The Foundation of Early Modern Science: Metaphysics, Logic and Theology

Andrea Strazzoni

Strazzoni, A.

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Andrea Strazzoni

born in Cremona, Italy

Erasmus University Rotterdam

Doctoral Committee

Promotor:

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Introduction

In recent years, a new discipline has emerged within the broader field of the history of philosophy: the history of philosophy of science. The growth of this specialty has been substantiated by the birth of the *The International Society for the History of Philosophy of Science* and of its *Journal* (2011-), aiming to «construe this subject broadly, to include topics in the history of related disciplines and in all historical periods, studied through diverse methodologies»[1]. As noted by Peter Dear,

> where once philosophers were taken to lead historians in setting the agenda and questions for HPS, contemporary philosophers of science who look to history do so by following the lead of historians; many philosophers of science are now historians of the philosophy of science. […] Perhaps the chief movers in this endeavor are Daniel Garber and Roger Ariew, both specialists in Cartesianism[2].

Thomas Uebel has explained the rapid growth of this field as a consequence of a «change in methodological attitude that late 20th century philosophy of science prided itself on, a change sometimes characterised as a naturalistic turn or even a turn to scientific practice: either way it involves the self-conscious rejection of a priori reflection about grand philosophical themes related to science and instead demands detailed knowledge of current scientific theories and experimental practices»[3]. Accordingly, the history of philosophy of science is a reflection on scientific practices in their historical development, i.e., it is philosophy of science applied to history of science, and can be more properly defined as "philosophy of science by other means". For Thomas Morman, commenting upon Uebel, this definition has the positive effect of «forestall a profusion of undesired meta(meta)disciplines which threaten the conceptual unity of an interdisciplinary research dealing with the history and philosophy of scientific culture»[4]. However, Uebel's definition excludes the very possibility of a study of the self-reflection of past philosophers and scientists on their methods

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1 See www.hopos.org, accessed on 15th January 2015.

2 P. Dear, *Philosophy of Science and its Historical Reconstruction*, in S. Mauskopf, T.M. Schmaltz (eds.), *Integrating History and Philosophy of Science: Problems and Prospects*, Dordrecht-Heidelberg-New York-London, Springer 2012, pp. 67-82: pp. 68-69.

3 T. Uebel, *Some Remarks on Current History of Analytical Philosophy of Science*, in F. Stadler (ed.), *The Present Situation in the Philosophy of Science*, Dordrecht-Heidelberg-New York-London, Springer 2010, pp. 13-28: p. 13.

4 See T. Morman, *History of Philosophy of Science as Philosophy of Science by Other Means? Comment on Thomas Uebel*, *ibid*., pp. 29-40: p. 30.

and the conceptual premises of their theories, which Ariew and Garber have successfully accomplished in the last two decades[5]. It is not by chance, in fact, that the initiators of the history of philosophy of science are specialists in Cartesianism. In recent years, the historiography of Cartesian philosophy has been boosted by renewed attention to the problem of the foundations of philosophical knowledge. Instead of a crystallized dualistic approach to metaphysical problems – on the one hand – and to natural philosophical method on the other, the philosophy of René Descartes has been increasingly analysed in the light of the metaphysical problems entailed by his methodology and *vice versa*[6]. Indeed, the breakthrough of the philosophy of Descartes brought about a reflection on the method, the assumptions and the functions of philosophy, substantiated in the development of foundational theories as premises of philosophy as such. His tenet that the source of philosophical knowledge is to be found in the clear and distinct ideas of reason rather than in sensory experience called for a reformulation of the principles of philosophy, and caused an unprecedented interest in the foundation of philosophical knowledge both as the justification of the very possibility of acquiring a certain, indubitable and secure knowledge of philosophy (*scientia*), and as the definition of the main concepts, the method and the first principles of different philosophical disciplines (*scientiae*)[7].

In this dissertation I will assess whether it is legitimate to commence a history of the philosophy of science with the study of Cartesian philosophy. From a historical point of view,

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[5] See R. Ariew, *Descartes among the Scholastics*, Leiden-Boston, Brill 2011 (revised edition of his *Descartes and the Last Scholastics*, Ithaca, Cornell University Press 1999); D. Garber, *Descartes' Metaphysical Physics*, Chicago, University of Chicago Press 1992; id., *Descartes Embodied. Reading Descartes's Philosophy through Cartesian Science*, Cambridge, Cambridge University Press 2001. Desmond Clarke has analyzed Cartesian physics, on the other hand, from the standpoint of the history of philosophy of science as conceived by Uebel and Morman: see D.M. Clarke, *Descartes' Philosophy of Science*, Manchester, Manchester University Press 1982.

[6] See M. Fichant, *Science et métaphysique dans Descartes et Leibniz*, Paris, PUF 1999; Garber 1992 and 2001; id., *Physics and Foundations*, in K. Park, L. Daston (eds.), *The Cambridge History of Science. Volume 3, Early Modern Science*, New York, Cambridge University Press 2006, pp. 21-69. See the classic studies of E. A. Burtt, *The Metaphysical Foundations of Modern Physical Science: A Historical and Critical Essay*, London, Routledge and Kegan Paul 1932; E. W. Strong, *Procedures and Metaphysics: A Study of the Philosophy of Mathematical-Physical Science in the Sixteenth and Seventeenth Centuries*, Berkeley, University of California Press 1936); A. Koyré, *Metaphysics and Measurement: Essays in Scientific Revolution*, Cambridge (Massachusetts), Harvard University Press 1968; G. Buchdahl, *Metaphysics and the Philosophy of Science: The Classical Origins, Descartes to Kant*, Cambridge (Massacchussets), MIT Press 1969; G. Hatfield, *Metaphysics and the New Science*, in D. Lindberg, R. Westman (eds.), *Reappraisals of the Scientific Revolution*, Cambridge, Cambridge University Press 1990, pp. 93-166. These texts are mentioned in Garber 2006, p. 22, n. 1.

[7] On the meaning of "*scientia*" in the history of early modern philosophy, see P. Achinstein, *Concepts of Science: A Philosophical Analysis,* Baltimore, J. Hopkins Press 1968; T. Sorell, G.A. Rogers, J. Kraye (eds.), *Scientia in Early Modern Philosophy. Seventeenth-Century Thinkers on Demonstrative Knowledge from First Principles*, Dordrecht-Heidelberg-London-New York, Springer 2010.

therefore, I will ask whether Descartes's revolution in philosophy brought about a new function of philosophy as a reflection upon the method and the conceptual premises of different disciplines, including what we may label as "science", that is, the experimental and mathematical study of natural phenomena. From a methodological standpoint, I will substantiate the possibility of a history of philosophy of science as a branch of philosophical historiography different from philosophy of science applied to historical topics, i.e., from a "philosophy of science by other means". Accordingly, this double aim will be pursued by a study of Descartes's legacy in philosophy, that is, by showing how Descartes's foundationalism, in the hands of his followers and successors, became an essential part of philosophy throughout the seventeenth and eighteenth centuries: the Cartesian quest for a foundation of philosophy shaped a new function of metaphysics, logic and rational theology as forms of reflection upon the principles of knowledge, leading to the birth of the philosophy of science.

Descartes aimed to provide his whole philosophy with a foundation by metaphysical and rational-theological arguments, these being the core of his *Discours de la méthode* (1637), *Meditationes de prima philosophia* (1641), and the first part of his *Principia philosophiae* (1644). His metaphysical foundationalism has been thoroughly surveyed by Garber, who has pointed out the new role of metaphysics with respect to the Aristotelian tradition:

> In its strict Aristotelian meaning, metaphysics was usually taken to be the science of being qua being, the science of being as such. In addition, metaphysics was often taken to include an account of God, separated (i.e., immaterial) substances, and substance in general. […] Although the view that physics depends in some substantive way on metaphysics was not completely unheard of among medieval Aristotelian schoolmen, physics was generally held to be a discipline largely independent of metaphysics, and as a more concrete discipline dealing with sensible things, it should be studied before the student took up metaphysics. Therefore, in this strict sense, for an Aristotelian, one could not properly talk about the metaphysical foundations of physics[8].

Garber has shown the development of the notions of matter and motion in Descartes's metaphysics, interpreting "foundation" as i) the cluster of basic notions and principles dealt with in Descartes's metaphysical writings, and hence employed in his natural philosophical theories, and has ii) the deduction of the principles of motion and laws of impact from the idea of God[9]. On the other hand, Daniel Flage and Clarence Bonnen give a slightly different interpretation of what is a foundation in

[8] Garber 2006, p. 21.
[9] See Garber 1992, chapters 5-6, 9.

Cartesian philosophy, that is, the iii) preparation of the mind to the acknowledgment of the first principles of philosophy, and the iv) justification of the reliability of our faculties in acquiring the truth. Given the possibility of doubt, a foundation ensures the appraisal of the first principles in Cartesian physics (i.e., natural philosophy)[10]. In fact, the problem of scepticism plays a crucial role in early modern philosophy. As shown by Richard Popkin's classic study, modern scepticism is to be traced back to the "intellectual crisis" of the Reformation, and to the rediscovery of the arguments of the ancient sceptics[11]. Descartes embarked on an "intellectual crusade" against the scepticism of his time, attempting to overturn the sceptical arguments as the basis of his metaphysics, which starts with radical doubt[12]. The quest for a foundation characteristic of Cartesianism was motivated by the need to reach an evident knowledge through a new method that could prevail over the Aristotelian introduction to philosophy, vulnerable to the arguments of the sceptics. As signalled by Flage and Bonnen:

> Consistent with the shift away from an empiricist epistemology, first principles are known by reason, not by abstraction from experience […]. This epistemological shift marks a significant departure from the Aristotelian tradition, which held that even the truths of mathematics and metaphysics are abstracted from experience[13].

Accordingly, a main reason for Descartes's foundationalism was, along with the overcoming of scepticism, the justification of a way of practising philosophy more professionally than in the commonsensical, childish Scholastic approach. Descartes's foundation shows why his philosophy, based on an alternative source of knowledge and upholding the differentiation between the deceiving "evidences" of sensory experience and the mechanical causes of phenomena, could replace a four centuries old Aristotelian tradition in philosophy. The theoretical need for a foundation of knowledge, therefore, went along with the necessity of demonstrating the reliability

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[10] «Descartes gives voice to another theme that recurs throughout the *Meditations*, namely, that the discovery of false beliefs is the motive for systematic doubt. If knowledge is based on the wrong foundations, error can easily follow. […] The philosopher at the beginning of the *Meditations* is understood as one in a state of philosophical naiveté, one having all the natural biases toward the reliability of sense perception. By weaning oneself from sense experience, one becomes aware of those axioms that are "in us from birth" […], and one is in a position to recognize their truth by the natural light», D.E. Flage, C.A. Bonnen, *Descartes and Method. A Search for a Method in Meditations*, Routledge, London and New York 1999, p. 112.

[11] See R. Popkin, *The History of Scepticism from Savonarola to Bayle*, New York, Oxford University Press 2003, third revised and expanded edition of his *The History of Scepticism From Erasmus to Descartes*, Assen, Van Gorcum 1960. On Descartes and scepticism, see M. Grene, *Descartes and Skepticism*, «The Review of Metaphysics» 52/3 (1999), pp. 553-571; T.M. Lennon, *The Plain Truth. Descartes, Huet, and Skepticism*, Leiden-Boston, Brill 2008.

[12] Popkin 2003, pp. 144-145.

[13] Flage-Bonnen 1999, p. 112.

of Descartes's groundbreaking methodology with respect to the established Aristotelian paradigm.

The relation between foundationalism and the "rationalist" aim of acquiring evident knowledge has been noted by Tom Sorell in the moral field as well, as this is a derivative matter from Descartes's metaphysics and physics, the *scientiae* of soul and body[14]. In fact, he interprets foundation as the derivation of philosophical theories from self-evident principles, as does Garber[15]. However, the problem of foundationalism seems to go beyond the entailments of Descartes's "rationalism". Indeed, in the last years the rationalism/empiricism dichotomy has been partially replaced by the categories of "speculative" and "experimental" philosophy[16]. This has allowed a broader approach to the history of Cartesian philosophy, appreciated in its different experimental-empirical aspects, taking into account the establishment of Newtonianism[17]. Yet, this replacement has not disproved the inner connection of Descartes's foundationalism and his search for philosophical principles in pure reason, that is, by a method alternative to the ways of discovery and demonstration established in European universities at the beginning of seventeenth century, such as the methodologies of Aristotle, Galen, Ramus and Zabarella[18].

