598-1679) and Johannes de Raey (1620-1702) made of illustrations. However, since Regius's imagery had a longer evolution than De Raey's, who did not improve the illustrative apparatus of his works, I will start my survey with the latter.

In his *Clavis philosophiae naturalis aristotelico-cartesiana* (1654, 1677)[12], De Raey provides a Cartesian interpretation of Aristotle's philosophy by showing that the basics of Cartesian physics were shown by Aristotle. His book aimed at softening the introduction of Cartesianism at Leiden University, where a ban on new philosophy was enacted during the Leiden crisis (1647), was still effective in the early 1650s[13]. However, rather than to impede the dissemination of Descartes's ideas, the ban was meant to avoid any further controversy within the University. Indeed, after having been forbidden to teach Descartes's metaphysics in 1648[14], De Raey was asked in 1651 by the University Curators to provide some lectures on Descartes's

[11] HEEREBOORD 1654, *Ad Curatores epistola*, 5-6.
[12] DE RAEY 1654; DE RAEY 1677.
[13] VERBEEK 1992, 32-51.
[14] MOLHUYSEN 1918, 15*, 11.

natural philosophy[15]. Yet, under the condition that the matter would be dealt by showing that Aristotle's philosophy was consistent with Descartes's, and through a commentary of Aristotle's *Problemata*[16]. Hence, between 1651 and 1652 De Raey held five disputations *Ad Problemata Aristotelis*, later enlarged and published as his *Clavis philosophiae naturalis*. Along with the establishment of a concordance between Aristotle and Descartes, in these works De Raey provides a *specimen* of Descartes's physics, concerning the nature of matter, the laws of motion and the notion of subtle matter, presented by him as purely intellectual *praecognita*, or the basics of a rational physics. In fact, De Raey's disputations and *Clavis* open with an introductory *Oratio de gradibus et vitiis notitiae vulgaris* assessing the specificity of new philosophy in respect of the means of Scholastic or vulgar knowledge. Still, even if stating that imagination is a mean of the vulgar way of reasoning characterizing Scholastic philosophy[17], De Raey relies on the use of pictures in different manners.

Through De Raey's *Clavis*, one can acknowledge different use of images in the dissemination of Cartesian philosophy. First of all, De Raey wants to establish a concordance between old and new philosophy. Insofar Aristotelian physics concerned qualitative features of reality, it was scarcely capable of visual representation. Still, in De Raey's *Clavis* there is the very depiction of an Aristotelian concept, which could be represented, however, since it regards some geometrical feature of bodies. Such image can be found in the second section of the chapter *De materia subtili*, where the existence of

---

[15] DE RAEY 1654, *Epistola dedicatoria*, XXIV (unnumbered).
[16] MOLHUYSEN 1918, 54; DE RAEY 1654, *Epistola dedicatoria*, XXIV (unnmbered). See STRAZZONI 2011.
[17] DE RAEY 1654, 8.

subtle matter – admitted by Descartes as one of the three basic elements of the universe[18] – is proven by stating that the inhomogeneity of matter entails the existence of particles that can adapt themselves to every space[19]. De Raey argues that this is consistent with Aristotelian physics, as according to Aristotle heterogeneous bodies cannot be composed by regular solids (here reprinted as fig. 1, in the appendix)[20], and require a subtler matter to fill their gaps. In this way, De Raey provides the depiction of an Aristotelian concept: being not necessary to understand Descartes's theory, it acts as a propagandistic mean. Indeed, it is included in a text not aimed to provide a comprehensive view of Cartesian philosophy but only to support its introduction also through persuasive tools as images. That is, to popularize the very contents of Descartes's *Principia* by tracing them back to Aristotle's genuine thought and by means of pictures. De Raey, actually, carries out such "popularization", through imagination as a vulgar or Aristotelian means of knowledge.

This function of De Raey's *Clavis* is confirmed by the next pictures used by De Raey, which help in understanding Descartes's laws of motion and rules of collision through the representation of perfectly equal masses (fig. 2)[21]. Such pictures, which can be found also in the original text of De Raey's *Disputationes ad Problemata Aristotelis* (1651-1652)[22], should convey the idea of the different proportions of such bodies, conceived as if they have no contact

---

[18] It is discussed in DESCARTES 1644, III, §§ 48-52.
[19] DE RAEY 1654, 147-149.
[20] Fig. 1, *ibid.*, 149. «Cumque Aristoteles III de coelo, cap. 8 dicit *pyramidem et cubum* [...] *replere posse totum* aliquod spacium […] manifestum est ibi sermonem esse de istiusmodi cubis, pyramidibus, et c. quae geometricam habeant perfectionem», DE RAEY 1654, 150. See Aristotle's *De coelo*, III, 8, 306b 3-9.
[21] Fig. 2, DE RAEY 1654, 113.
[22] DE RAEY 1652, 10 (unnumbered).

with all the other ones (i.e., in void). Hence, they serve to help the reader in imaging the in-motion, dynamic sequence of their collision. Being not representable in itself, De Raey still represents such masses, whereas Descartes included only one picture of them in his *Principia* (fig. 3)[23]. Such pictures can find their proper place in De Raey's abridgement of Descartes's physics. Thus, they have also a didactic function, to the extent that they help the reader in understanding the laws concerning the proportions of motion, size and forces of bodies, still without formulating these in a mathematical form. The missing mathematical formulation, eventually, is replaced by De Raey through a visual tool, as Descartes did in the main part of his treatise[24].

Also, the propagandistic function of De Raey's *Clavis* is noticeable in the use of metaphors in pictures. Like Descartes, De Raey explains how insensible structures can be taken into account for observable phenomena. Because such structures cannot be observed, their features are suggested by means of a comparison with clews of worms or eels[25]. These pictures, in fact, have a precise reference in Descartes's work, since they depict a metaphor used – but not illustrated in picture – in Descartes's *Meteores*[26]. As in the case of the colliding masses depicted to present the laws of motion, De Raey integrates Descartes's contents with new images, providing the readers with an illustrated handbook of some sections of Descartes's works.

In other cases, in De Raey's *Clavis* images act as replacements of textual contents. This is the case of the representation of the *particulae striatae*, used by Descartes to explain magnetic phenomena and whose form is argued by

---

[23] Fig. 3, DESCARTES 1644, 60.
[24] LÜTHY 2006.
[25] DE RAEY 1654, 151-152.
[26] AT VI, 233-234.

De Raey from the nature of round particles, which leave triangular gaps among themselves. These are occupied by subtle matter, which assumes a screwed shape to fit them: actually, such shape is suggested by De Raey through a comparison of images, without any direct statement on its consequentiality from the triangular spaces left between globes (figs. 4-5)[27]. A similar case concerns the circularity of motion, which is not explicitly stated but only suggested in picture as a corollary to some considerations on the role of subtle matter in rarefaction and condensation (fig. 6)[28]. Imagination – through illustrations – is thus the means by which De Raey brings the reader to understand the basic shapes of subtle matter. Such matter is required to explain the seeming presence of void shown by Torricelli's tube, the only scientific instrument described and depicted in De Raey's *Clavis* (fig. 7)[29]. The evidences resulting from its use apparently contradict the Cartesian theory, whose falsification is prevented by the notion of subtle matter. In other words, the tube is not used as a test-bed for theory: its use and depiction are aimed to excite wonder in order to convince the reader of the existence of subtle matter through a lowbrow experience[30].

2. Didactics and experience

Whereas De Raey provided a theory of philosophical knowledge consistent with Descartes's metaphysics, while expounding his physics by means of

[27] Fig. 4, DE RAEY 1654, 186; fig. 5, *ibid.*, 188.
[28] Fig. 6, *ibid.*, 193.
[29] Fig. 7, *ibid.*, 194.
[30] «Tria insuper alia argumenta magis popularia et obvia coronidis loco obiter indicare lubet», *ibid.*, 191. «Ut naturae hoc arcanum […] admirandum longius prosequamur», *ibid.*, 196-197.

images also when these were not required to understand the text – and even through images alone –, Regius embraced a different view of philosophical knowledge. Presenting in his *Fundamenta physices* (1646)[31] a comprehensive physical theory based on Descartes's *Essais*, *Principia* and *Le monde* (which Regius could read as Descartes provided him with a copy[32]), Regius defines his theory as a hypothetical account for phenomena, based on experience as the source of philosophical knowledge. Indeed, he rejects the existence of any innate idea – even that of God[33] – and assumes Revelation as the only guarantee for the reliability of mental faculties in providing physical explanations[34]. Thus, his conclusions are only provisional and not meant to convince everyone, since evidence is determined by bodily temperaments[35]. Descartes – who could read the proofs of Regius's book in advance – criticized him as leaving the principles of physics without a foundation on adequate *probationes*[36]. In fact, instead of providing a deductive physics based on metaphysical principles, Regius wanted to furnish some explanations based on experience. Such account of philosophical knowledge, hence, has relevant entailments in the huge illustrative apparatus of his textbook, primarily intended to provide students with a comprehensive manual of new physics, yet deprived of its metaphysical foundation.

---

[31] REGIUS 1646. Further editions: REGIUS 1654; REGIUS 1661; REGIUS 1686.

[32] See the letter of Descartes to Regius of May 1641, in AT III, 374, and in BOS 2002, 70-71. On Regius's *Fundamenta physices*, see VERBEEK 1994. On Regius's natural philosophy, see BELLIS 2013. Regius's *Fundamenta physices* were also based on the contents of his *Physiologia sive cognitio sanitatis* (REGIUS 1641), *Responsio, sive Notae in appendicem* (REGIUS 1642) and of his unpublished *Compendium physicum*, whose contents were developed by Regius on the sole basis of Descartes's *Essais*: see VERBEEK 1994, 546; BOS 2002, 4, n. 9.

[33] REGIUS 1646, 251-254.

[34] *Ibid.*, 249.

[35] *Ibid.*, 287, 305-306.

[36] See the letter of Descartes to Regius of July 1645: AT IV, 249, BOS 2002, 187-188. For an account of the role of illustrations in Descartes's cosmology, see LÜTHY 2006, 113-116.

First of all, according to Regius the laws of motion are not deduced from the constant action of God on the world[37]. Hence, he mentions only Descartes's first[38] and second law, and grounds these on experience[39]. Descartes's third law is left out by Regius, nor he adopts all the seven rules of impact drawn by the Frenchman from the laws of motion[40]. Given the problematic status of the third law and of the rules of impact[41], Regius focuses on the relation between force, size and speed of bodies (in his words, *validitas*, *celeritas* and *tarditas, magnitudo* and *parvitas*[42]) by showing how these can be exploited by means of some simple devices[43]. He does not provide the rules of their behaviour, still maintaining their proportionality. This can be observed with lever (*vectis*), inclined plane (*planum inclinatum*, fig. 8) and pulley (*trochlea*), represented by Regius according to their geometrical features or in more realistic ways[44]. The conclusions reached through these devices are generalized to the use of wheel and axle (*axis in peritrochio*), snail (*cochlea*), wedge (*cuneus*), mentioned as samples of more complex devices, since they embody the combination of the previous tools[45]. Eventually, instead of Descartes's rules of collision – put in pictures by De Raey – Regius sets forth some samples of daily used devices. Their illustration does not convey the idea of the basic, mechanical behaviour of parts of matter in the

---

37 DESCARTES 1644, II, §§ 36-42.
38 REGIUS 1646, 1, 7.
39 *Ibid.*, 17.
40 Regius avails only the first and second rule: *ibid.*, 18-19.
41 CLARKE 1977.
42 REGIUS 1646, 10-11.
43 «Illa proportio celeritatis, in parvo corpore existentis, ad magni mobilis tarditatem, in illis machinis, per earum conformationem variam, infinitis rationibus potest augeri et variari […]. Atque haec in machinis facile demonstrari possunt», *ibid.*, 11.
44 *Ibid.*, 12-13. Fig. 8 is at p. 13.
45 *Ibid.*, 15-17.

same way as De Raey attempted to show. In fact, Regius's illustrations serve only to help the reader in grasping the very existence of forces. They have a main pedagogical function and reflect the empirical attitude of Regius, both in discovery and in teaching. On the other hand, illustrations play a more relevant role in Regius's next, general considerations on the properties of motion, concerning its determination or direction.