Moreover, questions have been raised by the analysis of the Scholastic background of Descartes's foundation: John Cottingham has shown how «supporting the trunk of his physics by unearthing its metaphysical roots, gradually overwhelmed Descartes by its complexity; and that in attempting to complete the task, he was drawn, little by little, to fall back on the very scholastic

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[14] «Descartes is a rationalist in ethics, but he always regarded ethics as a highly derivative science, partly because he thought that what was worthwhile to do in life depended on *scientia* about the perfections of mind and body (metaphysics) and *scientia* about the workings of the human body (physics)», T. Sorell, *Descartes Reinvented*, Cambridge, Cambridge University Press 2005, p. 83.

[15] «Rationalism […] can be associated with foundationalism, the idea that there are a small number of self-evident truths in the light of which all or most other truths are evident, or from which other truths can be derived by self-evident reasoning. Cartesian rationalism extends to ethics and the conduct of life, where it asserts that detachment from the appetites is sometimes necessary for distinguishing genuine from merely apparent goods, and for identifying an order of priority among the genuine goods», *ibid*., p. xii. See ch. 3, *The Belief in Foundations*, pp. 57-84.

[16] See P. Anstey, *Experimental versus Speculative Natural Philosophy*, in P. Anstey, J.A. Schuster (eds.), *The Science of Nature in the 17th Century: Patterns of Change in Early Modern Natural Philosophy*, Dordrecht, Kluwer/Springer 2005, pp. 215-242; S. Gaukroger, *The Collapse of Mechanism and the Rise of Sensibility. Science and the Shaping of Modernity, 1680-1760*, Oxford, Oxford University Press 2010.

[17] See M. Dobre, T. Nyden (eds.), *Cartesian Empiricisms*, Dordrecht-Heidelberg-New York-London, Springer 2013.

[18] On pre-Cartesian concepts of method, see N.W. Gilbert, *Renaissance Concepts of Method*, New York, Columbia University Press 1960; G. Nuchelmans, *Deductive Reasoning*, in D. Garber, M. Ayers (eds.), *The Cambridge History of Seventeenth-Century Philosophy*, Cambridge, Cambridge University Press 1998, vol. I, pp. 132-146; P. Dear, *Method and the Study of Nature*, *ibid*., pp. 147-177; M. Savini, *Le développement de la méthode cartésienne dans les Provinces-Unies (1643-1665)*, Lecce, Conte 2004, pp. 32-49; S. Roux, *L'Essai de logique de Mariotte. Archéologie des idées d'un savant ordinaire*, Paris, Garnier 2011.

apparatus that he so derided in his scientific work»[19]. Descartes's use of the Scholastic tradition in metaphysics has been thoroughly unveiled by Roger Ariew, particlularly where Descartes's relation to the Scotist notions of objective being, idea, and the self-substantiality of pure matter is concerned[20]. In sum, we are now in possession of an image of Descartes which takes into account his awareness of the conceptualization of past philosophy, the groundbreaking novelty of his approach, and of the interrelation of physics and metaphysics, as well as his blind spots on his own theories[21].

If the problem of the foundation of Descartes's philosophy has been exhausted, its reception has not received the same attention. Whilst some studies on the problem of a foundation of Cartesian philosophy in different contexts have appeared – such as the doctoral dissertations of Mark Aalderink – concerning Descartes's and Geulincx's theory of knowledge – and Mihnea Dobre, who has focused on the foundation of natural philosophy in French Cartesianism[22] – the topic has been generally neglected. Up to the present, different factors have prevented the writing of a history of foundationalism as a topic underlying the history of Cartesian philosophy and of early modern philosophy as such. (I) First, the failure of Cartesian physics in the second half of seventeenth century, that is, its speculative claims, the absence of a mathematical formulation of natural laws, and the ambiguous use of experience have brought about an image of Cartesianism as a dead corner in the history of early modern philosophy and science. Accordingly, scarce attention has been paid to the interrelation of physics, metaphysics and other branches of philosophy apart from the case of Descartes. As a consequence, Descartes's followers have been mostly labelled as uninteresting figures in early modern philosophy and science, whereas their master purported an actual novelty in the history of philosophy. (II) The dichotomy of Cartesianism, Newtonianism and different scientific alternatives has hindered the appreciation of philosophical foundationalism as a

[19] J. Cottingham, *Cartesian Reflections. Essays on Descartes's Philosophy*, Oxford, Oxford University Press 2008, p. 58.

[20] See Ariew 2011.

[21] Not surprisingly, the study of the self-awareness of Descartes as a philosopher went along with a growing interest for the "biographic" development of his philosophy: see S. Gaukroger, *Descartes: An Intellectual Biography*, Oxford, Oxford University Press 1995; D.M. Clarke, *Descartes. A Biography*, New York, Cambridge University Press 2006.

[22] M. Aalderink, *Philosophy, Scientific Knowledge, and Concept Formation in Geulincx and Descartes*, Utrecht, Utrecht University: Publications of the Department of Philosophy 2009; M. Dobre, *Metaphysics and Physics in Cartesian Natural Philosophy: Descartes and Early French Cartesians on the Foundation of Natural Philosophy*, Nijmegen, Proefschrift Radboud Universiteit 2010; M. Dobre, *Knowledge and Certainty in the Foundation of Cartesian Natural Philosophy*, «Revue Roumaine de philosophie» 57/1 (2013), pp. 95-110.

topic entangled with the birth of modern science as such. As far as foundationalism has been considered as essential to Descartes's "rationalism", its relevance in early modern philosophy has not been systematically dealt with. (III) Thirdly, the ongoing dichotomy of empiricism and rationalism has prevented to prevail over such perspectives on the history of early modern philosophy[23].

The case of the reception of Cartesian philosophy in the Dutch context is no exception. Even though Descartes's philosophy was taught for the first time in history in Dutch Universities, partially replacing the Aristotelian course of studies[24], no history of the foundation of philosophy in the Dutch Republic after Descartes has been written so far. Even though the partial dismissal of the aforementioned dichotomies has recently led to the appearance of some work in the history of philosophy of science in the Dutch context, one can still see difficulties in discerning a common element underlying the development of philosophy in the Dutch context in the early modern age through Cartesianism and Newtonianism[25]. According to this essay, this common element is the

[23] For a more detailed account of contemporary perspectives and method of historiography early modern philosophy, see M. Laerke, J.E.H. Smith, E. Schliesser (eds.), *Philosophy and Its History. Aims and Methods in the Study of Early Modern Philosophy*, New York, Oxford University Press 2013; M. Lenz, A. Waldow (eds.), *Contemporary Perspectives on Early Modern Philosophy*, Boston, Springer 2013. See also S. Roux, *An Empire Divided: French Natural Philosophy (1670-1690)*, in D. Garber, S. Roux (eds.), *The Mechanization of Natural Philosophy*, New York, Kluwer 2012, pp. 55-95. On the historiography of science, see J. Agassi, *Science and Its History: A Reassessment of the Historiography of Science*, Boston, Springer 2008, revised edition of his *Towards an Historiography of Science*, The Hague, Mouton 1963.

[24] See the classic studies on Dutch Cartesian philosophy of Josef Bohatec, C. Louise Thijssen-Schoute, Paul Dibon, T. Arthur McGahagan, and the more recent surveys of Theo Verbeek and Wiep van Bunge: J. Bohatec, *Die cartesianische Scholastik in der Philosophie und reformierten Dogmatik des 17. Jahrhunderts*, Leipzig, A. Deichert 1912; P. Dibon, *La Philosophie néerlandaise au siècle d'or. Tome I. L'enseignement philosophique dans les Universités à l'époque pre-cartésienne* (1575-1650), Paris-Amsterdam-Londres-New York, Elsevier Publishing Company 1954; id., *Regards sur la Hollande du siècle d'or*, Naples, Vivarium 1990; C.L. Thijssen-Schoute, *Nederlands cartesianisme, avec sommaire et table des matières en français*, Amsterdam, Noord-Hollandsche Uitg. Mij. 1954; E.G. Ruestow, *Physics at Seventeenth and Eighteenth-Century Leiden: Philosophy and the New Science in the University*, The Hague, Nijhoff 1973; A. McGahagan, *Cartesianism in the Netherlands. 1639-1676. The New Science and the Calvinist Counter-Reformation*, Ph.D. Dissertation, University of Pennsylvania 1976; T. Verbeek, *Descartes and the Dutch. Early Reactions to Cartesian Philosophy, 1637-1650*, Carbondale and Edwardsville 1992 (a); W. van Bunge, *From Stevin to Spinoza. An Essay on Philosophy in the Seventeenth-Century Dutch Republic*, Leiden-Boston-Köln, Brill 2001. See also E.J. Dijksterhuis (ed.), *Descartes et le cartésianisme hollandais – Etudes et documents*, Presses Universitaires de France, Paris 1950; G. Vanpaemel, *De mechanistische natuurwetenschap aan de Leuvense Artesfakulteit (1650-1797)*, Leuven, Katholieke Universiteit 1985; W. Frijhoff, M. Spies, *Dutch Culture in a European Perspective I: 1650: Hard-won Unity*, Assen, Van Gorcum 2004.

[25] Aalderink 2009; Dobre-Nyden 2013; S. Ducheyne, *'s Gravesande's Appropriation of Newton's Natural Philosophy, Part I: Epistemological and Theological Issues*, «Centaurus» 56/1 (2014), pp. 31-55 (a); id., '*s Gravesande's Appropriation of Newton's Natural Philosophy, Part II: Methodological Issues*, «Centaurus» 56/2 (2014), pp. 97-120 (b). See also E. Schliesser, *Newton's Challenge to Philosophy: A Programmatic Essay*, «HOPOS: The Journal of the International Society for the History of Philosophy of Science» I/1 (2011), pp. 101-128; A. Janiak, E. Schliesser (eds.), *Interpreting Newton. Critical Essays*, Cambridge, Cambridge University Press 2012; E. Jorink, A. Maas (eds.), *Newton and the Netherlands. How Isaac Newton was Fashioned in the Dutch Republic*, Leiden, Leiden

foundation of philosophy, which turned to be, in early eighteenth century, a reflection on modern mathematical-experimental science.

As a result, even though it has been assessed why Cartesianism called for a foundation of philosophy – i.e., as an answer to the "sceptical crisis" and as a defence of a novel way of reasoning in philosophy –, it is still to be understood where the construction of the philosophical edifice started, and what the reasons were for the different solutions given to the problem of the foundation after Descartes. An answer to these questions will show why (and how) a process of internal transformation of Cartesian foundationalism gave rise to a philosophy of science. Such internal transformation is to be studied by a survey of the problems emerging during the reception of Cartesian ideas, that is, from the clash between some issues underlying Descartes's philosophy and its adaptation to particular historical demands. Finally, it must be made sure that the solutions to such problems created a philosophical framework capable of accepting scientific renovation beyond Cartesian philosophy itself.

As to the choice of a context of reception, this dissertation aims at adding a new chapter to the history of philosophy in the Dutch Republic, where Cartesianism and Newtonianism had their first acceptance in the Universities. Scholastic philosophy, taught in Dutch academies mainly through the textbooks of Franco Burgersdijk (1590-1635), did not include a foundation of philosophy as a justification of its reliability, but only an introduction to logical instruments of philosophy. Metaphysics, on the other hand, was among the last disciplines to be taught, and included a science of being (*metaphysica generalis*) and the basics of a rational theology (*metaphysica specialis*)[26]. With the emergence of Cartesianism, this order of disciplines would change: Cartesianism brought about a replacement of the disciplines hitherto based on the Scholastic paradigm as parts of the official curriculum of the universities, calling upon a reflection on philosophy as such. Thus, foundationalism became crucial for the justification of the adoption of Cartesianism and Newtonianism and for their development into fully-fledged philosophical alternatives. Even if with the rise of Cartesianism a foundation was provided in different contexts – as Dobre has demonstrated – the birth of a philosophy of science through foundationalism can be appreciated by

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University Press 2012.

[26] See E.-P. Bos, H.A. Krop (eds.), *Franco Burgersdijk (1590-1635): Neo-Aristotelianism in Leiden*, Amsterdam, Rodopi 1993; H. Krop, *Burgersdijk, Franco (1590-1635)*, in W. van Bunge, H. Krop, B. Leeuwenburgh, H. van Ruler, P. Schuurman, M. Wielema (eds.), *The Dictionary of Seventeenth and Eighteenth-Century Dutch Philosophers*, Bristol, Thoemmes Press 2003, vol. I, pp. 181-190.

a study of the Dutch academic context, where the Cartesian revolution led to a substantial change in the official, academic culture. Therefore, it is my aim to write a history of foundationalism in seventeenth and eighteenth century Dutch philosophy which is at the same time a history of Cartesianism – from the point of view of the foundations it entailed –, and a history of Dutch philosophy in the period between Cartesianism and Newtonianism. Indeed, foundationalism did not only characterize Cartesian philosophy, but Newtonian science, too, was provided with a philosophical defence and introduction in Dutch Universities. Accordingly, an analysis of the Dutch context will provide a crucial case of study of the foundation of philosophy and science, and of the emergence of a philosophy of science in early modernity.

As to the problems transforming Cartesian foundationalism into a philosophy of science, I have identified a set of questions emerging from the Dutch reception of Descartes. Since Descartes aimed at replacing Scholastic philosophy, the foundation of Cartesian philosophy must be considered as a comprehensive corpus of Academic disciplines: including logic, moral philosophy, metaphysics as science of being, with respect to upper arts (medicine, theology and law). So the first question msut be whether the foundation of philosophy as a purely rational enterprise was consistent with a plan of reform of the whole course of philosophy, which include empirical disciplines. Secondly, as a main aim of Descartes was to develop a moral philosophy as the foremost among the sciences[27], it must be clarified why a Cartesian ethics needed a foundation. In the case of Spinoza, for instance, one can find a purely rational ethics developed without a foundation, as Spinoza started his *Ethica* with a series of axioms the evidence of which is not justified[28]. Thirdly, the impact must be verified on foundational theories of the emergence of a mathematical-experimental science which debunked the principles of Cartesian physics, as the discovery of the laws of impact by Huygens, Wren and Wallis in the 1660s. The question must be asked whether a foundation of physics could enable an integration of such science in a Cartesian framework in terms of the weight of experience in the formulation of the principles of philosophy and the use of experiments as a means of discovery and teaching.

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[27] See D. Rutherford, *Descartes' Ethics*, in *Stanford Encylopedia of Philosophy* (plato.stanford.edu/entries/descartes-ethics/, accessed on 16 January 2015).

[28] «Often this metaphysics served (as for Descartes) not only to give a foundation for the new sciences but especially to defuse the threat that this new science seemed to pose to traditional religious culture. Spinoza's metaphysics constitutes a totally different approach. Not only is there no need for a separate justification of the new, scientific way of thinking - certainly not one arrived at through the proof of a personal, benevolent God - but, for Spinoza, it also is possible to reflect about being and man [...] and even about God», H. de Dijn, S*pinoza: The Way to Wisdom*, West Lafayette, Purdue University Press 1996.

In the course of the survey different kinds of foundation of philosophical knowledge will be analysed as answers to such problems. I will maintain that the foundation of philosophy was carried out by theological, logical and metaphysical arguments, which fitted the needs of answering the introductory requirements of new paradigms and assessed the reliability of new methodology in leading the mind to grasp the truth. A theological foundation relies on a conception of God in order to ensure that our faculties do not deceive us; a logical foundation consists of a survey of the ways we deal with the contents of our mind, and a metaphysical foundation is an examination of the basic concepts of philosophy and science. Such solutions can be traced back to Descartes's writings, where the foundations of his philosophy are embodied by i) the notions of metaphysics matching a dualistic world-view, i.e., the basics of a Cartesian ontology; ii) the deduction of physical laws from metaphysical principles, as the notion of body, soul and their modes, and the perfections of God; iii) the preparation of the mind to philosophy as the cleansing of the mind from the Aristotelian errors; iv) the justification of the right functioning of mental faculties: as of a) evidence as the criterion of truth, provided by means of doubt and *cogito*, and of b) the truth of past demonstrations, by the appeal to the goodness of God[29]. Descartes located the actual place of the consideration of these

[29] These points have been thoroughly addressed in secondary literature: on Cartesian ontology (i), see Garber 1992; J.-L. Marion, *Sur l'ontologie grise de Descartes. Science cartésienne et savoir aristotélicien dans les «Regulae»*, Paris, Vrin 1993. R.A. Watson, *The Breakdown of Cartesian Metaphysics*, Atlantic Islands, Humanities Press International 1998; T.M. Schmaltz, *Descartes on Causation*, New York, Oxford University Press 2008; P. Anstey, D. Jalobeanu, (eds.), *Vanishing Matter and the Laws of Motion: Descartes and Beyond*, London, Routledge 2011. On Descartes's deductive physics (ii), see Clarke 1982; Garber 1992, chapters 7-8; Dear 1998; J. Schuster, *Whatever Should We Do with Cartesian Method? Reclaiming Descartes for the History of Science*, in S. Voss, *Essays on the Philosophy and Science of Rene Descartes*, New York, Oxford University Press 1993, pp. 195-223; Garber 1992 and 2001; S. Gaukroger, J. Schuster and J. -Sutton (eds.), *Descartes' Natural Philosophy*, Routledge, London 2000; S. Gaukroger, *Descartes' System of Natural Philosophy*, Cambridge, Cambridge University Press 2002; J.A. Schuster, *Descartes-Agonistes. Physico-mathematics, Method & Corpuscular-Mechanism 1618-33*, Dordrecht-Heidelberg-New York-London, Springer 2012; T. Sorell, *Scientia and Sciences in Descartes*, in Sorell-Rogers-Kraye 2010, pp. 71-82. On the introduction to philosophy (iii), see M. Williams, *Descartes and the Metaphysics of Doubt*, in J. Cottingham (ed.), *Descartes*, Oxford, Oxford University Press 1998, pp. 28-49; Flage-Bonnen 1999; J. Broughton, *Descartes's Method of Doubt,* Princeton, Princeton University Press 2002; Sorell 2005; Clarke 2006; E. Curley, *The Cogito and the Foundations of Knowledge*, in S. Gaukroger (ed.), *The Blackwell Guide to Descartes' Meditations*, Malden-Oxford-Carlton, Blackwell 2008, pp. 30-47. On evidence as truth criterion (iv.a), M. Ayers, *Theories of Knowledge and Belief*, in Garber-Ayers 1998, vol. II, pp. 1003-1061; L. Datson, *Probability and Evidence*, *ibid*., pp. 1108-1144; L. Alanen, *Descartes's Concept of Mind*, Cambridge-London, Harvard University Press 2003; D.M. Clarke, *Descartes's Theory of Mind*, Oxford, Clarendon Press 2005; Sorell 2005; S. Gaukroger, *Knowledge, Evidence and Method*, in D. Rutherford (ed.), *The Cambridge Companion to Early Modern Philosophy*, Cambridge, Cambridge University Press 2008, pp. 39-66; S. Patterson, *Clear and Distinct Perception*, in J. Broughton, J. Carriero (eds.), *A Companion to Descartes*, Blackwell, Malden, MA and Oxford 2008, pp. 216-234; D. Boyle, *Descartes on Innate Ideas*, London & New York, Continuum 2009; E. Curley, *Certainty: Psychological, Logical and Metaphysical*, in Voss 1993, pp. 11-30. On Descartes's use of rational theology as a guarantee for rational truths (iv.b), M. Della Rocca, *Descartes, the Cartesian Circle, and Epistemology without God*, «Philosophy and Phenomenological Research» 70/1 (2005), pp. 1-33; J. Cottingham, *The Role of God in Descartes's Philosophy*, in

issues in metaphysics, which he conceived as the roots of the whole tree of philosophy in the French edition of his *Principia* (1647). Thus, metaphysics is the foundation of Descartes's physics, and includes a consistent use of rational theological arguments. On the other hand, he excluded any use of logical considerations in his philosophy, as these are, according to him, not provided with any function of discovery[30]. Dutch philosophers would address all these strategies and develop – or reject – Descartes's very arguments according to their own interests and standpoints.

Accordingly, I will show why and how Descartes's arguments were used, rejected, or survived in 1) the foundation of philosophy as a comprehensive corpus of Academic disciplines and as a rational enterprise, 2) the foundation of a philosophical ethics, 3) the Cartesian foundation of an empirical science. This program will be pursued by comparing, in six chapters, six different cases of foundation, which provided different answers to such problems.

As a prologue to my survey, I will devote the first chapter to Henricus Regius, whose foundation of natural philosophy entailed an interpretation of Cartesian philosophy from which Dutch Cartesians tried to distance themselves. Regius regarded experience as the only source of knowledge – in accordance with his medical orientation – and based natural philosophy on Revelation, having discarded Descartes's metaphysics as speculative. His solution, however, was considered philosophically untenable and detrimental to Descartes's philosophy itself.

The second chapter will concern the accommodation of new philosophy to the academic curriculum by Johannes Clauberg, who maintained a metaphysical foundation embodying theological arguments, while providing at the same time a logical theory of the method for natural philosophy, as well as for law, theology and medicine. His case shows a possible answer to the first problem.

The third chapter will provide deeper insights into this problem, by unveiling the strategy used by Johannes de Raey to detach philosophical from practical disciplines through a logical foundation. According to him, logic consists in the analysis of language aimed at defining the boundaries of natural philosophy – the sole discipline to be based on Descartes's method – and at

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Broughton-Carriero 2008, pp. 288-301; D. Cunning, *Argument and Persuasion in Descartes' Meditations*, Oxford, Oxford University Press 2010; id., *The First Meditation: Divine Omnipotence, Necessary Truths and the Possibility of Radical Deception*, in D. Cunning (ed.), *The Cambridge Companion to Descartes' Meditations*, Cambridge, Cambridge University Press 2014, pp. 68-87; T.M. Lennon, *The Fourth Meditation: Descartes's Theodicy avant la lettre*, *ibid*., pp. 168-185.

[30] I address this topic in chapter II.

avoiding Regius's radical interpretation of Cartesian ideas. His case can be interpreted as the first reflection, in Dutch Cartesianism, on the limits of philosophy itself.

The fourth chapter will concern the theological foundation of ethics by Arnold Geulincx, resulting in the development of a moral science based on an introspective method and consistent with reformed creed, whereas the previous cases mainly concerned physics. In accordance with such theological foundation, he considers physics as based on hypotheses drawn from experience, our only means to discover the arbitrary laws put by God upon matter. His case shows an answer to the second problem, and partially to the third one – as far as the use of experience in philosophy is concerned.

In the fifth chapter I will consider the impact of mathematical-experimental science on Dutch Cartesianism, by showing that the empirically oriented form of Cartesian physics of Burchard de Volder was based on a scarce metaphysical foundation, with no attention for logic or theology. His case, along with Geulincx's, shows that Dutch Cartesians cared less and less about a deduction of physical models from metaphysical or rational-theological principles. However, such principles still played a foundational role in ensuring the reliability of evident knowledge.

Finally, I will address the foundation of Newtonian natural philosophy of Willem J. 's Gravesande, embodying metaphysical, logical and theological arguments. Eventually, his case confirms the strength of my approach, because even after the demise of Cartesianism these alternatives served as a foundation for Newtonian science, and showed a change in the function of such branches of philosophy, embodying a philosophical reflection on modern science.