By considering the difference between motion and direction in a moved body, and the opposition between different determinations in motion – since the quantity of motion cannot vary, whereas directions can be changed in colliding bodies[46] – Regius presents some samples of reflection and refraction of bodies, for whose discussion he relies on the sample of the tennis ball provided in Descartes's *Dioptrique* (fig. 9), depicted by Regius in its mere geometrical features (fig. 10)[47]. Instead of Descartes's metaphysical deduction of the mechanical laws of nature, which results in a hardly depictable imagery, Regius presents some practical samples revealing the existence of forces and the geometrical determination of colliding bodies, borrowed from Descartes's *Dioptrique*. His empirical and geometrical account of the basics of physics, hence, results in a more consistent illustrative apparatus devoted to their explanation.

Regius's didactic purposes are testified in the most part of his *Fundamenta physices*, which are abounding of several illustrations. Along with

---

[46] *Ibid.*, 18-19. Regius mentions Descartes's first and second rule of collision as samples of the modification of determination of motion. See DESCARTES 1644, II, §§ 44-52.

[47] «Ut motus oritur a corpore movente, ita haec originem ducit ex situ superficiei corporis moventis vel obvii. Quid situs corporis moventis hic possit, manifestum est in determinatione pilae reticulo propulsae», REGIUS 1646, 19 (fig. 9). Fig. 10 is taken from DESCARTES 1637, *La dioptrique*, 13. On the use of geometrical illustrations in Descartes's *Dioptrique*, see LÜTHY 2006, 99-101.

the pictures yet contained in Descartes's *Principia* and *Essais*, one can find new illustrations of the inclination of earth axis[48], of burning lenses[49], of the structure of snow[50], of magnetic phenomena[51] and of anatomical parts[52]. Actually, the images of dissected bodies reveal the source of Regius's empirical attitude, namely, his medical interests. Regius aimed philosophy to the application of Cartesian principles to health care[53], and his efforts were to integrate the results of anatomical observations by explaining them with mechanical philosophy, whose epistemic foundation reflects his medical empiricism. According to Descartes, however, Regius plagiarized his unpublished *Traité de l'homme*[54]. Theo Verbeek, who has shown that Regius could read a copy of Descartes's treatise only when he was correcting the proofs of his own book, nevertheless, had established the originality of Regius's *Fundamenta physices*[55]. Therefore, Regius's *Fundamenta physices* include the first complete exposition of a Cartesian physiology, based on Descartes's published works and on his *Le monde*, but also independently developed by Regius.

In order to present in a comprehensive way the functioning of human body, chapters VIII to XI of Regius's *Fundamenta physices* contain some illustration concerning anatomical parts. These are to be considered, thus, as the first anatomical illustrations provided in a Cartesian treatise: indeed,

---

48 REGIUS 1646, 70.
49 *Ibid.*, 86.
50 *Ibid.*, 117.
51 *Ibid.*, 135-138, 140-144.
52 *Ibid.*, 168-236, 296-297.
53 REGIUS 1647, 3.
54 See the preface to the French translation of Descartes's *Principia philosophiae* (1647): AT IX-B, 19-20
55 VERBEEK 1994, 542-543.

Descartes's illustrated *De homine* would be published only in 1662 by Florentius Schuyl and in 1664 by Claude Clerselier[56], who would be refused by Regius (according to Clerselier, the only one who could provide Descartes's explanation of bodily functions with illustrations) of his help[57]. Furthermore, Descartes's *Descriptio humani corporis*, redacted in 1647 and 1648, does not contain any picture, nor in his *Essais*, *Principia* and *Le monde* any picture is devoted to living bodies, with the exception of some idealized representation of human eye and brain present in his *Dioptrique*[58]. For his physiological explanations, thus, Regius presents the picture of the dissected body of a dog, on which he could have some experience, mentioned also by Descartes[59]. Canine body, indeed, is similar to human body and allows an explanation of *coctio* and of blood circulation, studied through vivisections carried on by tying veins and vessels[60]. Other images, concerning human body, represent heart, lungs, biliary, hepatic and cystic vessels, excretory and genital apparatus, as well as brain[61]. Such pictures offer a broad overview of the main structures and organs of body, serving as a didactic introduction to anatomy according to a mechanical point of view. Moreover, such didactic function is revealed by the picture of a slug in a bottle, used in order to

[56] ZITTEL 2011.
[57] DESCARTES-CLERSELIER 1664, preface, 6-9 (unnumbered).
[58] See *Discours* V and VI. Similar pictures are presented by Regius in chapter XII of his *Fundamenta physices*, devoted to man.
[59] REGIUS 1646, 175. Such experiences concern *coctio* and lacteal vessels, discovered by Gaspare Aselli in the body of dog. On the use of experience in Regius's physiology, see KOLESNIK-ANTOINE 2013; see the letter of Descartes to Regius of 24th of May 1640, commented *ibid*., 133 (AT III, 66-70). On the relation of physics and medicine in Regius and Descartes, see BITBOL-HESPÉRIES 1993. On the use of illustrations in medical textbooks, see KUSUKAWA 2012; PANTIN 2013.
[60] REGIUS 1646, 168, 171-172, 185, 189.
[61] *Ibid*., 176-223.

explain spontaneous movement in body by means of analogy[62]. Still, in his considerations and illustrations on physiology Regius shows some originality in respect to Descartes, who aimed to explain *coctio* in a more general way, whereas Regius was more detailed in his explanations, as he attributed *coctio* to different processes going on in ventricles, intestines, liver and heart. For this purpose, he illustrates the dissected body of a dog from different perspectives (figs. 11, 12)[63], in its overall structure.

The empiricist epistemology and the didactic aims of Regius's textbook are even more noticeable in its further editions, as its original structure is revised and enlarged[64]. In its 1654 edition (*Philosophia naturalis*) Regius openly declares how he works with those insensible features hypothesised to explain the observable functions of bodies. He underlines the hypothetical character of explanations involving unobservable qualities, provided only with a moral certitude grounded in Revelation[65]. Their existence and typologies are thus assessed «per manifestam […] imaginationis demonstrationem»[66], whereas in the first edition he attributed such hypothesis to intellect only[67]. In this way, Regius provides the assessment of the existence and shapes of insensible particles with a foundation on imagination. Descartes's supposedly clear and distinct deduction of the existence of such particle[68], therefore, is replaced by Regius with a mere imaginative reasoning, in accordance with his account of

[62] *Ibid.*, 232.
[63] Fig. 11, *ibid.*, 171; fig. 12, *ibid.*, 168, 185.
[64] VERBEEK 1994, 546.
[65] REGIUS 1654, 441-442.
[66] *Ibid.*, 8.
[67] «Insensibiles sunt, quae, propter exiguitatem […] sensus fugientes, solo intellectu […] observantur», Regius 1646, 3; «insensibiles sunt, quae, propter exiguitatem […] sensus fugientes, solo imaginationis et iudicii intellectu […] observantur», *ibid.*, 6.
[68] On imagination and deduction in Descartes, see LÜTHY 2006, 124.

philosophical knowledge. Ultimately, Regius takes Descartes's "clear and distinct knowledge" out of its metaphorical context, that is, it is traced back to visual representation.

Furthermore, between the first and the second edition of Regius's *Fundamenta physices* a main difference in pictures is in the increased number of the devices used to show the properties of motion[69]. Regius includes the image of a balance to illustrate the basic concept of position, by showing how different positions of weights modify the equilibrium in this device[70]. Also, differences in 1654 edition are recognizable in the figurative apparatus enriching the section on astronomy, where Regius adds thirteen pictures, often repeated in text[71]. These are all new in respect to Descartes's books, with the exception of a table of solar system which can be found in Descartes's *Principia,* printed with a type used again for Regius's 1646 *Fundamenta physices* (fig. 13), and modified and enriched in 1654 text with a crown of fixed stars (fig. 14)[72]. This replacement could have practical reasons, as the loss of the original type: however, it is more likely a didactic addition within the enlarged section on astronomy[73]. Even the confrontation with the traditional systems is emphasized, as, along with images concerning Copernican system, tables of Tyhconic and Ptolemaic universe are printed in

---

69 REGIUS 1654, 27, 28, 32.

70 «Situs est corporis inter corpora positio. Huius efficacia patet, vel ex sola aequipondii A, in statera C B, positione varia, qua vel maiora, vel minora pondera D, propter situs eius varietatem, attolluntur, vel in aequilibrio sustinentur», *ibid.*, 43.

71 New images are at pages 83, 91, 92, 94, 97, 100, 104, 110, 114, 120, 122, 124, 127, 129, 131, 132, 137-141, 167.

72 REGIUS 1646, 60 (fig. 13); REGIUS 1654, 83, 91, 114, 137 (fig. 14). See DESCARTES 1644, 83. On the use of illustrations in astronomical treatises, see PANTIN 2001; see also RAPHAEL-JARDINE 2010-2011, and FAY-JARDINE 2012.

73 Such section passes from twenty-two pages of *Fundamenta physices* to fifty-nine of 1654 *Philosophia* naturalis: cf. REGIUS 1646, 54-76 and REGIUS 1654, 82-141.

the book[74].

Such confrontation reveals the didactic function of the images, serving for the explanation of the differences between old and new models. Finally, in the last edition of Regius's *Fundamenta physices*, i.e. in his 1661 *Philosophia naturalis*, there is the description of a new anatomical experience, carried on by Ludovicus Bilsius on the body of a dog[75]: it serves to confirm that chylum passes through mesaraic vessels in intestines, as Regius already supposed in his 1641 *Physiologia* – which does not contain any picture – and in 1646 *Fundamenta physices*, against Descartes's opinion[76]. Still, this experience is described without any new pictorial means. In fact, mesaraic vessels had already been depicted in fig. 11 (I-K-L), present in Regius's 1646 *Fundamenta physices* and aimed to help the explanation of *coctio* and blood circulation. However, such anatomical images do not convey any interpretation on the mechanical behaviour of canine body, as they have a didactic role in respect to the overall structure of body.

In sum, one can state the didactic function of Regius's illustrations, and, by consequence, of his whole *Fundamenta physices*. This is to be noticed, above all, in the additions to the pictorial apparatus he borrows from Descartes's works. Moreover, one can recognize a more consistent use of illustrations in Regius's books than in Descartes's. Whereas pictures in Descartes's books serve to fill the gap between the clarity and distinction of his supposedly deductive physics and its actual development through hypotheses, *a posteriori*

---

[74] *Ibid.*, 140-141.

[75] REGIUS 1661, 297. Such experience is described in BILSIUS 1659. See KOLESNIK-ANTOINE 2013, 138-139.

[76] REGIUS 1641, *De actionibus naturalibus; Pars prior*, § 9 (19-20), edited and commented in BOS 2002, 213. REGIUS 1646, 172-174. See BOS 2002, 43-44 (notes 18-19), KOLESNIK-ANTOINE 2013, 131-132.

explanations and conceptualizations based on imagination instead of on pure intellect[77], Regius uses the same pictures in order to support an explanation of phenomena based on hypothesized or imagined physical features. They can thus find their proper place in Regius's *Fundamenta physices* rather than in Descartes's exposition of his supposedly deductive physics.