As a matter of fact, these three foundational strategies cannot be clearly distinguished at all. An analysis of the foundation of philosophy and science raises a large number of questions, both historical and methodological. The problem of the definition of the basic concepts to be used in such research – as well as in any study of historical topics, since these are defined by our pre-conceptions – reveals the interplay of these two kinds of issues. Accordingly, a historical analysis may help in solving a methodological problem, which, in turn, can throw light on the very history of philosophy, resulting, however, in a circle between history and theory. Such circularity entailed by a historical approach aimed at solving methodological problems and *vice versa* can be positively solved by paying attention to the problems expressly faced and solved by early modern philosophers: in this case, to the problem of a foundation of philosophical knowledge, the different

solutions of which can be regarded as interpretative categories in the history of philosophy. The main problem emerging from my study, in fact, is that of the definition of the meaning of "foundation" itself, which I will regard as a heuristic concept which can be clarified through a historical analysis. By "foundation" I will primarily refer to those arguments aimed at providing philosophy and science with a demonstration of their reliability in acquiring the truth, that is, as the demonstration of the reliability of human faculties in philosophical and scientific reasoning. Secondarily, I will refer to foundation in the theory providing philosophy and science with its ontological apparatus, as to the notions of mind, body and God. Thirdly, foundation is the introduction of students and scholars to new ways of thinking, and – fourthly – the deduction of the first principles of various branches philosophy and science from logical, metaphysical and theological notions. Since this dissertation is aimed at developing a history of philosophy of science as a study of the self-reflection of philosophers on philosophical and scientific knowledge the main focus will be on the first kind of foundation. However, since such notions were often linked in early modern philosophy, I will from time to time also consider the further notions of "foundation". In fact, "foundation" or "*fundamentum*" remains a metaphor: the use of this concept allowed philosophers to convey the rough idea of a "construction" of disciplines provided with a basis. The very terminology adopted by early modern philosophers did not often discriminate between metaphysics, rational theology and logic. Moreover, there was no agreement on the possibility of providing philosophy with a foundation by rational means. Therefore, rather than imposing strict distinctions between the concepts and ways of foundation, I will focus on the ways in which the meanings of the term, and the three kinds of solutions – logic, metaphysics and theology – were dealt with in theories, in which one of these alternatives played a leading role.

As to the parts of philosophy provided with a foundation I will consider, first and foremost, physics or natural philosophy, broadly conceived as the study of natural and material world. However, I will also take into account the possible relations of natural philosophy with other disciplines, such as ethics, medicine and law. Accordingly, this study will make it possisble to define the assumptions and the scope of philosophy, the relations among disciplines, their epistemic status, i.e. their being capable of reaching different kinds of certainty, and their ends. Finally, an analysis of the problem of the foundation will make it possible to answer the problem of the functions of philosophy in early modernity, assessing the specificity of Cartesianism and Newtonianism with respect to Aristotelianism.

1. The prologue: Regius's rejection of Cartesian metaphysics

1.1 Introduction

The quest for a foundation of philosophical knowledge on a Cartesian basis was not undertaken by all the interpreters of Descartes's philosophy in the Low Countries. Let us examine the case of Henricus Regius (1598-1679), who developed a comprehensive physical theory based on Cartesian principles, but which he did not provide with a foundation either on Descartes's metaphysics or on any philosophical argument. The problem of the reliability of human faculties, indeed, was solved by him through an appeal to Revelation. This may have resulted from his lack of interest in metaphysical questions as such, as he was mainly concerned with physical and medical problems. Still, an analysis of his positions reveals some theoretical reasons for his refusal to give a foundation on a Cartesian, metaphysical basis. His case shows that even if he did not find any rational means to provide the new natural philosophy with a foundation, and was anyhow unconcerned with metaphysical problems as such, he had to appeal to a source of indubitable knowledge – as Revelation – to set a basis for his philosophy. That is, Regius's case still reveals the importance of the problem of the foundation of Cartesian philosophy. Moreover, it shows some of the reasons that attracted other Cartesian philosophers – such as Johannes Clauberg and Johannes de Raey –, to provide a foundation taking into account the broader metaphysical aspects entailed by Cartesianism, neglected by Regius. Indeed, Regius's standpoints caused harsh polemics within the Dutch Academic context.

Born in 1598, Regius had been one of the first teachers of Cartesian philosophy in a European Academy[31]. After having matriculated at the medical faculties of Groningen and Leiden University,

[31] The first Dutch Cartesian scholar seems to have been his friend Henricus Reneri, see F. Sassen, *Henricus Renerius, de eerste "Cartesiaanse" hoogleraar te Utrecht*, Amsterdam, Noord-Hollandse Uitgeversmaatschappij 1941; R. Buning, *Henricus Reneri (1593-1639), Descartes' Quartermaster in Aristotelian Territory*, Utrecht, Utrecht University: Publications of the Department of Philosophy 2013.

he graduated at Padua University in 1623[32], where Cesare Cremonini was among his *promotores*. As he came back to Utrecht in 1634, he started privately to lecture on Cartesian natural philosophy, to which he had been introduced by Descartes's friend Henricus Reneri. Apparently, he could obtain a position at Utrecht University in 1638 – at first as extraordinary professor of theoretical medicine – thanks to such private teaching. Indeed, Reneri was among those who supported his candidacy for a chair in medicine at the Academy[33]. In his *Epistola ad Patrem Dinet*, moreover, Descartes reports that Regius was appointed at the medical faculty because he wrote a comprehensive textbook on Cartesian physiology, which he presented to the friends supporting him before the city authorities[34]. This textbook can be regarded as an original development of Descartes's physical principles: in 1638, indeed, Regius could have read only Descartes's *Essais* and *Discours de la méthode* (1637), as Descartes's *Le monde* was read by him only after April 1641, when it was mentioned for the first time in his correspondence[35]. Eventually, his developments of a Cartesian philosophy resulted in two series of disputations he held in 1641: his *Physiologia sive cognitio sanitatis* and *De illustribus aliquot quaestionibus physiologicis*. The latter series, in fact, is infamously known as having occasioned the Utrecht crisis, since Regius defined man as an accidental union of two substances[36]. In any case, this event did not stop his cooperation with Descartes, which however came to an end in 1645, when Descartes read the proofs of Regius's *Fundamenta physices*, his main treatise in natural philosophy, containing some positions inconsistent with Descartes's metaphysics. Later, he will clarify these points in his *Explicatio* and

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[32] See P. Farina, *Sulla formazione scientifica di Henricus Regius: Santorio Santorii e il* De statica medicina, «Rivista Critica di Storia della Filosofia», 30 (1975), pp. 363-399; id., *Il corpuscolarismo di Henricus Regius: materialismo e medicina in un cartesiano olandese del seicento*, in U. Baldini (ed.), *Ricerche sull'atomismo del Seicento* (conference acts, Santa Margherita Ligure, 14-16 October 1976), Firenze, La Nuova Italia 1977, pp. 119-178

[33] See the official report of the University on the Utrecht crisis, G. Voetius et al., *Testimonium Academiae Ultraiectinae, et Narratio Historica*, Utrecht, ex typographia Wilhelmi Strickii, 1643, p. 9, also in T. Verbeek, *La Querelle d'Utrecht*, Paris, Les Impressions nouvelles 1988.

[34] «Doctor quidam medicinae […] legit Dioptricam meam et Meteora, cum primum edita sunt in lucem, ac statim aliqua in iis verioris philosophiae principia contineri iudicavit. Quae colligendo diligentius, et alia ex iis deducendo, ea fuit sagacitate, ut intra paucos menses integram inde Physiologiam concinnarit, quae, cum privatim a nonnullis visa esset, eis sic placuit, ut professionem medicinae, ibi tunc forte vacantem, pro illo, qui antea ipsam non ambiebat, a magistratu petierint et impetrarint», *Oeuvres de Descartes*, edited by C. Adam, P. Tannery, Paris, L. Cerf 1897-1913 (hereafter as "AT"), VII, pp. 582-583. Regius's *Compendium physicum*, revised through the years, is mentioned in the correspondence of Regius and Descartes, in their *Responsio*, in Descartes's *Epistola ad Voetium*, and in the *Narratio historica,* under various titles: *Physiologia*, *Compendium physices*, *Prodromus novae philosophiae*, *Physica fundamenta*: see *The Correspondence between Descartes and Henricus Regius*, ed. by E-J. Bos, Utrecht, Utrecht University: Publications of the Department of Philosophy 2002, p. 4, n. 9, and p. 40.

[35] AT III, p. 374. See T. Verbeek, *Regius's Fundamenta Physices*, «Journal of the History of Ideas» 55 (1994), pp. 533-551: pp. 543-546.

[36] See Verbeek 1992a, pp. 17-33.

Brevis explicatio mentis humanae (1647, 1648), written against Descartes's criticism. Regius published different editions of his treatises in physics and medicine: his *Fundamenta medica* (1647, 1657, 1668), and his *Philosophia naturalis*, or the enlarged edition of his *Fundamenta physices*, which was also translated and published in French after his death in 1679.

Regius's philosophy has been thoroughly examined by Theo Verbeek, who has outlined the evolution of Regius's thought in the light of his quarrels with Voetius and Descartes[37]. More recently, Erik-Jan Bos has edited the complete correspondence between Regius and Descartes and a series of disputations held by Regius in 1641 (*Physiologia sive cognitio sanitatis*)[38]. In the past years, two essential studies on the natural philosophy of Regius were published by Delphine Bellis and Delphine Kolesnik-Antoine, focusing on the actual methodology employed by the Dutchman[39]. Bellis has focused on the theory of vision resulting from Regius's empiricism, and on the ways physical principles and explanations are to be provided in accordance with Regius's epistemological assumptions. Kolesnik-Antoine, on the other hand, has taken into consideration the role of dissection in the development of a Cartesian physiology. While touching across to these topics, this chapter will focus on a different point: it will present the reasons that drove Regius to appeal to the Bible for the foundation of natural philosophy. These are to be found in his rejection of innatism and of evidence as indubitable truth criterion. Eventually, the peculiarities of Regius's foundation are to be traced back to his interests in medicine, shaping his empirical approach in accounting for the functioning of mental faculties and for the method of natural philosophy. Such an approach led him to discard Descartes's metaphysical assumptions, and to argue for a foundation of knowledge on Revelation as the only way to avoid scepticism. However, Regius also deployed some logical and theological arguments against Descartes's metaphysics, whose inconsistencies are highlighted by paying attention to the logical fallacies and to the powers of God in deceiving us. While providing a Cartesian physics, Regius's metaphysical positions were thus developed in opposition to Descartes and through his very polemics with him.

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[37] Verbeek 1988; Verbeek 1992a; id. *Ens per accidens: le origini della Querelle di Utrecht*, «Giornale critico della filosofia italiana», 71 (1992) (b), pp. 276-288); id., *Descartes et Regius. Autour de l'Explication de l'esprit humain* (ed.), Rodopi, Amsterdam 1993; Verbeek 1994; id., *The Invention of Nature. Descartes and Regius*, in S. Gaukroger, J. Schuster and J. Sutton (eds.), *Descartes' Natural Philosophy*, Routledge, London 2000, pp. 149-167.

[38] Bos 2002; id., *Henricus Regius et les limites de la philosophie cartésienne*, in D. Kolesnik-Antoine (ed.), *Qu'est-ce qu'être cartésien?*, Lyon, ENS 2013, pp. 53-68.

[39] D. 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), pp. 125-145; D. Bellis, *Empiricism without Metaphysics: Regius' Cartesian Natural Philosophy*, in Dobre-Nyden 2013, pp. 151-183.