3. Missing illustrations

The illustrations provided by De Raey and Regius reveal the different ways by which Cartesian physics was disseminated in the Dutch context. However, it is important to note that Cartesian theories were also spread by scarcely illustrated treatises, or even not provided with any illustration: in so far, such absence deserves an explanation. This is the case of De Raey's pupil Johannes Clauberg (1622-1665), whose attempts to favour the dissemination of new philosophy mainly concerned logic and metaphysics, exposed in his *Defensio cartesiana* (1652), *Logica vetus et nova* (1654, 1658) and *Initiatio philosophi* (1655). Eventually, he edited his writings on natural philosophy in the 1660s, without any illustration. His *Physica*, published in 1664, contains his *Pysica contracta* (or *Dictata physica privata*), *Disputationes quibus principia physica latius explicantur*, *Theoria corporum viventium* and *Corporis et animae in homine coniunctio*[78], which have a scholastic format. His *Physica contracta*, indeed, consists in a series of dictates on the main topics of Descartes's physics, which are discussed in the following *Disputationes*. These, actually, are maintained

---

[77] LÜTHY 2006, 107.
[78] CLAUBERG 1664A.

in their original form as a series of questions and solutions. Whereas De Raey and Regius rearranged the contents of their disputations in illustrated books, Clauberg remained loyal to the original structure of disputes as vehicles of philosophical knowledge, which could be hardly carried on by means of illustrations. Also his *Theoria corporum viventium*, where Clauberg considers life through a Cartesian interpretation of the traditional principles of humidity and heat, is structured on a series of definitions. His *Coniunctio*, finally, focuses on the problem of interaction of soul and body from a metaphysical point of view, which allows no visual representation. According to Clauberg illustrations had no basic didactic use – as this can be appreciated in Regius's books – and he replaced them by a more traditional exposition of Descartes's physics through dictates and discussion of particular problems. Ultimately, this was consistent with his broader attempt to provide Cartesian philosophy with a scholastic form.

Furthermore, a scarce figurative apparatus is also found in the texts of Arnold Geulincx (1624-1669), teacher at Leiden University from 1662. His *Physica vera*, indeed, contains few geometrical figures concerning the properties of motion, which were not even printed in the first edition of the treatise, published in posthumous works of his pupil Cornelis Bontekoe (1688)[79]. However, Geulincx's text explicitly refers to such figures (*schemata*), which can be finally found in the critical edition of his works published by Jan Pieter Nicolaas Land in the 1890s[80]. In fact, these *schemata* reveal the peculiar character of Geulincx's Cartesian physics, which is provided with a deductive structure. According to Geulincx, indeed, physics relies on few

[79] BONTEKOE 1688.
[80] GEULINCX 1892, *Physica vera*, 394-395, 403-404, 406, 410.

rational principles, expounded in his *Physica vera* through a series of properties of body, movement and rest, which are systematically deduced from each other. Thus, the first treatise of Geulincx's *Physica vera* concerns the nature body and its properties (as its being divisible, palpable, or indefinite), whereas the second one is about motion. This latter, actually, is illustrated by few geometrical figures concerning the determination of motion according to straight or circular lines (fig. 15), as well as some case of reflection of bodies[81]. Moreover, in the third treatise, *De quiete*, Geulincx include the picture of globes in order to show that some space is left among them, and require a subtler matter to be filled up – as in the case of Descartes's, De Raey's and Regius's imagery. Eventually, these pictures do not convey any mathematical law: still, they reflect the character of Geulincx's physics as visualizations of the deductively argued "geometrical" properties of matter and motion. Therefore, they have a demonstrative and teaching function. On the other hand, in the following treatises of Geulincx's *Physica vera*, devoted to the assessment of a bulk of hypotheses on the constitution of the world and to their use in the explanation of astronomical phenomena and bodily functions, no picture can be found. For instance, in the fifth treatise (*De mundo magno*) Geulincx expounds Descartes's vortex theory and his account of the nature of light[82]. Whereas one can find in Descartes's works an impressive amount of pictures aimed to help the understanding of such theories, this section of Geulincx's treatise is not illustrated. Indeed, as far as the illustrative

---

[81] *Ibid.*, 394-395, 403, 404, 406. Fig. 15 is at p. 394: it serves to explain that insofar the angle EAB is always minor than GHI (since in the case of a coincidence of points G and H with E and A , the line HI will intersect the arch BA) a body deflecting from the line FE would "facillime" follow the angle EAB as its new direction, rather than GHI. Thus, bodies deflecting from straight direction will assume circular trajectories.

[82] *Ibid.*, 428-439.

apparatus of Descartes's vortex theory was widely spread and known in Dutch context, there was no need to replicate it. Furthermore, since Geulincx was attempting to reduce Cartesian physics to a deductive bulk of propositions, he did not need any persuasive means besides few geometrical figures to convey his theories.

4. Late Cartesian illustrations

After the death of Geulincx, the appointments of the Cartesian professors Theodor Craanen and Burchard de Volder strengthened the teaching of new philosophy at Leiden University. Moreover, a physical theory embodying some Cartesian principle was developed by Wolferd Senguerd, to be considered, along with De Volder, as the main expounder of Leiden experimental tradition. Theodor Craanen (1620-1689) attempted to develop a Cartesian medicine extensively based on the theories of Henricus Regius, who had been his mentor at Utrecht University. His theories are presented in his *Oeconomia animalis* (1685)[83], *Lumen rationale medicum* (1686)[84], and *Tractatus physico-medicus de homine* (1689)[85]. Actually, Craanen's *Oeconomia animalis* does not contain any illustration. While addressing different problems on the nature and diseases of body, explained in the light of the

83 CRAANEN 1685. See LUYENDIJK-ELSHOUT 1975.

84 CRAANEN 1686. Regius's *Praxis medica* had three editions: however, only the second one can be found (REGIUS 1657A). Regius's *Praxis medica* was published along with his *Fundamenta medica* (REGIUS 1647, REGIUS 1657B, REGIUS 1668). Whereas Regius's *Fundamenta medica* are devoted to the explanation of the principles of medicine, his *Praxis medica* contains some samples of their application. On the other hand, his *Fundamenta physices* set the ground for medicine: still, the contents of Regius's medicine are mostly borrowed from traditional medicine: see VERBEEK 1989.

85 CRAANEN 1689.

mechanical behaviour of subtle matter and animal spirits in vessels and pores, Craanen presents his theory by a series of questions and answers, avoiding a systematic approach. Also, his *Lumen medicum*, a commentary of Regius's *Praxis medica*, only contains medical prescriptions for particular cases of disease: hence, no illustration is required for it. On the other hand, one can find a magnificent illustrative apparatus in his more systematic *Tractatus physico-medicus de homine,* posthumously edited by Theodor Schoon «cum figuris aeneis». This treatise embodies a comprehensive explanation of the functions of human body from a Cartesian standpoint, based on the principles of subtle matter, fermentation and pores, whose structure is conceived by imagination[86]. It is noteworthy that Craanen refines Regius's and Descartes's imagery, as he provides more detailed anatomical illustrations (fig. 16[87]), pictures of the geometrical figures of pores (fig. 17[88]), and various depictions of phenomena analogue to those taking place in human body. It is to be noticed, for instance, a new use of the illustration of wedge, used in Regius's *Fundamenta physices* to provide an example of the existence of forces (fig. 18), and assumed by Craanen to demonstrate the circulation of fluids in the body (fig.19)[89]. Whereas Regius's illustrations

[86] «Similem structuram nobis debemus imaginari in tubulis, tendentibus ex uno musculo in eius antagonistam […]», *ibid.*, 460.

[87] Fig. 16, *ibid.*, 726: it portrays the female reproductive apparatus. Anatomical pictures are also present at pp. 23, 74, 82, 122, 126, 131, 239, 268, 291, 322, 336, 393, 464, 474, 548, 732 and 746.

[88] Fig. 17, *ibid.*, 274.

[89] Fig. 18, REGIUS 1646, 16; fig. 19, CRAANEN 1689, 152. Also, a refinement of the illustrations present in older Cartesian treatises is to be noticed in the depiction of the metaphor of the stick, aimed to explain sense perception, or that of canvas for imagination, inspired by those of Descartes's *De l'homme* illustrated by Clerselier, Craanen uses the example of the sticks to explain vision (CRAANEN 1689, 474; DESCARTES-CLERSELIER 1664, 50), and that of canvas for imagination (CRAANEN 1689, 577; DESCARTES-CLERSELIER 1664, 76).

mainly have a didactic function in respect to Descartes's physiology, those of Craanen aimed to present further discoveries and theories. Hence, he needed a renewed imagery – still based on the previous examples.

Finally, a huge illustrative apparatus is present in the works of Wolferd Senguerd (1646-1724). His use of illustrations reflects the character of his scientific enterprise. First of all, Senguerd was consistently concerned with experimental practices: in his *Philosophia naturalis* (1681, 1685) he uses illustrations to show machines as the air pump Johann van Musschenbroek built for him (fig. 20), as well as De Volder's air pump, built by Samuel van Musschenbroek (fig. 21)[90]. Less embellished pictures of instruments are also present in his *Rationis atque experientiae connubium* (1715), where experimentalism is more carefully theorized in its methodological relevance. Differences with his *Philosophia naturalis* are plain, as Senguerd provides detailed illustrations of pneumatic devices and Torricelli's tube, (fig. 22) relevantly different from its depiction in his 1680 treatise (fig. 23)[91], where it has a decorative character.

Actually, Burchard de Volder, who established the Leiden experimental cabinet in 1675, carried on experiments on pneumatics also. Still, his *Quaestiones de aëris gravitate* (1681), the only text he devoted to physics, do not contain any picture. Apparently, De Volder was more interested in practical, experimental teaching[92] (aimed to confirm a mechanical worldview based on

---

[90] Fig. 20, SENGUERD 1681, 169; a more refined illustration of the same pump can be found in the second edition of Senguerd's *Philosophia naturalis* (SENGUERD 1685), 256; fig. 21, SENGUERD 1681, 65. On Leiden instruments makers, see DE CLERCQ 1997. On De Volder and Senguerd, as well as on the Leiden experimental tradition, see DE PATER 1975; WIESENFELDT 2002.
[91] Fig. 22, SENGUERD 1715, table II; fig. 23, SENGUERD 1681, 62. Cf. fig. 7.
[92] On De Volder's teaching, see NYDEN 2013 and NYDEN FORTHCOMING.

Descartes's principles), than to develop a comprehensive experimental philosophy. In fact, in his *Quaestiones* De Volder mentions the use of Torricelli's barometer and Von Guericke's sphere: however, he mainly describes mental experiments with the use of tube[93] and does not provide any picture. The depiction of his air pump and of barometer, on the other hand, can be found in Senguerd's *Philosophia naturalis*, appeared in the same year of De Volder's *Quaestiones* and meant to provide a comprehensive physical theory, also conveyed by pictures as persuasive tools. In fact, in his *Philosophia naturalis* Senguerd reveals an eclectic approach, as he combines Cartesian, Aristotelian, and atomist positions. For instance, he conceives body as extension itself: still, he admits the existence of void and explains gravity in terms of desire for unit of matter[94]. Eventually, his multifaceted theory is supported by a refinement of Cartesian imagery. This is the case of the illustration of vortex printed in Regius's *Philosophia naturalis* (1654) as a geometrical figure (fig. 24) and replaced with an artistic depiction in Senguerd's treatise (fig. 25)[95], or that of *particulae striatae*, illustrated in a picture that has a more decorative than a didactic or explanatory value (fig. 26)[96]. Furthermore, some images present in the first edition of the text as terse geometrical figures are replaced by magnified metaphors of natural processes in the second edition of Senguerd's book (1685)[97]. Also, in such edition new images are added to make more understandable the phenomena of the communication of motion, as that of soldiers ramming a gate, which replaces

---

[93] De VOLDER 1681, 16-23.
[94] SENGUERD 1681, 10-11, 59, 109
[95] Fig. 24, REGIUS 1654, 19; fig. 25, SENGUERD 1681, 51.
[96] Fig. 26, SENGUERD 1681, 125. Cf. those of De Raey, figs. 4-5.
[97] SENGUERD 1681, 62, cf. SENGUERD 1685, 83.

Regius's image of the wedge[98]. Eventually, Senguerd's *Philosophia naturalis* embodies the last development of Cartesian imagery, as Descartes's and Regius's essential visualizations are rendered into fine pieces of art. However, the persuasive or wondering function of pictures would disappear from Newtonian treatises.

5. Newtonian machines in view

The teaching of De Volder and Senguerd at Leiden University paved the way to the dissemination of Newtonian physics in the Netherlands, since they made experimental practices part of academic curriculum and purported a model of philosophical knowledge consistently open to the use of experience[99]. The first expounder of Newtonian physics in the Dutch context was Willem Jacob 's Gravesande (1688-1742), who taught the contents of Newton's *Principia mathematica* (1687) and *Opticks* (1704) to an audience more versed in experimental practices than in the complex mathematical apparatus of Newton's natural philosophy, which hindered its dissemination. Like John Desaguliers, whose lectures in experimental philosophy were attended by 's Gravesande during his staying in England in 1715 and 1716, 's Gravesande tried to spread Newtonian physics «without geometry»[100], that is, by stressing its experimental character. The demonstration of Newton's physics through experiments was thus presented by 's Gravesande in his monumental *Physices elementa mathematica, experimentis confirmata*, firstly

[98] *Ibid.*, 40.
[99] VAN BUNGE 2013; VAN BUNGE FORTHCOMING.
[100] GORI 1972, 96, n. 25. On 's Gravesande methodology, see DUCHEYNE 2014.

published in 1720-1721[101], which had three further revised editions (1725, 1742, 1748), as well as numerous translations and reprints[102], testifying its international and not only academic audience. Hence, his *Elementa* were provided with several tables representing machines and tools used in experiments, carefully indexed and scale reduced[103], serving as an essential expository mean. Such *tabulae*, actually, make his *Elementa* a technical manual for their construction (figs. 27-28)[104]. On the other hand, no illustration of insensible particles are depicted in 's Gravesande's treatise, in accordance with his rejection of Cartesian hypotheses of insensible features[105]. Eventually, Newtonian illustrations are not intended to convey an imaginative physics, and they have no more a persuasive function as Cartesian illustrations; rather, they present the actual means of scientific discovery. Accordingly, such illustrations have not a strict didactic function: indeed, the simplified version of 's Gravesande's *Elementa*, his *Philosophiae Newtonianae Institutiones in usus academicos* (1723), aimed for students, lacks of the tables of machines and experiments performed during lectures[106]. These are replaced with few tables showing how forces interact through simple

---

[101] 'S GRAVESANDE 1720-1721.
[102] For a comprehensive bibliography, see DE PATER 1988. On the reception of Newtonian science through illustrations, see DUPRÉ 2008.
[103] See the 3rd edition ('S GRAVESANDE 1742), *Index Tabularum*, LXXV-LXXXVI.
[104] Fig. 27, *ibid*., 42, table IV; fig. 28, 'S GRAVESANDE 1720-1721, vol. II, 16.
[105] 'S GRAVESANDE 1736, III, § 34.
[106] «Minori ideo forma eadem nunc recudi curavimus, ut dum in ante edito tractatu, sibi auditores in memoriam revocant, quae a nobis coram oculis exponuntur, in portatili volumine ea habeant, quae circa physicam in privatis et publicis exercitiis explicamus […]. Experimentorum quibus propositiones aliunde demonstratae confirmantur, aut dilucidantur, nulla hic fit mentio; illorum vero, quibus quae naturae leges spectant deteguntur, ea tantum memorantur quae ad, inde deductas, conclusiones, intelligendas, necessaria sunt», 'S GRAVESANDE 1723, *Ad lectorem*, 2 (unnumbered). The handbook had several reprints.

idealized bodies and geometrical images.

Having been introduced in the Low Countries by ‘s Gravesande, Newtonian physics was spread and developed also by his pupil Petrus van Musschenbroek (1692-1761), professor at Utrecht and Leiden universities. His works and illustrations reveal an approach different from that of ‘s Gravesande’s. Besides being used to make Newton’s physics more understandable[107], his experiments and illustrations are functional to his “Baconian” project to “vex” nature. Following the rules set forth in his *Oratio de methodo instituendi experimenta physica* (1730)[108], Musschenbroek performed several experiments on magnetism, electricity, meteorology, botany, anatomy and zoology, aimed to further the results of the new experimental science. Musschenbroek’s “Baconian” attitude is revealed by the large amount of data graphs present in his works, as those provided for the sake of the discovery of a law of magnetism in his *Physicae experimentales dissertationes*, where Bacon and Newton are regarded as the first and the last masters of Seventeenth Century experimental physics[109]. Besides simple graphs, moreover, the dissertations contain also depictions of balances and compasses used for experiments and of idealizations of natural bodies, as magnetized masses[110]. Such historical attitude is even more noticeable in his *Additamenta* to Lorenzo Magalotti’s *Tentamina experimentorum in Academia del Cimento* (1667, 1731). Magalotti’s essay is a relevant example of Seventeenth Century Italian experimentalism, assumed by Musschenbroek as the starting point of his

---

[107] «Nous allons tâcher de faire comprendre cela plutôt que de le démontrer mathématiquement. Représentez-vous que le vase ABCD […]», MUSSCHENBROEK 1739, 386.
[108] In MAGALOTTI-MUSSCHENBROEK 1731, I-XLVIII.
[109] MUSSCHENBROEK 1729, *Praefatio*, II. On Baconianism in the Netherlands, see STRAZZONI 2012.
[110] MUSSCHENBROEK 1729, table I, IV, IX.

survey. The most part of images is about machines and instruments mainly yet contained in the original work, whereas new pictures are data graphs added by Musschenbroek[111]. In this treatise, nevertheless, we can find the description and the illustration of pyrometer, one of Musschenbroek's most famous inventions, depicted in an *Additamentum* to Magalotti's *Experimenta circa aliquem effectum caloris et frigoris* (fig. 29)[112].

In so far, whereas 's Gravesande's illustrations have a disseminating function in respect to Newton's physics, those of Musschenbroek serve to convey new experimental data. A basic didactic function is however fulfilled by Musschenbroek's handbooks for students[113], and it is revealed by images. As in the case of 's Gravesande's *Institutiones*, such handbooks are scarcely illustrated as they convey the basics of physics. This is the case of his *Epitome elementorum physico-mathematicorum* (1726), which has no illustrations. Musschenbroek's *Elementa physicae* (1734) and *Institutiones physicae* (1748), on the other hand, are enriched with idealizations of optical phenomena and geometrical images, but with few views of machines[114]. In his *Institutiones* Musschenbroek presents simple devices as barometer, lever and pump[115]. Machines and tables can be found in a consistent manner again in his posthumous *Introductio ad philosophiam naturalem* (1762), the *resumé* of

---

111 With the exception of tables XXIX-XXXII. Common instruments are aimed to data collection: as thermometer or clock. See MAGALOTTI 1667, 3, 6, 8, 13, 17, 19, 21; MAGALOTTI-MUSSCHENBROEK 1731, tables I, II.

112 Fig. 29, MAGALOTTI-MUSSCHENBROEK 1731, table XXX, 12.

113 MUSSCHENBROEK 1726; MUSSCHENBROEK 1734; MUSSCHENBROEK 1748; MUSSCHENBROEK 1762A;

114 MUSSCHENBROEK 1734, tables XV-XVI.

115 MUSSCHENBROEK 1748, tables I, III, VIII, XVI, XXIII. Musschenbroek adds the description of the well renowned Leyden jar, used for experiments on electricity, *ibid.*, 198-239.

Musschenbroek's natural philosophy[116]. Eventually, his *Introductio* contains some pictures of corpuscles, revealing a less critique attitude to the use of hypotheses on the microscopical features of bodies (fig. 30)[117].

6. Illustrations as rupture means

Despite their peculiarities, the images used by 's Gravesande and Musschenbroek served to help the understanding and the developments of a natural philosophy different from that of Scholastic or Cartesian philosophers. In Aristotelian philosophy visual depictions were not required and even impossible, as phenomena were explained through essences and teleological principles. On the other hand, Descartes's physics concerned features to be deduced from the notion of extension. Illustrations have thus an important role in Cartesian treatises, as they represent geometrical entities – i.e. the modes of matter – potentially attainable through vision. Finally, Newtonian imagery mainly concerns machines, and has a scientific rather than a persuasive function, as it represents those devices allowing the development and confirmation of scientific theories. In fact, whereas Cartesian machines do not play a central role in scientific discovery and demonstration, and often have a wondering function, in Newtonian physics they are the essential means of scientific enterprise, and are much more carefully illustrated. Still, continuity between Cartesian and Newtonian illustrations stands in their very role as vehicles of new ways in

---

116 MUSSCHENBROEK 1762B.

117 Fig. 30, *ibid*., vol. I, table I. See 23-55.

understanding nature. Like Descartes, Regius and De Raey used images as disseminating means in the central years of seventeenth century, ‘s Gravesande would pursue the exposition of the hardly understandable mathematical physics of Newton through the visual means of experiments, machines and their depiction in books. Eventually, the presence of pictures in early modern philosophical treatises is to be accounted for in the light of their role of rupture means of the established philosophical and scientific paradigms. However, such account is still in its commencement.