1.2 A medical standpoint on philosophy

The contents of Regius's first, unpublished treatise were probably used for his first comprehensive work, i.e., his series of disputations *Physiologia sive cognitio sanitatis* (1641)[40]. Since the official chair of natural philosophy belonged to Arnold Senguerd, the disputations were not in physics but in physiology, that is, the theoretical explanation of bodily functions, or the physical premise of medicine[41]. Actually, this was not only a measure to avoid conflicts with the Academic authorities: Regius's philosophy, indeed, was structured on physics as the condition for a better understanding of diseases, resulting in a large treatise on medicine published in 1647, his *Fundamenta medica*[42], which focused on the causes, symptoms and healing of diseases. The relations between philosophy and medicine are outlined by Regius in this 1647 treatise. Following the traditional structure of medical textbooks, he divides medicine into *cognitio* and *curatio*[43]. *Cognitio*, or theoretical medicine, is divided into *physiologia*, or the knowledge of health (concerning *bona temperies* and *apta conformatio* of bodily parts), and *cognitio pathologica*, or the knowledge of diseases[44]. However, at the beginning of the treatise Regius points out the continuity between *cognitio* and *curatio*, or between theoretical and practical medicine, as explanations of bodily functions are aimed at healing[45]. Moreover, he rectifies the vulgar definition of physiology as the study of the natural things concerning the human body[46]: this is, indeed, only an imprecise definition of physiology, which more properly concerns human health. He distinguishes two kinds of physiology: a "general" physiology, or the study of natural things in the human body (which is a

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40 H. Regius, *Physiologia sive cognitio sanitatis*, Utrecht, ex officina Aegidii Roman 1641 (a), also in Bos 2002, pp. 195-248 (for bibliographical details, see pp. 195-196). The two first disputations are *De sanitate*; the next four are *De actionibus animalibus*. Later, other disputations completed Regius's *Physiologia*: they took place in 1641 and 1643 and were on medical topics only: *De morbis*, *De syntomatis specialibus*, *De morborum signis* (1641), *De diagnosi et prognosi morborum*, *De hygienia*, *De therapeutica* (1643). They cover the topics later addressed in his *Fundamenta medica*.

41 *Narratio Historica*, p. 18.

42 H. Regius*, Fundamenta medica*, Utrecht, apud Theodorum Ackersdycium 1647 (a).

43 *Ibid*., p. 2.

44 *Ibid*., p. 3.

45 «Medicina inter artes numero: quia omnia eius praecepta ad aliquid agendum sunt delineata. Atque hinc constat illa vulgo male in theoretica et practicam dividi: cum omnes artes […] doctrinae sint practicae […]. Neque his adversatur prior medicinae pars, quae cognitio a nobis appellatur; uti nec sanitatis, remedii, et multorum aliorum in medicina tradendorum, definitiones. Nam haec omnia revera sunt practica; cum ad actionem medicam, sive medendum, cuncta dirigantur», *ibid*., p. 1.

46 Regius seems to refer to Jean Fernel's definition, who, however, considered only the constitution of healthy man: see J. Fernel, *Universa medicina*, Paris, apud Andream Wechelum 1567, *Praefatio*, p. IV (unnumbered): «φυσιολογικὴ, quae hominis integre sani naturam, omnes illius vires functionesque persequitur».

branch of physics), and a medical physiology, concerning human health. Such a distinction prevents the repetition of the same notions in medical and physical treatises[47]. Physics, thus, is to be considered a necessary premise for medicine, from which it is detached only for pragmatic reasons[48]. In his 1641 disputations, however, the two kinds of physiology are mixed: his *Physiologia*, indeed, concerns both human health and animal actions, namely, the "medical" physiology and the study of the main functions of the human body. Given such topics, Regius's disputations include some remarks on the different kinds of knowledge embodying the premises of his mature epistemology, focused on the sensory origin of knowledge. Providing a detailed classification of *actiones animales* in the third disputation, Regius distinguishes between cogitative and automatic actions, both involving the human mind, whereas *actiones naturales* concern only the body[49]. Cogitative actions are performed by mind and are divided into intellect and will. On the other hand, automatic actions are those of which the soul is not aware: sense reception, natural appetite and spontaneous motion[50]. As these are performed by the body only, they are similar to

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47 «Cognitio physiologica est de cognoscenda sanitate. Haec vulgo appellatur physiologia; definiturque pars medicinae, quae agit de rebus naturalibus; seu talibus, quae corpus humanum constituunt. […] Sed meo iudicio, non satis bene: cum talis physiologia sit pars physicae, cuius munus est de rebus naturalibus, quales hae sunt, agere. Nec iuvat, quod physici alia ratione et alio respectu haec tractent, quam medici. Si enim artes et scientiae, pro diversitate tractationis usus et respectus, diversae essent, diversisque locis deberent tradi, una eademque doctrina infinitis pene locis esset repetenda. Haec autem cognitio recte physiologica vel physiologia dicitur, quia illud, quod homini, secundum naturam inest, nempe sanitatem, cognoscere docet», Regius 1647a, p. 3. See also the second edition of Regius's main work in natural philosophy, his *Fundamenta physices* (Amsterdam, apud Lodovicum Elzevirium 1646), published as *Philosophia naturalis* (Amsterdam, apud Lodovicum Elzevirium 1654): «philosophia naturalis, quae vulgo physica et physiologia dicitur, est rerum naturalium scientia», p. 1. *Philosophia naturalis* had another edition in 1661 (Amsterdam, apud Lodovicum et Danielem Elzevirios). In the second edition of *Fundamenta medica*, which appeared in 1657 as *Medicinae libri quatuor* (Utrecht, typis Theodori ab Ackersdijck, et Gisberti a Zijll), Regius added some lines to the paragraph here quoted, underlining that he had to repeat some notions already developed in physics in order to make the treatise more understandable: «itaque, si quicquam istarum rerum naturalium dictarum, in cognitione hac physiologica, a me tradatur, vel designetur; id non ut ad medicinam proprie pertinens; sed, tanquam per necessarium istius cognitionis commentarium hic repetitum, tantum est habendum», Regius 1657, p. 3.

48 On the other hand, in his *Philosophia naturalis* (1654) the difference between physics and medicine is more stressed: «philosophia naturalis […] est rerum naturalium scientia. Scientiam illam appello, et quidem meram; nam, haec sola sciendi dogmata, nulla vero faciendi praecepta, tradit. Nec obest, quod huius utilitas ad theologiam, iurisprudentiam, medicinam, omnesque alias disciplinas et artes, faciendi magistras, pertineat. Nam, ut lucrum honor, et existimatio, aliis discipliniis et artibus; ita haec utilitas, est physicae tantum accidentaria; nequaquam vero essentialis: ac proinde, propter illam physica ad practicas disciplinas, sive artes, minime est referenda», Regius 1654 p. 1. In the second edition of his *Fundamenta medica*, however, Regius consistently inserts those sections on human nature already contained in his *Fundamenta physices* and 1654 *Philosophia naturalis*: see Regius 1657, chapters IV, V and VI: *De actionibus animalibus cogitativis*, *De animi affectibus*, *De actionibus animalibus automaticis*.

49 «Absolutis actionibus naturalibus sequuntur animales, quae non tantum a natura partium, seu naturali temperie et conformatione fiunt, sed etiam vi animae seu mentis perficiuntur», Regius 1641a, p. 33.

50 «Expositis actionibus cogitativis aggrediamur automaticas, quae anima seu mente ad rem non attendente per solum organorum animalium, nempe spirituum, nervorum, cerebri, aut musculorum, ab obiecto externo vel interno agitatorum motum ab homine tanquam aliquo automato peraguntur. […] Actiones automaticae sunt receptio,

actiones naturales. However, whereas natural actions are mere organic processes such as generation and *alitura*, animal automatic actions can be turned into cogitative ones, if the mind pays attention to them[51]. The background of their explanation is Cartesian: Regius provides a mechanistic account of sense perception distinguishing it from the purely mental acknowledgment of immaterial entities, like God or mind[52]. Perception or intellect can be either organic or inorganic, that is, working with or without the body[53]. However, a short remark on the difference between organic and inorganic perception is the only concession to Descartes's theory of pure understanding, as Regius's account of perception concerns only the sensory acquaintance of movements through *sensus reflexus*, *reminiscentia* and *imaginatio*[54]. Even the perception of universals is organic, as these are gained through imagination[55]. The point, actually, had been discussed by Regius in his correspondence with Descartes, who found it questionable[56]. In his further works, Regius will make explicit his refusal of any innate idea by identifying intellect with sensory perception, therefore called *sensus cogitativus*, and omitting any reference to inorganic perception[57]. In this way, he will retain the arguments of his *Physiologia* as the basis for an explanation of every mental activity depending on sense perceptions. Few variations will be necessary to transform Regius's physiology into an empiricist account of human knowledge.

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appetitus sensitivus simplex, et motus spontaneus. Receptio est actio (vel potius passio) animalis automatica, qua motus rerum recipimus. […] Haec triplex est sensus simplex, reminiscentia simplex, imaginatio simplex», *ibid*., p. 46.

51 *Ibid*., p. 17.

52 Regius distinguishes rational and vegetative soul as mind and body («anima in homine unica est, nempe rationalis. Neque enim actiones humanae ullae censendae sunt, nisi quae a ratione dependent, vis autem vegetandi, et corporis movendi […] in homine nihil aliud est, quam certa partium corporis constitutio», Regius 1641a, p. 15). However, he still defines the rational soul as a substantial form added to matter («nos substantiam corpoream esse unicam omnium corporum materiam agnoscimus, nullasque isti materiae substantiales formas realiter ab illa distinctas adiungimus (excepta sola anima rationali)», ibid., p. 5). Later, such "substantial form" will be defined by Regius as "*forma specialis*", and accidentally united to the body, giving rise to the Utrecht crisis: see his second series of disputations in physiology, *De illustribus aliquot quaestionibus physiologicis*, Utrecht, ex officina Aegidii Roman 1641 (b), II, §§ 14-16.

53 «Intellectus est rerum obiectarum cognitio. Estque perceptio et iudicium. Perceptio est intellectus, quo res mente percipimus. Estque inorganica et organica. Inorganica perceptio est, qua mens nostra sine organo ullo percipit res imagine corporea carentes, ut Deum, animam rationalem, etc. Perceptio organica est, qua mens nostra instrumento corporeo percipit res imaginationem corpoream habentes. Haec triplex est, sensus reflexus, reminiscentia, imaginatio», Regius 1641a, p. 33.

54 See the quotation in the previous note.

55 «Receptio universalium ad imaginationem pertinet. Universalia enim sunt singularia in abstracto considerata sine notis individuationis hoc, hic, nunc, ut loquuntur scholastici. Itaque haec fiunt per imaginationem, quae detrahit», Regius 1641a, p. 42. The same point is recalled in Regius 1646, p. 285.

56 See the letter of Descartes to Regius of July 1641: AT III, p. 66 (attributing Descartes's remarks on universals to a letter of 24th of May 1641), Bos 2002, p. 76 (dating it after the disputation).

57 Regius 1646, p. 252.

1.3 Descartes's enthusiasm

These points came to light in Regius's *Fundamenta physices* (1646), a comprehensive textbook following the structure of Descartes's *Principia philosophiae* and based upon the texts of his *Physiologia* and of his early, unpublished *Compendium physicum*[58]. When a first draft of the text was submitted to Descartes before publication, the Frenchman distanced himself from Regius's metaphysics in a letter of July 1645[59]. Regius next refused to publish some parts of the book after Descartes's criticisms, which appeared in his *Explicatio mentis humanae* (1647) and in the following texts, reflecting, indeed, some contents of the letter. In his missive, Descartes objects to two main points of Regius. The first objection is not to have provided adequate proofs for his physics, as Regius displays definitions and divisions, going from the general to the particular, – following the Ramistic method of dichotomies –, and without grounding them on adequate *probationes*[60]. Moreover, Descartes criticizes Regius's consideration of the soul as a bodily modification, objecting to his lack of shrewdness in dealing with theology[61]. In his *Explicatio*, in fact, Regius will admit that the human soul can be an accident of the body, or *modum corporis*[62]. What is at stake are two aspects of Regius's philosophy: the first concerns the adoption of natural philosophical explanations no longer based on some innate principles and natural laws deduced from the *cogito*, but on experience [63]. The second is the way of dealing with the nature of the soul. Both points are related to the problem of the foundation, involving the rejection of Descartes's use of evidence, by which he claimed the substantiality of the soul and the absolute truth of the innate

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58 Regius's *Fundamenta physices* begins with a chapter on the principles of physics, focusing next on cosmology, on earthly phenomena, on animals and ending with a chapter on man.

59 «Quod ne in me etiam redundet, cogar deinceps ubique profiteri, me circa res metaphysicas quam maxime a te dissentire, atque etiam scripto aliquo typis edito id publice testari, si liber tuus prodeat in lucem», AT IV, pp. 249-250.