ANDREA STRAZZONI

ERASMUS UNIVERSITY, ROTTERDAM

ILLUSTRATIONS

Fig. 1

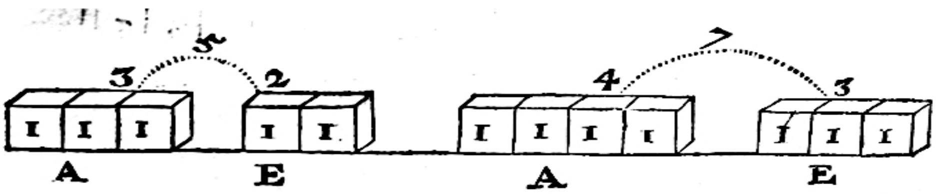

Fig. 2

Fig. 3

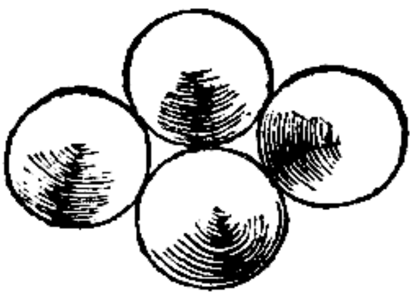

Fig. 4

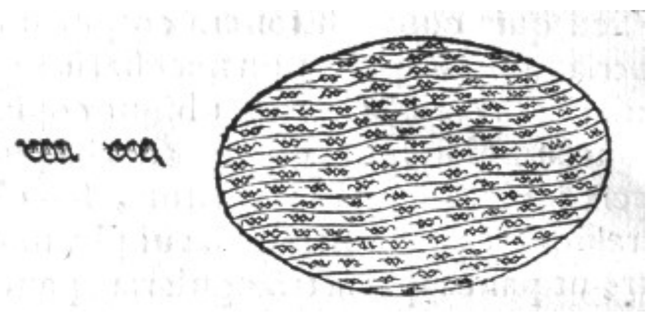

Fig. 5

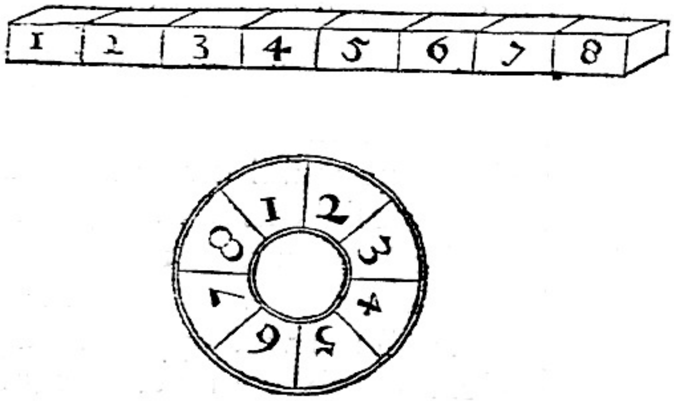

Fig. 6

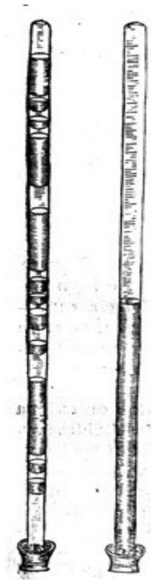

Fig. 7

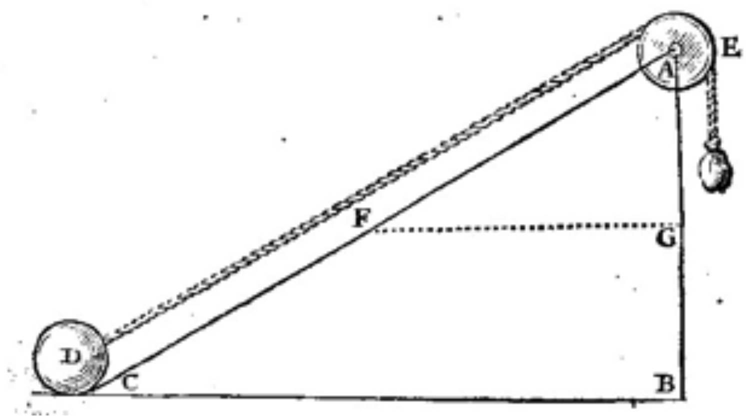

Fig. 8

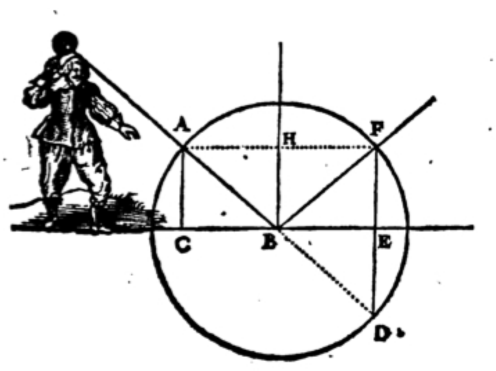

Fig. 9

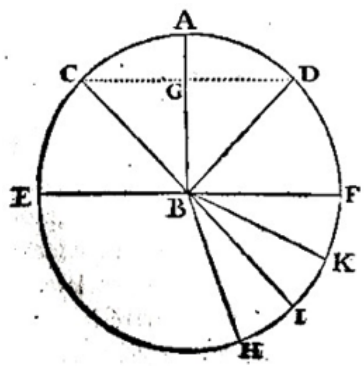

Fig. 10

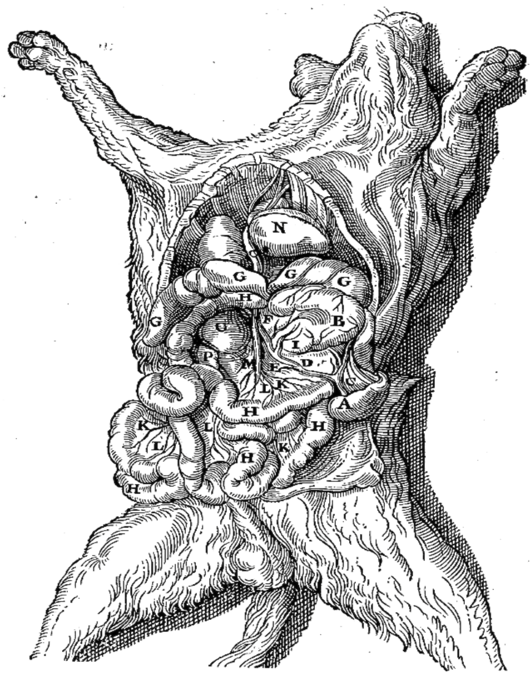

Fig. 11

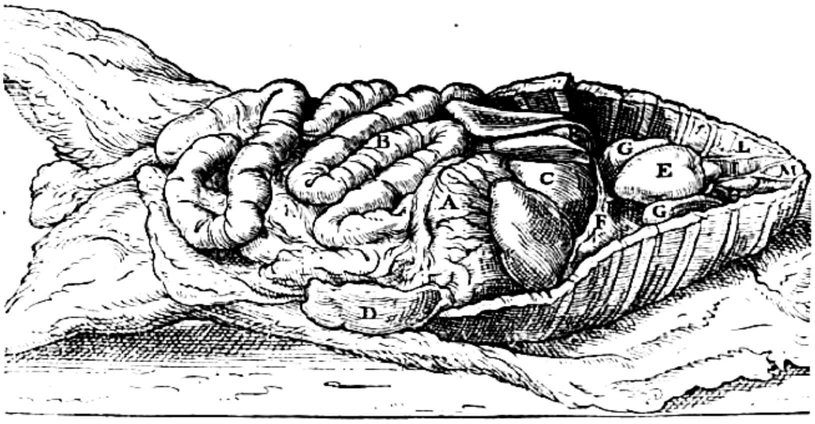

Fig. 12

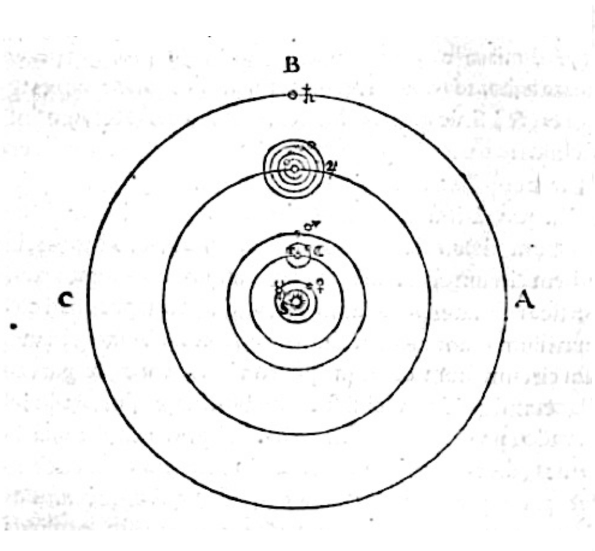

Fig. 13

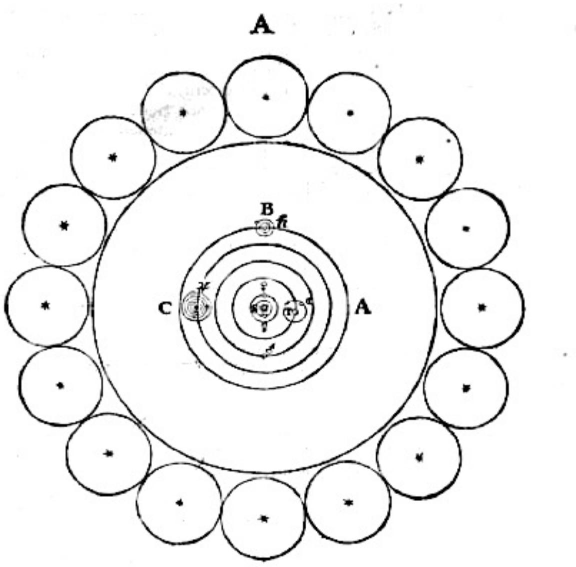

Fig. 14

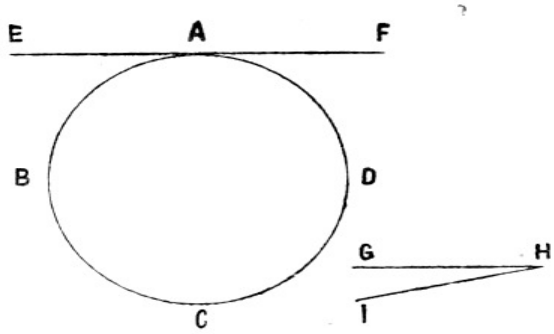

Fig. 15