60 «Fateor quidem eas per definitiones et divisiones, a generalibus ad particularia procedendo, recte tradi posse, atqui nego probationes debere tunc obmitti; […] Alii autem legentes assertiones sine probationibus, variasque definitiones plane paradoxas, in quibus globulorum aethereorum, aliarumque similium rerum, nullibi a te explicatarum, mentionem facis, eas irridebunt et contemnent, sicque tuum scriptum nocere saepius poterit, prodesse nunquam», *ibid*., p. 249. On Regius's Ramist method, see Verbeek 2000.

61 «Nuncque omnino subscribo illorum sententiae, qui voluerunt, ut te intra medicinae terminos contineres. Quid enim tanti opus est, ut ea quae ad metaphysicam vel theologiam spectant scriptis tuis immisceas, cum ea non possis attingere, quin statim in alterutram partem aberres? Prius, mentem, ut substantiam a corpore distinctam, considerando, scripseras hominem esse *ens per accidens*; nunc autem e contra, considerando mentem et corpus in eodem homine arcte uniri, vis illam tantum esse *modum corporis*», *ibid*., p. 250.

62 *Infra*, n. 89.

63 Regius 1646, p. 17.

principles apt to ground physics.

In fact, Regius's rejection of Descartes's metaphysics is fully stated in his answer to Descartes of 23 July 1645. Since Descartes, according to Regius, supported his positions the way any enthusiast could do with his fantasies, i.e. just claiming their evidence, he was subjected to the fanciful imaginations caused by bodily constitutions[64].

vous ne serez pas surpris de ma conduite, lorsque vous saurez que beaucoup de gens d'esprit et d'honneur m'ont souvent témoigné qu'ils avaient trop bonne opinion de l'excellence de votre esprit, pour croire que vous n'eussiez pas, dans le fonds de l'âme, des sentiments contraires à ceux qui paraissent en public sous votre nom. Pour ne vous en rien dissimuler, plusieurs se persuadent ici que vous avez beaucoup décrédité votre philosophie, en publiant votre Métaphysique. Vous ne promettiez rien que de clair, de certain et d'évident; mais, à en juger par ces commencements, ils prétendent qu'il n'y a rien que d'obscur et d'incertain, et les disputes que vous avez eues avec les habiles gens à l'occasion de ces commencements, ne servent qu'a multiplier les doutes et les ténèbres. Il est inutile de leur alléguer que vos raisonnements se trouvent enfin tels que vous les avez promis. Car ils vous répliquent qu'il n'y a point d'enthousiaste, point d'impie, point de bouffon qui ne pût dire la même chose de ses extravagances et de ses folies[65].

Regius's accusation of enthusiasm clearly restates the critique of Voetius in the *Admiranda methodus* (1643). According to Voetius Descartes's method, based on the rejection of the use of the senses, would lead us to accept fantasies as evident truths. Descartes, in fact, is compared to the autodidacts and to religious enthusiasts, who avoid the use of the senses or Revelation[66]. The importance of the senses in the discovery of truth is stressed in the further works of Regius, as he

[64] In his 1654 *Philosophia naturalis* Regius underlines that in sickness we have more vivid perceptions of immaterial things: «cum itaque mens a rebus mundanis abstracta, eaque his instrumentis purioribus est instructa; tum nihil est mirandum aegros illos, quamvis reliquum corpus sit debile, sapientiorum cogitationum proferre indicia», p. 343. This can be read, actually, as a crypto-accusation of enthusiasm against Descartes.

[65] AT IV, p. 255.

[66] «Eadem methodus recta ad enthusiasmum ducit. […] Periculosae vero aleae plenissima haec methodus est. Mens enim sive intellectus ob caligantes, quos habet oculos, sensibus externibus ut ducibus, haut aliter indiget ac coecus suo ductore; ipsa axiomata solis radiis clariora, ut indubitata non amplectitur, nisi sensuum ministerio eorum instituerit examen illorumque certitudinem in praxi manibus quasi palpaverit. […] Quando primo enim a sensibus abducitur ad contemplationem eorum axiomatum, quae ei insculpta videntur, exuitur ammussi ac norma sua, sibique relicta facile axioma quod fingere potest, quod si normae exhibeatur, postea falsum ac sublestae fidei deprehendatur: quoniam nihilominus, prerogativa ei deferur, (quasi eiusmodi iudice cum regula non indigeret) pertinaciae callo obducitur, audetque se munire per axiomata contemplando adinventa contra quascunque rationes et apertissimam etiam veritatem. Quod ἀυτοδιδάκτοις accidere solet, qui opinionum Helenas, a se inventas, prae amore comprimendo enecare quae derelinquere malunt, contemplantibus talibus accidit. […] Antiqui et recentiores enthusiastae […] Scripturam contemnere inceperunt, et vice divinorum oraculorum ea obtrudere quae mens dictabat. Fateor, quidem, hos inter enthusiastas antesignanos, pro mente iactasse interum hominem, spiritum, Deum loquentem, somnia, et quae alia fanaticorum vocabula esse solent, sed unius rei, mentis nempe variae tantum denominationes fuerunt», M. Schoock, G. Voetius, *Admiranda Methodus novae philosophiae Renati des Cartes*, Utrecht, ex officina Joannis van Waesberge 1643, pp. 255-257. On the critiques to enthusiams, see M. Heyd, *"Be Sober and Reasonable": The Critique of Enthusiasm in the Seventeenth and Early Eighteenth Centuries*, Leiden, Brill 1995.

supports an empiricist theory of knowledge. As Descartes's metaphysics is discarded, Regius's foundation of philosophy would rely on Revelation, through which he solved the main metaphysical problems raised by the new philosophy.

1.4 From innatism to Revelation

Metaphysical issues are dealt with by Regius in the last chapter of his *Fundamenta physices*, entitled *De homine*. These are discussed in the light of an empiricist theory of knowledge. Whereas in his *Physiologia* Regius maintained that perception could be also *inorganica*, concerning immaterial things, in his 1646 treatise *intellectio* is reduced to *sensus cogitativus*, *reminiscentia* and *imaginatio*[67]. Innate ideas, in fact, are not required in the explanation of cognitive phenomena and for the formulation of the first principles:

nullis videtur menti ad cogitandum opus esse ideis […] innatis; sed sola innata cogitandi facultas ipsi ad omnes actiones cogitativas peragendas sufficit; quod in doloris, coloris, saporis, aliorumque similium perceptione est manifestum, quae a mente recte percipiuntur, quamvis nullae eorum ideae menti sint innatae. Nec est ulla ratio, cur unae ideae magis a natura sint insitae, quam aliae. Itaque omnes notiones, quae vulgo communes dicuntur, quales sunt, totum est maius sua parte […] similiaque omnia alia, ex observationibus rerum didicimus[68].

The body is an indispensable instrument for the soul, providing the mind with its objects[69] even in knowing immaterial things, as Regius clarifies in his *Brevis explicatio mentis humanae* (1648)[70]: therefore, we are not always thinking. Whereas in his *Physiologia*, more in accordance with

[67] Regius 1646, pp. 252-253. According to his *Physiologia*, organic perception includes *sensus reflexus*, *reminiscentia* and *imaginatio*: Regius 1641a, p. 33.

[68] Regius 1646, p. 251. In his 1654 *Philosophia naturalis* Regius adds a criticism of Plato's innatism expounded in *Meno,* see Regius 1654, p. 355. In the 1661 *Philosophia naturalis* he appeals also to Aristotle's authority to support the sensory origins of knowledge: see Regius 1661, p. 419.

[69] «Corpus, sine ullius alterius rei auxilio, se perpetuo per se extendit. Mens vero actu non cogitat, nisi obiecta cogitabilia, mediantibus aptis instrumentis, ipsi offerantur. Quod cum non semper fiat, non est mirandum, mentem non semper actu cogitare», Regius 1646, p. 247.

[70] «*Mens* […] *est organica*, ita ut actiones suas sine corporeis organis perficere non possit, eaque utatur corpore, corpus vero non utatur mente. In omnibus enim actionibus saltem cerebro satis sano et satis recte disposito indiget; ut passim in pueris, senibus, deliris, sanis, aliisque quotidiana docet experientia: idque non tantum in rebus corporeis, sed etiam spiritualibus et divinis, considerandis», H. Regius, *Brevis explicatio mentis humane*, Utrecht, ex officina Theodori Ackersdicii 1648, p. 10. Italics mark the original text of his *Explicatio mentis humanae* (published as corollaries to a 1647 disputation: *Medicatio viri cachexia leucophlegmatica affecti. Corollaria*, Utrecht, Johannes à Noortdyck 1647 (b): *Corollaria* are published in AT VIII-2, pp. 342-364)

Descartes's metaphysics, Regius defines mind as εντελεχεια or *actus purus*[71], in his *Fundamenta* mind as *actus primus* is distinguished from *actiones cogitativae*, which are not always performed[72]. In sickness, for instance, it is not possible to state whether we are thinking[73]. The point fully reveals the medical roots of Regius's arguments, as the functioning of mind is analysed in the light of bodily conditions.

The rejection of innatism leads Regius to appeal to Revelation in order to ground philosophy. His empiricist theory of knowledge undermines the first step in Descartes's metaphysics: in his 1654 and 1661 *Philosophia naturalis* the argument of the *cogito* is defined just as a general concept, which has its origin in the senses and from which it is not possible to deduce the existence of any innate ideas[74]. Moreover, since the idea of God is shaped by the mind according to ordinary experiences[75], a rational theology based on Descartes's proofs is no longer possible. The point is stated in Regius's *Explicatio mentis humanae* (1647) and *Brevis explicatio mentis humanae* (1648), where Regius openly dismisses the possibility of demonstrating the existence of God from His idea:

conceptus noster de Deo, sive idea Dei, in mente nostra existens, non est satis validum argumentum ad existentiam Dei probandam: cum non omnia existant, quorum conceptus in nobis observantur; atque haec idea, utpote a nobis concepta, idque imperfecte, non magis quam cuiusvis alius rei conceptus, vires nostras cogitandi proprias superet[76].

It is not possible to prove the existence of God from the objective content of His idea, formed through imagination[77] and not requiring a perfect cause. With this, Regius criticizes a fallacy hidden in Descartes's ontological proof, namely, his mistaking *necessitas consequentiae* with *necessitas*

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71 Regius 1641a, p. 15.

72 «Actiones cogitativae sunt, quarum mens sibi est conscia. Sic imaginatio, sensatio, et omnis similis operatio, cuius sumus conscii, est operatio cogitativa. Per cogitationem itaque hic intelligimus, non cogitandi actionem, sed actum, ut vocant, primum, seu facultatem, sive principium internum cogitandi: quod etiam tum in nobis est, cum ab omni cogitandi actione abstinemus», Regius 1646, p. 245.

73 *Ibid*., pp. 246-247. Regius will explicitly deny that we are constantly thinking in his 1654 *Philosophia naturalis*, p. 344.

74 «Patet sensum aliquem omnis cognitionis, reliquarumque actionum cogitativarum esse principium, ac proinde non esse omnis cognitionis principium, sive primum cognitum, cogito; nedum, cogito, ergo sum. Hi enim sunt conceptus generales, qui ex speciali aliquo sensu primam originem duxerunt», Regius 1661, p. 399.

75 «Imo ipsa idea Dei, quae scilicet non est ex revelatione vel inspiratione divina, non videtur nobis innata, sed vel ex rerum observatione in nobis primum producta […]. Nam in ente summo, quod Deum appellamus, humanum ingenium nihil quicquam considerat, quam bonum aliquod, quod quotidie in homine observatur», Regius 1646, p. 252.

76 Regius 1647b, AT VIII-2, p. 345.

77 Regius 1648, pp. 12-13, 15.

consequentis: it is true that if God exists, He exists necessarily, but it is not necessary that He exists. The content of the idea of God, therefore, does not allow us to argue for His actual existence both by the ontological and causal argument[78]. Rejecting Descartes's proofs of God's existence and goodness, Regius appeals to Holy Writ as the only means to ground our knowledge of external reality, which is subjected to sense deception:

cum itaque sic a natura mens sit comparata, ut a variis motibus variae perceptiones et iudicia ipsi possint excitari, cumque illi motus non tantum a corporibus veris, sed etiam a causis imaginariis, et a potentissimo directore tantum imaginariis productis, animae offerri queant: hinc sequitur per naturam dubium esse, vera an falsa, seu imaginaria, mente percipiamus et diiudicemus. Verum hoc dubium nobis tollit Divina in Sacris revelatio […]. Unde patet ea quae recte percipimus, esse res veras, et non imaginarias […]. Atque ita magna illa dubitatio, quae in animis recte philosophantium per naturam necessario utramque paginam etiam in evidentissimis faceret, per Verbum Dei penitus evertitur. Unde recte quilibet verus philosophus, iam cum propheta canit: *verbum Dei est lucerna pedibus meis*[79].