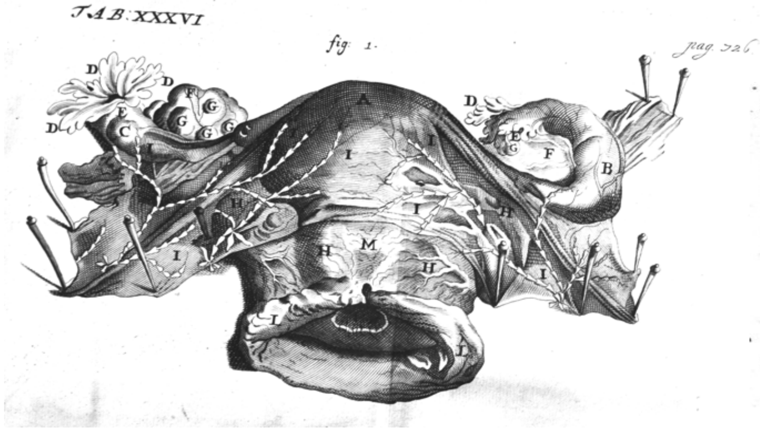

Fig. 16

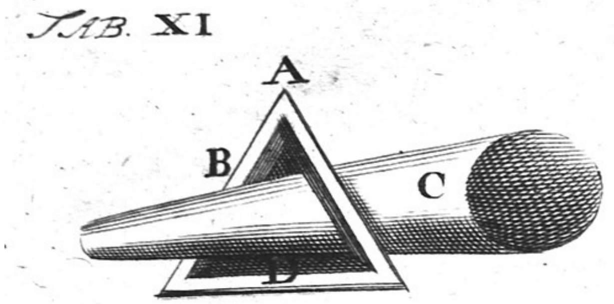

Fig. 17

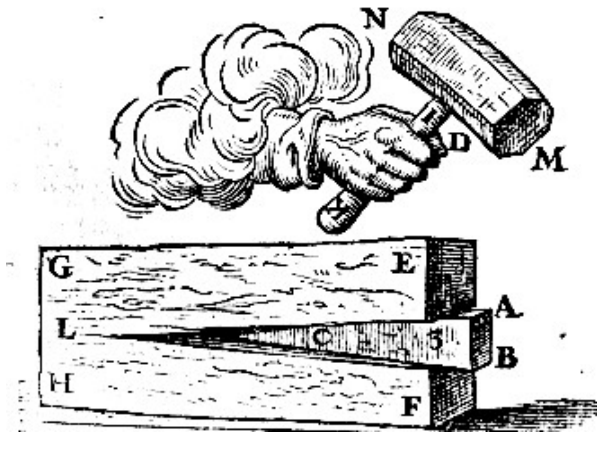

Fig. 18

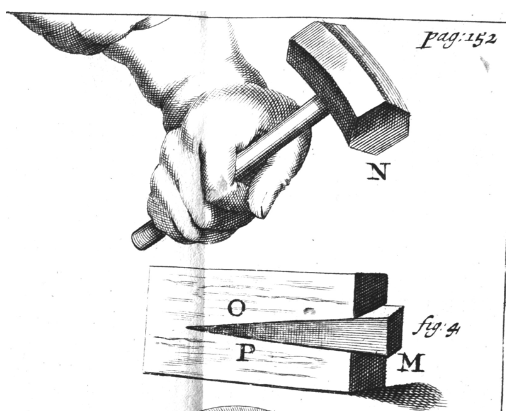

Fig. 19

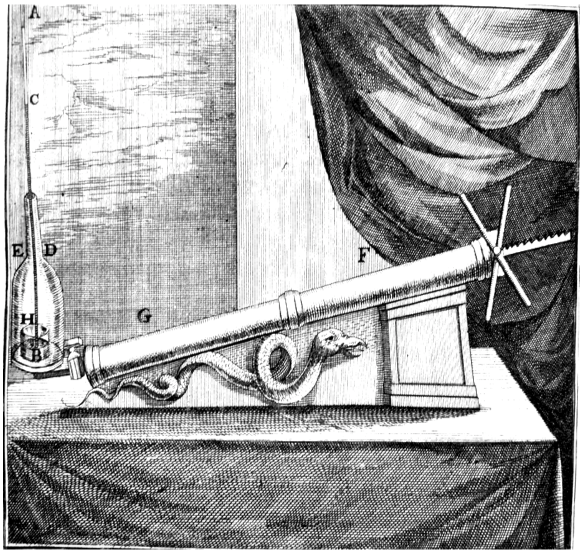

Fig. 20

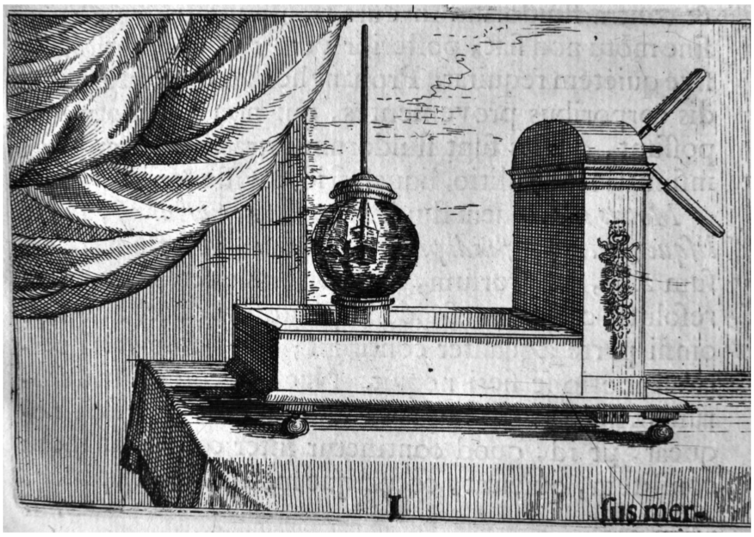

Fig. 21

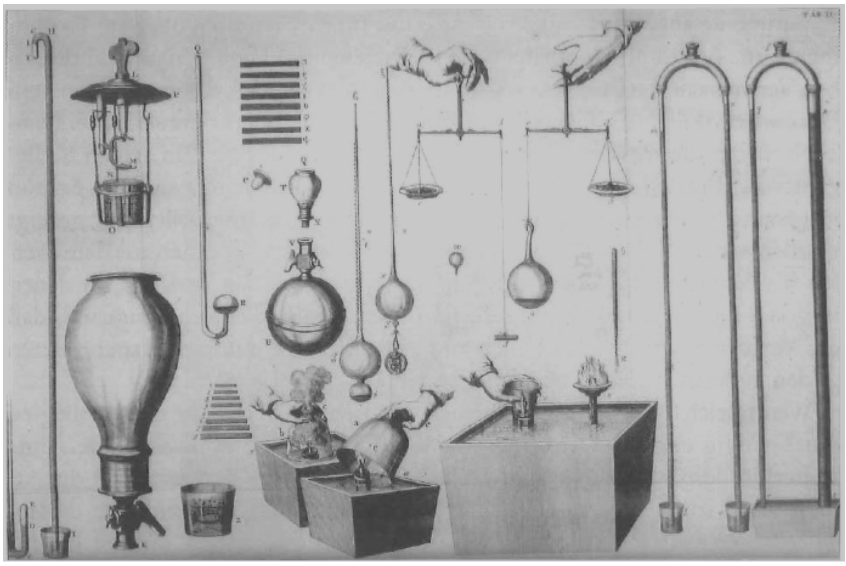

Fig. 22

Fig. 23

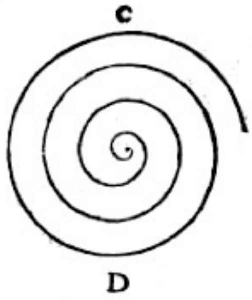

Fig. 24

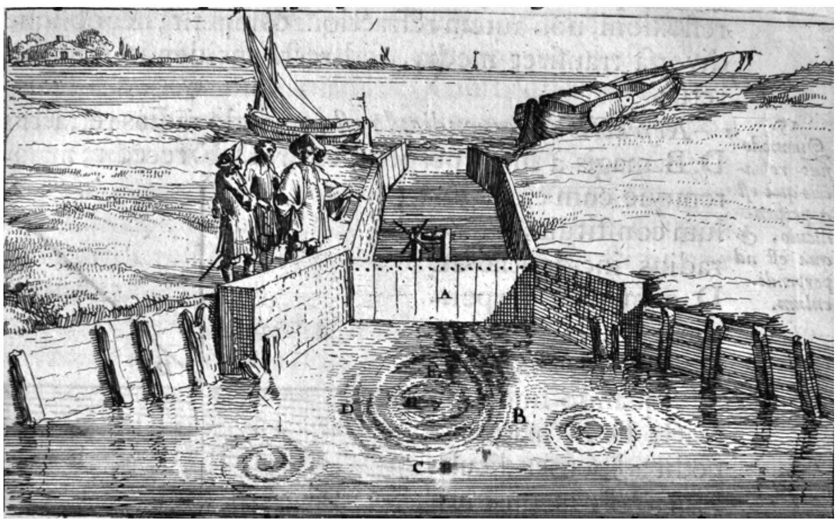

Fig. 25

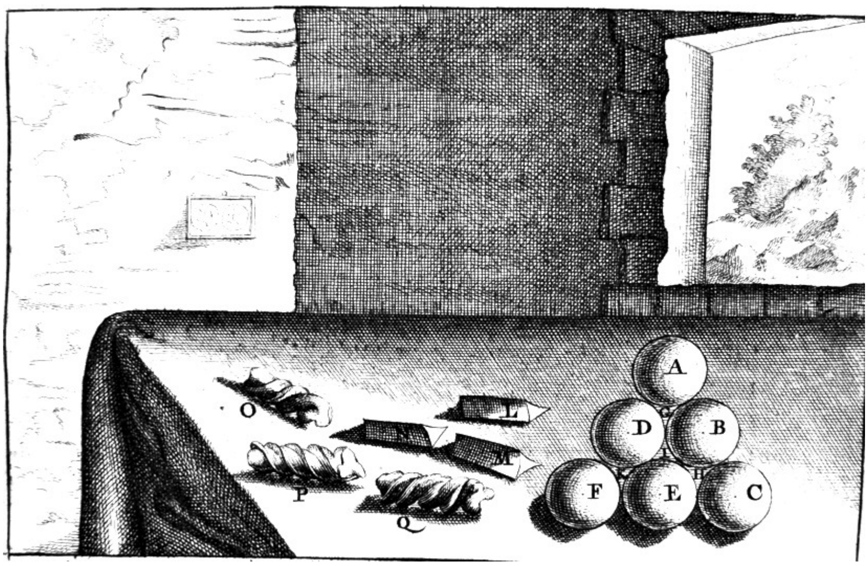

Fig. 26

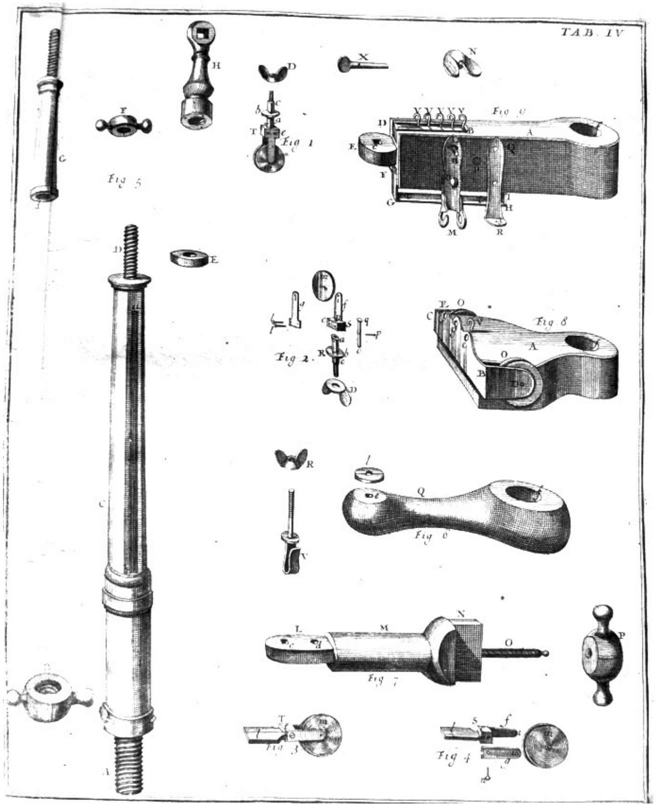

Fig. 27

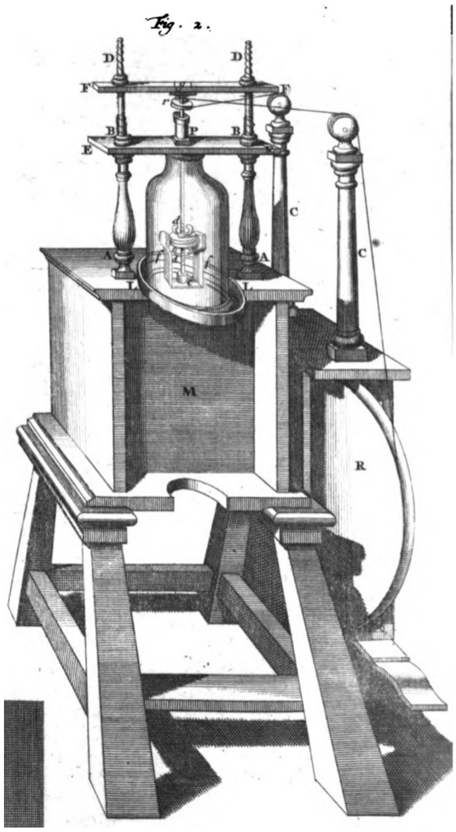

Fig. 28

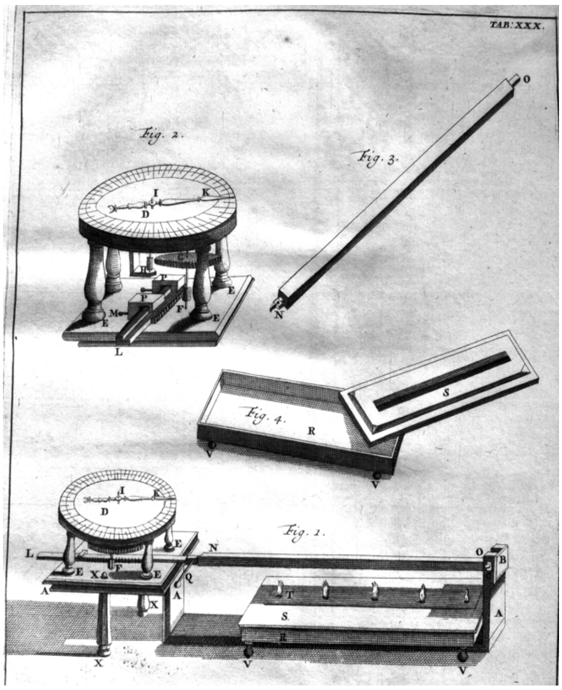

Fig. 29

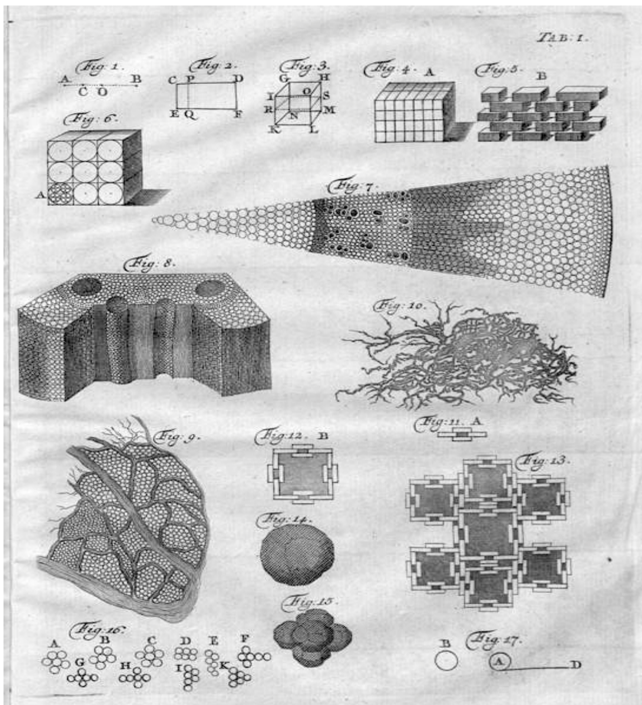

Fig. 30

Fig. 22: SENGUERD 1715, table II.