In this way, Revelation is the ultimate guarantee for the existence of external things, as remarked in Regius's *Explicatio* and *Brevis explicatio*[80], and at the beginning of his *Philosophia naturalis* (1654)[81].

The rejection of innatism and of Descartes's proofs is not the only reason to appeal to Revelation for the foundation of philosophy. The reliability of knowledge, in fact, is subjected to the power of God, «a potentissimo directore». In Regius's perspective even innate ideas could be deceptive, as God is not bound not to hoodwink us, limited only by the contradiction principle. In this perspective, even Cartesian principles of nature as deduced from divine constancy are no longer tenable. On the other hand, even admitting the goodness of God could not justify our grasp of reality. In his *Brevis explicatio*, indeed, Regius clarifies how God can be a deceiver: as a

[78] «In ente summo, quod Deum appellamus, humanum ingenium nihil quicquam considerat, quam bonum aliquod, quod quotidie in homine observatur […] atque ita idea entis perfecti seu Dei a nobis primo imaginatione sive phantasia producitur, vel ita a nobis producta aliis traditur, vel ab aliis discitur. […] Nec obest, quod in idea sive conceptu Dei existentia necessaria et actualis comprehendatur. Nam hinc non sequitur, quod Deus iam necessario et actu existat; sed tantum, quod ille, ubi existit, non contingenter, sed necessario existat, sive tum non possit non existere. […] Neque enim verum est, realitatem idearum nostrarum obiectiva […] requirere causam, in qua eadem ipsa realitas non tantum obiective, sed etiam formaliter […] contineatur. […] Atque hinc factum est, sic multi ex idearum rerum observatarum coniunctione, multiplicatione, divisione, aliisque mentis imaginantis operationibus, sibi innumerorum mundorum […] ideas […] in mente formaverint», Regius 1648, pp. 13-14. In his 1661 *Philosophia naturalis* Regius openly mentions Descartes's distinction between the material and formal being of ideas, stating that it does not allow a demonstration of the existence of God: see pp. 426-427.

[79] Regius 1646, pp. 249-250. See *Psalm* 119.105.

[80] Regius 1647b, AT VIII-2, pp. 343-344 (corollaries IV, VI, IX); id., *Brevis explicatio*, pp. 10-11.

[81] «Res naturales sunt, quae natura sunt praeditae. Harum vera existentia ex probabili intellectus, sive sensuum, reminiscentiae, imaginationis, et iudicii nostri certitudine (de qua inferius, capite de mente humana, agemus,) est quam maxime verisimilis; ex infallibili vero Dei revelatione, nobis in Sacris Literis facta, ea est plane indubitabilis», Regius 1654, p. 1.

punishment for men, or as a wise physician or a father can lie to the sick or the sons[82]. Therefore, the argument of the goodness of God cannot be used in order to ensure that God is not a deceiver. Given a power of God bound by moral principles (whether or not their violation constitutes a contradiction of goodness as His essence), this does not imply that God does not deceive us, as this can be consistent with His goodness. In fact, those statements we cannot doubt are to be reduced to a few principles and matters of fact.

1.5 From enthusiasm to *recte percipere*

As noted, the break between Regius and Descartes was caused by Regius's positions on the human soul. These concern the problem of how clear and distinct perception works in philosophy. Being grounded on divine goodness as stated in Revelation, however, right perception is not systematically accounted for by Regius. This is to be seen in the logical criticisms he offers Descartes: Regius defines the adequate acknowledgment of a concept in accordance with logical canons, that is, by showing the logical fallacies consequent on its unclear acknowledgement. With his critique, Regius addresses the deficient account of evidence provided by Descartes. Through the *cogito*, evidence is assumed by Descartes as the mark of truth because it characterizes the acknowledgment of our existence. Therefore, God cannot deceive us in our evident perceptions, as this will undermine the first truth gained after metaphysical doubt, which cannot be negated without contradiction. God could, at most, deceive us in our past perceptions, as these are not evident anymore[83]. Regius does not deny that the *cogito* proves the existence of the soul[84], but he does not assume it as grounding the truth of every kind of "evident" perception, paving the way to enthusiasm in philosophy. Actually, he attempts to provide a logical account of evidence, in order to

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[82] «Nec obstat, si quis dicat per naturam constare Deum esse, eumque non posse fallere […]. Respondeo enim primo, Deum pro summa sua […] potestate, fallacia posse uti, primo innocua et sapienti, quali medici et prudentes patres familias utuntur; et deinde paenali […], quod testatur Scriptura, cum dicit: *et tradidit ipsos in sensum perversum*», Regius 1648, p. 11. See *Epistle to the Romans*, 1.18. In his 1661 *Philosophia naturalis* a new quotation from the Bible is added to confirm that God can be a deceiver: see p. 414; see *Ezekiel*, 14.9. See also Regius 1654, p. 349. Regius remarks, however, that God is not responsible for men's faults as men are free in suspending judgement: Regius 1648, p. 11.

[83] Descartes's rational theology, actually, is aimed at guaranteeing the validity of past evidence as it is retained in memory: see AT VII, pp. 69-70, 140.

[84] «De mentis vero existentia nullus dubitandi superest locus, cum illa etiam per dubitationem et falsam mentis imaginationem sit manifesta; nam nihil potest dubitare vel falsa imaginari, quod non existit», Regius 1646, p. 248.

define what we can state as being rightly perceived.

In Regius's *Fundamenta physices* the difference between soul and body is put forward at the beginning of the chapter *De homine*. *Mens* or *cogitatio* is distinguished from extension according to their different essences[85]. Mind is defined by Regius as *organica*, as it depends on the body in order to perform its functions: however, it is independent from the essence of body: cogitative actions ultimately rely only on the mind itself and are only aided or hindered by bodily conditions[86]. In any case, a dualism between extended and cogitative substance is asserted only by Revelation[87]. It is doubtful, indeed, whether mind is a substance: Revelation is thus the only source of the solution to the problem[88]. This position is clarified in his *Explicatio* and *Brevis explicatio*, in those statements probably omitted in *Fundamenta* after Descartes's criticisms. In the corollaries II, III and V of his *Explicatio* Regius manifests his doubts on the possibility of defining the nature of the soul, as its belonging to the body implies no contradiction, nor does our doubt of the existence of the body prove that it is a substance different from mind. Therefore, it is not possible to clearly conceive mind as distinguished from body[89]. As in his *Fundamenta physices*, the solution to the problem comes from Revelation. The point is deepened in his *Brevis explicatio*, where Regius admits that

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85 «Ut corporis natura in sola extensione; sic mens humana in sola hominis cogitatione consistit. Nam ut posita vel ablata extensione, corpus ponitur vel tollitur; sic posita vel ablata cogitatione, ponitur vel tollitur mens humana. Nec quicquam praeterea in ea demonstrari vel opus est, vel potest; cum per hanc naturam eius satis explicetur», *ibid*., p. 245.

86 «Animae rationalis actiones licet a bona corporis dispositione iuventur […] cum illud animae sive mentis sit instrumentum, eius tamen essentia, utcumque corpus fuerit dispositum, semper manet immutata et incorruptibilis, cum haec sit naturae a corpore et corporis dispositione plane diversae, utpote in sola cogitatione consistentis. nec ex illa dispositione oriri queat, cum ea tantum varios, et varie sibi mutuo occurrentes, ac inter se concurrentes, et se mutuo insequentes motus, nullam vero vel minimam perceptionem, aut aliam vel levissimam cogitationem, sive actionem cum coscientiam producere possit», Regius 1646, pp. 247-248.

87 «Quod autem mens revera nihil aliud sit quam substantia, sive ens realiter a corpore distinctum et actu ab eo separabile et quod seorsim per se subsistere potest, id in Sacris literis nobis clarissime est revelatum», Regius 1646, p. 246. Regius refers then to *Ecclesiastes*, 12.9, *Matthew* 17.3, *Luke* 16.9, 16.22, 24.43, *Second Epistle to the Corinthians*, 5.8, 12.3-4, *Apocalypse* 6.9-10. Actually, these references will disappear in the following works of Regius. Moreover, in the 1654 *Philosophia naturalis* Regius provides a brief account of Biblical interpretation: he suggests interpreting in a metaphorical sense those passages contradicting the new philosophy, as in the case of the lines on the heart as the place of intellect: Regius 1646, p. 344.

88 «Ita, quod per naturam dubium quibusdam esse posset, per divinam in sacris revelationem iam est indubitatum», *ibid*., p. 246.

89 «II. Quantum ad naturam rerum attinet, ea videtur pati, ut mens possit esse vel substantia, vel quidam substantiae corporeae modus; vel, si nonnullos alios philosophantes sequamur, qui statuunt extensionem et cogitationem esse attributa, quae certis substantiis, tanquam subiectis, insunt, cum ea attributa non sint opposita, sed diversa, nihil obstat, quo minus mens possit esse attributum quoddam, eidem subiecto cum extensione conveniens, quamvis unum in alterius conceptu non comprehendatur. Quicquid enim possumus concipere, id potest esse. Atqui, ut mens aliquid horum sit, concipi potest; nam nullum horum implicat contradictionem. Ergo ea aliquid horum esse potest. III. Errant itaque, qui asserunt, nos humanam mentem clare et distincte, tanquam necessario a corpore realiter distinctam, concipere. […] V. Nec obstat, quod de corpore dubitare, de mente vero dubitare nequaquam, possimus», Regius 1647b, AT VIII-2, pp. 342-343.

God could create thinking matter due to His unlimited power[90], as Locke will argue in his *Essay*[91]. God, indeed, can make things different from what they actually are: as in the case of the creation of different worlds[92]. Only Revelation, therefore, ensures us that mind is actually a substance[93].

In these texts, as well as in his 1654 and 1661 *Philosophia naturalis*, Regius brings his criticism of Descartes's theory of mind into the logical field. Admitting that if the essence of mind is thought, it is not necessarily a substance different from matter[94], Regius criticizes Descartes's substantialization of essences, ultimately caused by his misuse of the principle of evidence. It is an inferential error to argue for a substantial difference of matter and mind from their essential difference, since the essence of mind is that of thought or *cogitandi facultas*, from which we cannot deduce anything about its being a substance[95]. In his 1654 *Philosophia naturalis* Regius argues that the argument of the distinction of body and mind as two different substances is a mere *petitio principii*. Even if the concept of thought does not include that of extension, this does not mean that it is opposite to extension[96]. The essence of mind, as he underlines in his *Brevis explicatio*, can be multifarious, as a timekeeper can consist of wheels, sand, or a pillar: therefore, even matter can think, just as instruments can show us the time in different ways[97]. In his *Philosophia naturalis* (1654), Regius clarifies that an essence can have different species, which can vary while maintaining the sameness of genus[98]. Descartes, actually, misunderstood the very concepts genus

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90 Considering soul, Regius states «cum ea, ut iam probavimus, aeque tale attributum, vel substantiae corporeae modus, ac substantia per naturam, ob divinam omnipotentiam, esse possit», Regius 1648, p. 8.

91 J. Locke, *An essay concerning humane understanding*, London, printed for The. Bassett 1690 (1689), book IV, ch. 3, § 6.

92 «Et ne quis miretur, quod mens aliud quid possit esse, quam in sacris eam nunc esse nobis est revelatum; considera hunc mundum, qui millecuplo per divinam omnipotentiam praestantior, multisque aliis modis formatus, quam nunc est, esse potest», Regius 1648, p. 9.

93 *Ibid*., pp. 8-9. Regius omits, however, the quotations from the Bible.