Fig. 23: SENGUERD 1681, 62.

Fig. 24: REGIUS 1654, 19.

Fig. 25: SENGUERD 1681, 51.

Fig. 26, SENGUERD 1681, 125.

Fig. 27: 'S GRAVESANDE 1742, 42.

Fig. 28: 'S GRAVESANDE 1720-1721, vol. II, 16.

Fig. 29: MAGALOTTI-MUSSCHENBROEK 1731, table XXX, 12

Fig. 30: MUSSCHENBROEK 1762B, vol. I, table I.

BIBLIOGRAPHY

AT = RENÉ DESCARTES, *Oeuvres*, ed. by CHARLES ADAM, PAUL TANNERY, Paris, Cerf 1897-1913.

BAIGRIE 1996 = BRIAN SCOTT BAIGRIE, «Descartes's Scientific Illustrations and 'la grande mécanique de la nature'» in BRIAN SCOTT BAIGRIE (ed.), *Picturing Knowledge: Historical and Philosophical Problems Concerning the Use of Art in Science*, Toronto-Buffalo: University of Toronto Press 1996, 86-133.

BELLIS 2013 = DELPHINE BELLIS, «Empiricism Without Metaphysics: Regius' Cartesian Natural Philosophy» in MIHNEA DOBRE, TAMMY NYDEN (eds.), *Cartesian Empiricisms*, Dordrecht-Heidelberg-New York-London, Springer 2013 (Studies in History and Philosophy of Science 31), 151-183.

BILSIUS 1659 = LUDOVICUS BILSIUS, *Epistolica dissertatio, qua verus hepatis circa chylum, et pariter ductus chiliferi hactenus dicti usus, docetur*, Roterodami, typis Joannis Naerani 1659.

BITBOL-HESPERIES 1993 = ANNIE BITBOL-HESPERIES, «Descartes et Regius: leur pensée medicale» in THEO VERBEEK (ed.), *Descartes et Regius. Autour de l'Explication de l'esprit humain*, Amsterdam, Rodopi 1993, 47-68.

BONTEKOE 1668 = CORNELIS BONTEKOE, *Metaphysica et liber singularis de motu, nec non eiusdem oeconomia animalis* […] *quibus accedit Arnoldi Geulincx Physica vera*, Lugduni Batavorum, apud Johannem de Vivié, et Fredericum Haaring, 1688.

BOS 2002 = ERIK-JAN BOS, *The Correspondence between Descartes and Henricus Regius*, Utrecht, Zeno, The Leiden-Utrecht Research Institute of Philosophy 2002 (Quaestiones Infinitae. Publications of the Department of Philosophy Utrecht University XXXVII).

VAN BUNGE 2013 = WIEP VAN BUNGE, «Dutch Cartesian Empiricism and the Advent of Newtonianism» in MIHNEA DOBRE, TAMMY NYDEN (eds.), *Cartesian Empiricisms*, Dordrecht-Heidelberg-New York-London, Springer 2013 (Studies in History and Philosophy of Science 31), 89-104.

VAN BUNGE FORTHCOMING = WIEP VAN BUNGE, «The Waning of the Radical Enlightenment and the Rise of Newtonianism in the Eighteenth-Century

Dutch Republic» in WIEP VAN BUNGE, *From Bayle to Bilderdijk. An Essay on Philosophy in the Eighteenth-Century Dutch Republic*, forthcoming.

CLARKE 1977 = DESMOND M. CLARKE, «The Impact Rules of Descartes' Physics», *Isis* 68/1 (1977), 55-66.

CLAUBERG 1664A = JOHANNES CLAUBERG, *Physica, quibus rerum corporearum vis et natura, mentis ad corpus relatae proprietates, denique corporis ac mentis arcta et admirabilis in homine coniunctio explicantur*, Amstelodami, apud Danielem Elzevirium 1664.

CLAUBERG 1664B = JOHANNES CLAUBERG, Metaphysica de ente, quae rectius Ontosophia, Amstelodami, apud Danielem Elzevirium 1664.

DE CLERCQ 1997 = PETER DE CLERCQ, *At the sign of the Oriental Lamp. The Musschenbroek workshop in Leiden, 1660-1750*, Rotterdam, Erasmus Publishing 1997.

CRAANEN 1685 = THEODOOR CRAANEN, *Oeconomia animalis in duas partes distributa. Nec non Oeconomiae animalis ad circulationem sanguinis et chyli dispositae, brevis delineatio*, Goudae, ex officina Guilhelmi vander Hoeve 1685.

CRAANEN 1686 = THEODOOR CRAANEN, *Lumen rationale medicum, hoc est Praxis medica reformata sive Annotationes in praxin Henrici Regii*, Medioburgi, apud Johannem de Reede 1686.

CRAANEN 1689 = THEODOOR CRAANEN, *Tractatus physico-medicus de homine, in quo status eius tam naturali, quam praeternaturalis, quoad theoriam rationalem mechanice demonstratur*, Lugduni Batavorum, apud Petrum vander Aa 1689.

DUPRÉ 2008 = SVEN DUPRÉ, «Newton's Telescope in Print: The Role of Images in the Reception of Newton's Instrument», *Perspectives on Science* 16/4 (2008), 328-359.

DESCARTES 1637 = RENE DESCARTES, *Discours de la methode* […] *plus la dioptrique, les meteores et la geometrie*, a Leyde, de l'imprimerie de Ian Maire 1637.

DESCARTES-CLERSELIER 1664 = RENE DESCARTES, *L'homme*, edited and illustrated by CLAUDE CLERSELIER, a Paris, chez Charles Angot 1664.

DESCARTES 1644 = RENE DESCARTES, *Principia philosophiae*, Amstelodami, apud Ludovicum Elzevirium 1644.

DUCHEYNE 2014 = STEFFEN DUCHEYNE, «'s Gravesande's Appropriation of Newton's Natural Philosophy, Part II: Methodological Issues», *Centaurus* 56/2 (2014), 97-120.

FAY-JARDINE 2012 = ISLA FAY, NICHOLAS JARDINE (eds.), *The Production of Books and Images in Early-Modern Astronomy*, special issue of the *Journal for the History of Astronomy*, 43 (2012).

GEULINCX 1891 = ARNOLD GEULINCX, *Opera philosophica*, ed. by JAN PIETER NICOLAAS LAND, Hagae Comitum, apud Martinum Nijhoff 1891-1893, vol. I (1891).

GEULINCX 1892 = ARNOLD GEULINCX, *Opera philosophica*, ed. by JAN PIETER NICOLAAS LAND, Hagae Comitum, apud Martinum Nijhoff 1891-1893, vol. II (1892).

GORI 1972 = GIAMBATTISTA GORI, *La fondazione dell'esperienza in 's Gravesande*, Firenze, La Nuova Italia 1972.

'S GRAVESANDE 1720-1721 = WILLEM JACOB 'S GRAVESANDE, *Physices elementa mathematica, experimentis confirmata, sive introductio ad philosophiam newtonianam*, Lugduni Batavorum, apud Petrum vander Aa et Balduinum Janssonium vander Aa 1720-1721.

'S GRAVESANDE 1723 = WILLEM JACOB 'S GRAVESANDE, *Philosophiae Newtonianae Institutiones in usus academicos*, Lugduni Batavorum, apud Petrum vander Aa 1723.

'S GRAVESANDE 1736 = WILLEM JACOB 'S GRAVESANDE, *Introductio ad philosophiam: metaphysicam et logicam continens*, Leidae, apud Joh. et Herm. Verbeek 1736.

'S GRAVESANDE 1742 = WILLEM JACOB 'S GRAVESANDE, *Physices elementa mathematica, experimentis confirmata, sive introductio ad philosophiam newtonianam*, Leidae, apud Johannem Arnoldum Langerak, Johannem et Hermannum Verbeek 1742 (3rd edition of 'S GRAVESANDE 1720-1721).

HACKMANN 1993 = WILLEM D. HACKMANN, «Natural Philosophy Textbook Illustrations 1600-1800» in RENATO GIUSEPPE MAZZOLINI (ed.), *Non-verbal communication in science prior to 1900*, Firenze, Leo S. Olschki, 1993 (Biblioteca di Nuncius: Studi e testi 11), 169-196.

HEEREBOORD 1654 = ADRIAAN HEEREBOORD, *Meletemata philosophica, maximam partem metaphysica*, Lugduni Batavorum, ex officina Francisci Moyardi 1654.

KOLESNIK-ANTOINE 2013 = DELPHINE KOLESNIK-ANTOINE, «Le rôle des expériences dans la physiologie d'Henricus Regius: les «pierres lydiennes» du cartésianisme» *Journal of Early Modern Studies* II/1 (2013), 125-145.

KUSUKAWA 2012 = SACHIKO KUSUKAWA, *Picturing the Book of Nature. Image, Text, and Argument in Sixteenth-Century Human Anatomy and Medical Botany*, Chicago and London, University of Chicago Press, 2012.

LÜTHY 2006 = CRISTOPH LÜTHY, «Where Logical Necessity Becomes Visual Persuasion: Descartes's Clear and Distinct Illustrations» in SACHIKO KUSUKAWA, IAN MACLEAN (eds.), *Transmitting Knowledge. Words, Images, and Instruments in Early Modern Europe*, Oxford, Oxford University Press 2006 (Oford-Warburg Studies), 97-133.

LÜTHY-SMETS 2009 = CRISTOPH LÜTHY, ALEXIS SMETS, «Words, Lines, Diagrams, Images: Towards a History of Scientific Imagery», *Early Science and Medicine* 14 (2009), 398-439.

LUYENDIJK-ELSHOUT 1975 = ANTONIE M. LUYENDIJK-ELSHOUT, «Oeconomia Animalis, Pores and Particles: The Rise and Fall of the Mechanical Philosophical School of Theodoor Craanen (1621-1690)» in THEODOOR H.L. LUNSINGH SCHEURLEER, GUILLAUME H.M. POSTHUMUS MEYJES (eds.), *Leiden University in the Seventeenth Century: An Exchange of Learning*, Leiden: Brill 1975, 294-307.

MAGALOTTI 1667 = LORENZO MAGALOTTI, *Saggi di naturali esperienze fatte nell'Academia del cimento*, in Firenze, per Giuseppe Cocchini 1667.

MAGALOTTI-MUSSCHENBROEK 1731 = LORENZO MAGALOTTI, PETRUS VAN MUSSCHENBROEK, *Tentamina experimentorum naturalium captorum in Academia del Cimento*, Lugduni Batavorum, apud Joan. et Herm. Verbeek 1731.

MOLHUYSEN 1918 = PHILIPP CHRISTIAAN MOLHUYSEN (ed.), *Bronnen tot de Geschiednis der Leidsche Universiteit*, 's-Gravenhage, M. Nijhoff 1918, vol. III.

MURDOCH 1984 = JOHN E. MURDOCH, *Album of Science: Antiquity and Middle*

Ages, New York: Scribner's Sons 1984.

MUSSCHENBROEK 1726 = PETRUS VAN MUSSCHENBROEK, *Epitome elementorum physico mathematicorum conscripta in usus academicos*, Lugduni Batavorum, apud Samuelem Lugtmans 1726.

MUSSCHENBROEK 1729 = PETRUS VAN MUSSCHENBROEK, *Physicae experimentales, et geometricae* […] *dissertationes*, Lugduni Batavorum, apud Samuelem Luchtmans 1729.

MUSSCHENBROEK 1734 = PETRUS VAN MUSSCHENBROEK, *Elementa physicae, conscripta in usus academicos*, Lugduni Batavorum, apud Samuelem Luchtmans 1734.

MUSSCHENBROEK 1739 = PETRUS VAN MUSSCHENBROEK, *Essai de Physique*, a Leyden, chez Samuel Luchtmans 1739.

MUSSCHENBROEK 1748 = PETRUS VAN MUSSCHENBROEK, *Institutiones physicae, conscriptae in usus academicos*, Lugduni Batavorum, apud Samuelem Luchtmans et filium 1748.

MUSSCHENBROEK 1762A = PETRUS VAN MUSSCHENBROEK, *Compendium physicae experimentalis conscriptum in usus academicos*, Lugduni Batavorum, apud S. et J. Luchtmans 1762.

MUSSCHENBROEK 1762B = PETRUS VAN MUSSCHENBROEK, *Introductio ad philosophiam naturalem*, Lugduni Batavorum, apud Sam. et Joh. Luchtmans 1762.

NYDEN 2013 = TAMMY NYDEN, «De Volder's Cartesian Physics and Experimental Pedagogy» in MIHNEA DOBRE, TAMMY NYDEN (eds.), *Cartesian Empiricisms*, Dordrecht-Heidelberg-New York-London, Springer 2013 (Studies in History and Philosophy of Science 31), 227-249.

NYDEN FORTHCOMING = TAMMY NYDEN, «De Volder's Cartesian Physics and Experimental Pedagogy» in ZVI BIENER, ERIC SCHLIESSER (eds.), *Newton and Newtonianism*, Oxford, Oxford University Press, forthcoming.

VAN OTEGEM 2005 = MATTHIJS VAN OTEGEM, «The Relationship between Word and Image in Books on Medicine in the Early Modern Period» in KARL A.E. ENENKEL, WOLFGANG NEUBNER (eds.), *Cognition and the Book: Typologies of Formal Organisation of Knowledge in the Printed Book of the Early Modern Period*, Leiden, Brill 2005 (Intersections. Yearbook for Early Modern Studies 4-2004), 603-620.

PANTIN 2001 = ISABELLE PANTIN, «L'illustration des livres d'astronomie à la Renaissance: l'évolution d'une discipline à travers ses images» in FABRIZIO MEROI, CLAUDIO POGLIANO (eds.), *Immagini per conoscere: dal Rinascimento alla rivoluzione scientifica. Atti della Giornata di studio, Firenze, Palazzo Strozzi, 29 ottobre 1999*, Firenze Leo S. Olschki 2001, 3-41.

PANTIN 2013 = ISABELLE PANTIN, «Analogy and Difference: A Comparative Study of Medical and Astronomical Images in Books, 1470-1550» *Early Science and Medicine* 18/1-2 (2013), 398-439.

DE PATER 1975 = CORNELIS DE PATER, «Experimental Physics» in THEODOOR H.L. LUNSINGH SCHEURLEER, GUILLAUME H.M. POSTHUMUS MEYJES (eds.), *Leiden University in the Seventeenth Century: An Exchange of Learning*, Leiden, Brill 1975, 309-318.

DE PATER 1998 = CORNELIS DE PATER, *Willem Jacob 's Gravesande: welzijn, wijsbegeerte en wetenschap*, Baarn, Ambo 1988 (Geschiedenis van de wijsbegeerte in Nederland 13).

DE RAEY 1654 = JOHANNES DE RAEY, *Clavis philosophiae naturalis, seu introductio ad naturae contemplationem, aristotelico-cartesiana*, Lugduni Batavorum, ex officina Johannis et Danielis Elsevier 1654.

DE RAEY 1677 = JOHANNES DE RAEY, *Clavis philosophiae naturalis aristotelico-cartesiana. Editio secunda, aucta opuscolis philosophicis varii argumenti*, Amstelodami, apud Danielem Elsevirium 1677.

DE RAEY 1652 = JOHANNES DE RAEY (*praeses*), *Disputationum physicarum ad Problemata Aristotelis quarta, de propagatione et communicatione motuum*, Lugduni Batavorum, e typographeo Francisci Hackii 1652.

RAPHAEL-JARDINE 2010-2011 = RENÉE RAPHAEL, NICHOLAS JARDINE (eds.), *Forms and Functions of Early Modern Celestial Imagery*, special issue of the *Journal for the History of Astronomy*, 41 (2010) and 42 (2011).

REGIUS 1641 = HENRICUS REGIUS, *Physiologia, sive Cognitio sanitatis. Tribus disputationibus in Academia Ultrajectina publice proposita*, Ultraiecti, ex officina Aegidii Roman 1641.

REGIUS 1642 = HENRICUS REGIUS, *Responsio, sive Notae in Appendicem ad Corollaria Theologico-Philosophica Viri Reverendi et Celeberrimi D. Gisberti Voetii*, Ultraiecti, apud Ioannem à Doorn 1642.

REGIUS 1646 = HENRICUS REGIUS, *Fundamenta physices*, Amstelodami, apud Ludovicum Elzevirium 1646.

REGIUS 1647 = HENRICUS REGIUS, *Fundamenta medica*, Ultraiecti, apud Theodorum Ackersdycium 1647.

REGIUS 1654 = HENRICUS REGIUS, *Philosophia naturalis, editio secunda*, Amstelodami, apud Ludovicum Elzevirium 1654.

REGIUS 1657A = HENRICUS REGIUS, *Praxis medica, medicationum exemplis demonstrata, editio secunda*, Traiecti ad Rhenum, typis Theodori ab Ackersdijck, et Gisberti a Zijll 1657.

REGIUS 1657B = HENRICUS REGIUS, *Medicinae libri quatuor, editio secund*a, Traiecti ad Rhenum, typis Theodori ab Ackersdijck, et Gisberti a Zijll 1657.

REGIUS 1661 = HENRICUS REGIUS, *Philosophia naturalis, in qua tota rerum universitas, per clara et facilia principia, explanatur*, Amstelaedami, apud Ludovicum et Danielem Elzevirium 1661 (3rd edition of REGIUS 1646).

REGIUS 1668 = HENRICUS REGIUS, *Medicina et praxis medica, medicationum exemplis demonstrata*, Trajecti ad Rhenum, ex officina Theodori ab Ackersdijck 1668.

REGIUS 1686 = HENRICUS REGIUS, *Philosophie naturelle*, a Utrecht, chez Rodolphe van Zyll 1686, fr. transl. by Claude Rouxel.

SENGUERD 1681 = WOLFERD SENGUERD, *Philosophia naturalis, quatuor partibus primarias corporum species, effectiones, vicissitudines, et differentias, exhibens*, Lugd. Batav., apud Danielem à Gaesbeeck 1681.

SENGUERD 1685 = WOLFERD SENGUERD, *Philosophia naturalis, quatuor partibus: Primarias corporum species, affectiones, differentias, productiones, mutationes, et interitus, exhibens*, Lugd. Batav., apud Danielem à Gaesbeeck 1685 (2nd edition of SENGUERD 1681).

SENGUERD 1715 = WOLFERD SENGUERD, *Rationis atque experientiae connubium*, Roterodami, apud Bernardum Bos 1715.

SPINOZA 1677 = BENEDICTUS DE SPINOZA, *Opera posthuma*, s.l. [Amsterdam], s.n. 1677.

STRAZZONI 2011 = ANDREA STRAZZONI, «La filosofia aristotelico-cartesiana di Johannes De Raey», *Giornale critico della filosofia italiana* VII/7 (2011), 107-132.

STRAZZONI 2012 = ANDREA STRAZZONI, «The Dutch Fates of Bacon's Philosophy: Libertas Philosophandi, Cartesian Logic and Newtonianism», *Annali della Scuola Normale Superiore di Pisa – Classe di Lettere e Filosofia* 4/1 (2012), 251-281.

VANPAEMEL 2011 = GEERT VANPAEMEL, «The Louvain Printers and the Establishment of the Cartesian Curriculum», *Studium: Tijdschrift voor Wetenschaps- en Universiteitsgeschiedenis / Revue de l'Histoire des Sciences et des Universités* IV/4 (2011), 241-254.

VERBEEK 1989 = THEO VERBEEK, «Les passions et la fièvre: L'idée de la maladie chez Descartes et quelques cartésiens néerlandais», *Tractrix: Yearbook for the History of Science, Medicine, Technology and Mathematics* 1 (1989), 45-61.

VERBEEK 1992 = THEO VERBEEK, *Descartes and the Dutch*: *Early Reactions to Cartesian Philosophy, 1637-1650*, Carbondale and Edwardsville, Southern Illinois University Press 1992.

VERBEEK 1994 = THEO VERBEEK, «Regius's Fundamenta Physices», *Journal of the History of Ideas* 55 (1994), 533-551.

DE VOLDER 1681 = BURCHARD DE VOLDER, *Quaestiones academicae de aëris gravitate*, Medioburgi, typis viduae Remigii Schreverii 1681.

WIESENFELDT 2002 = GERHARD WIESENFELDT, *Leerer Raum in Minervas Haus. Experimentelle Naturlehre an der Universität Leiden, 1675-1715*, Amsterdam, Koninklijke Nederlandse Akademie van Wetenschappen 2002 (History of science and scholarship in the Netherlands volume 2).

ZITTEL 2005 = CLAUS ZITTEL, «Abbilden und Überzeugen bei Descartes» in KARL A.E. ENENKEL, WOLFGANG NEUBNER (eds.), *Cognition and the Book: Typologies of Formal Organisation of Knowledge in the Printed Book of the Early Modern Period*, Leiden, Brill 2005 (Intersections. Yearbook for Early Modern Studies 4-2004), 535-601.

ZITTEL 2009 = CLAUS ZITTEL, *Theatrum philosophicum. Descartes und die Rolle ästhetischer Formen in der Wissenschaft, Berlin*, Akademie Verlag 2009.

ZITTEL 2011 = CLAUS ZITTEL, «Conflicting Pictures: Illustrating Descartes' Traité De L' homme» in CRISTOPH LÜTHY, SVEN DUPRÉ (eds.), *Silent Messengers. The Material Vehicles of the Circulation of Natural Knowledge in the Low Countries*, Berlin, LIT Verlag 2011 (Low Countries Studies on the Circulation of Natural Knowledge Bd. 1), 217-260.