94 «At vero, cum mens sit ipsissima illa cogitandi facultas, sive illa concipiatur, ut per se subsistens, hoc est, ut susbstantia; sive ut attributum antea explicatum; sive ut substantiae corporeae modus: semper tamen concipitur, ut essentia cogitans, quae in facultate illa cogitandi consistit», Regius 1648, p. 8.

95 «Male vero hic ita inferat aliquis: cogitatio et extensio hic dicuntur diversa, ergo sunt opposita; quia unum non est alterum; et quidem contraria […]. Hic enim esset magnus, ex terminorum logicorum ignoratione ortus, paralogismus.[…] Quod autem nullum horum, quae dixi, implicet contradictionem, ex eo est manifestum, quod mens, sive substantia; sive aliquod attributum, eidem subiecto cum extensione conveniens; sive substantiae corporeae modus, quo illa modificetur, quique sit eius tantum accidens: semper tamen est facultas cogitandi, in qua mentis essentia consistit» *ibid*., pp. 7-8.

96 Regius 1654, pp. 336-337.

97 «Atque hinc iam est perspicuum, non esse absolute et necessarie verum, quod quicquid de alicuius rei essentia aliquando verum est, id semper sit verum. […] Atque hoc in horologio patet, cuius essentia […] nunc in styli, nunc in arenae, nunc in acquae recta, cum reliquarum partium, adaptatione consistit: quodque hinc variam et contingentem essentiam habet», Regius 1648, p. 9.

98 Regius 1654, p. 341.

and species in his characterization of soul as a substance. This is exemplified by the concept of animal, which does not include that of reason, whereas some animals are provided with reason[99]. The clear and distinct perception of the rationality of every animal thus has to be rejected, like that of the substantiality of soul. If admitted, it would be possible to state that every animal is a man, as man is a species of animal genus, or that an animal cannot be conceived as irrational[100].

Regius criticizes another fallacy in his critique of the mind as being a mode of the body. According to the argument, if thought belongs to matter, extension will be *affirmans* in the same way as it is long or deep. In any case, according to Regius even if extension and thought were two attributes of the same subject, they would still be different[101]. Regius, actually, anticipates Spinoza's views on substance and attributes: a substance, according to him, can have more than one essential attribute. However, he does not clarify how these two attributes are related to each other and to their substance. In fact, he admits at the beginning of his *Fundamenta physices* that there are only two kinds of substances: material or spiritual, characterizing them in terms of their essential attributes in order to criticize the Scholastic distinction of body and extension[102]. Eventually, the

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[99] *Ibid*., p. 337.

[100] «Si quis nihilominus diceret se mentem humanam clare et distincte, tanquam necessario a corpore realiter distinctam, concipere: hoc tantum fidem merentur, ac si quis diceret, se clare et distincte concipere animal necessario esse hominem, cum illud, utpote genus, oppositae speciei quoque competens, possit etiam esse bestia […] Nullius igitur momenti est haec obiectio: mens sive facultas cogitandi concipitur, vel concipi potest, ut substantia et quidem incorporea, ergo non potest recte concipi ut attributum, vel modus corporeus. Haec enim, tantundem a veritate recederet, ac si quis diceret, animal non posse concipi, quod sit irrationale, cum illud possit concipi, quod sit rationale. Affirmatio enim generis de una specie, non est negatio de altera opposita», *ibid*., pp. 339-340.

[101] «Verum ipsum subiectum, in quo haec duo attributa simul existerent, recte et vere posset dici longum, latum, rotundum, quadratum, ratione suae extensionis, et eius modorum, et simul cogitans, affirmans, negans, intelligens, volens, ratione cogitationis, quae in illo existeret», Regius 1654, p. 338. In Regius's 1647 *Explicatio* the opinion of extension and thought being two attributes of a common substance is referred to «nonnullos alios philosophantes», *supra*, n. 89.

[102] Extension – as it is body itself – does not require body as a subject different from itself. In fact, he admits that a body without extension will no longer be a substance, as it will be nothing: «materia rerum naturalium est corpus […]. Huius essentia in sola in longum, latum, et profundum extensione, quae ratione tantum a corpore differt […]. Si vero extensio ab illo tolleretur, mox corpus cessaret esse corpus, quia non esset amplius substantia extensa. Imo quicquid in illo est substantiae, penitus periret, quia nec esset substantia corporea nec incorporea, praeter quas nulla substantia datur. Nec opus est in corpore substantiam, tanquam subiectum, in quo extensio existat, quodque ab extensione natura seu re distinctum, fingere, cum entia non sint multiplicanda sine necessitate. Ipsa enim extensio non desiderat tale subiectum, sed per se subsistere potest; quippe quae non sit extensi seu corporis accidens […], sed sit ipsissima corporis essentia, praeter quam nihil in ipso demonstrari potest», Regius 1646, p. 2. In the 1654 and 1661 editions a little variation can be found: «ipsa enim extensio non desiderat tale subiectum re ab ipsa distinctum», Regius 1654, p. 3; Regius 1661, p. 3. He criticizes the theory of void and of imaginary spaces as well, which are extension with no matter. In this case, extension will be an attribute of nothing: therefore, it will be no more regarded as extension: «neque his imaginarium quorundam obstat spacium vacuum; cum illud, utpote nihil, nullam queat habere extensionem: nam non entis, seu nihili, nulla sunt attributa, nec ullae qualitates», Regius 1646, p. 3.

problem will be fundamentally re-addressed by Spinoza.

At the basis of Regius's criticism stands the recognition of the actual contents of the concepts of mind and body. Because the concept of mind is that of the activity of thought or of *facultas cogitandi*, nothing can be deduced about its being a substance. In the same way, even the concept of extension seems not to include that of substance, as can be argued from those passages where it is defined as an attribute like thought. On the other hand, he seems to admit at the beginning of his *Fundamenta physices*, that the essence of extension implies its being a substance[103]. At least in the case of thought, however, Regius defends a "reduction" of its concept to the mere *facultas cogitandi*, without considering any ontological properties of such faculty[104]. Because the concepts of mind and matter include only those of thought and extension in three dimensions, we cannot infer that mind and matter do not belong to another subject. Such "reductionism" recurs in the 1654 *Philosophia naturalis*, where Regius argues that even if the concept of thought included that of extension, it could not belong to matter, as in the case of the concepts of motion and figures. Indeed, if their concepts truly included that of extension, motions and figures would penetrate the very extension they modify[105]. This paradoxical conclusion leads him to state that neither the concept of motion nor that of thought can include the notion of extension: only in this case motion and thought can belong to extension itself as its modes.

It is in the light of Regius's logical "reductionism" regarding the concepts of mind and extension that it is possible to outline his position on clear and distinct perception. In fact, such a criterion of truth is referred to in his *Brevis explicatio*, as Regius adds to the original text of the *Explicatio* that we can clearly and distinctly (or rightly) perceive that the essences of body and mind do not contradict each other and can belong to a unique *subiectum*, in accordance with the unlimited

[103] See the previous note.

[104] I studied this aspect in an article underlining some inconsistencies resulting from Regius's arguments: A. Strazzoni, *The Crypto-Dualism of Henricus Regius*, in Stefano Caroti, Mariafranca Spallanzani (eds.), *Individuazione, individualità, identità personale*, Firenze, Casa Editrice Le Lettere, 2014 (b), pp. 133-151. On Regius's notion of soul, see also V. Alexandrescu, *Regius and Gassendi on Human Soul*, «Intellectual History Review», 23/2 (2013), pp. 1-20.

[105] «Nam si cogitatio in conceptu suo includeret extensionem, non posset esse in subiecto extenso; alioqui enim fieret penetratio dimensionum […]. Atque hinc patet absurdam eorum esse imaginationem, qui motum et figuram imaginantur in suo conceptu includere extensionem, atque ideo illa tanquam modi inesse posse extensioni corporis. Quandoquidem si ipsorum imaginatio esset vera, tum, motu et figura in corpore aliquo existente, esset penetratio dimensionum: extensio enim motus et figurae penetraret ipsam extensionem corporis ab illis modificati», Regius 1654, p. 337.

power of God[106]. This addition involves retaining the evidence criterion in metaphysics, whose misuse had been criticized in Regius's letter to Descartes of 1645. It is subjected, however, to logical limitations, as he shows that we cannot perceive the substantiality of mind while avoiding all contradictions. Regius's application of the criterion of right perception ultimately consists in a careful analysis of the logical implications of what is defined as evident. Regius thus criticizes Descartes's "evident" conclusions on the nature of the soul. Evidence as the mark of absolute, apodictic truth (or the introduction of enthusiasm into philosophical arguments[107]) is thus replaced by Regius with right perception and with a recourse to sense experience and testimony as the means to formulate natural philosophical theories, as will be shown in the next section.

1.6 Inference to the best explanation

Regius developed his view by paying attention not only to the justification of the reliability of our perceptions but also to judgement, will and freedom. Their discussion, in fact, throws light on his foundation and on the method of natural philosophy. According to his *Physiologia* judgement and will are, in principle, detached from each other. Judgement constitutes, together with perception, *intellectus*[108]. *Voluntas*, on the other hand, belongs with *intellectus* to the *actiones cogitativae*, which are opposed to *actiones automaticae* or *sensitivae*, those modifications of the body of which the soul is not aware[109]. Will does not concern truth: it is defined only in relation to bad and good,

[106] Italics by Regius, matching the original text; however, the two recurrences of "*recte*" are not present in the 1647 text: «*quantum ad naturam rerum attinet, ea videtur pati, ut mens possit esse vel substantia vel quidam substantiae corporeae modus vel, si nonnullos alios philosophantes sequamur, qui statuunt extensionem et cogitationem esse attributa, quae certis substantiis tanquam subiectis, insunt, cum ea attributa non sint opposita, sed diversa,* […] *nihil obstat quo minus mens possit esse attributum quoddam eidem subiecto cum extensione conveniens, quamvis unum in alterius conceptu non comprehendatur. Quicquid enim recte* sive clare et distincte *possumus concipere, id,* saltem per divinam potentiam*, potest esse atqui, ut mens aliquid horum sit, recte concipi potest; nam nullum horum implicat contradictionem, ergo ea aliquid horum esse potest*», Regius 1648, p. 7. Cf. the original text of his 1647 *Explicatio*, *supra*, n. 89.

[107] His critique of Descartes's enthusiasm, actually, is repeated in the same text: after having stated that right perception is ensured only by Revelation, he underlines that such appeal to Revelation cannot be considered to be vitiated by enthusiasm. Even if he does not discuss the problem, it is obvious that he is addressing Descartes's criterion of evidence, which is independent from any justification by Revelation: see Regius 1654, pp. 348-349.

[108] Regius 1641a, p. 33.

[109] «Expositis actionibus cogitativis aggrediamur automaticas, quae anima seu mente ad rem non attendente per solum organorum animalium, nempe spirituum, nervorum, cerebri, aut musculorum, ab obiecto externo vel interno agitatorum motum ab homine tanquam aliquo automato peraguntur. Huiusmodi actiones ex. gr. inter ambulandum et attentius colloquendum in nobis observantur, ubi inscii spiritum ducimus, pedes movemus, et nonnunquam etiam

being only *amplexio boni* and *reiectio mali*. It is consequent to intellect and its judgements, making Regius's positions apparently dissimilar to Descartes's. However, judgement implies will as it is constituted by *perpensio*, or the examination of the objects of knowledge, and *decisio*, or the very act of affirmation or negation. The problem of freedom is first discussed by Regius in regard to the possibility of suspending judgement:

decisio est de re percepta et perpensa sententiae prolatio. Estque affirmativa vel negativa. Atque haec potest suspendi vel proferri libere seu citra coactionem, aut contra arbitrium nostrum, in quo tota eius libertas consistit: quamvis non opus sit nos in utramque partem ferri. Et certe, quo magis determinati sumus, sive ex perceptione sive perpensione propria, sive ex illustratione divina, tanto liberior est decisio[110].

Freedom does not consist in indifference but in following reason. Basically, it is defined as the absence of any external constriction in judgement: as the determination by our perception is stronger, the more free we are in judging. His model in defining freedom relies on the Cartesian model of knowledge based on evident perception.

Actually, in his *Discours de la méthode* Descartes did not spend any word on the relation between will and intellect in forming judgements, nor on will as the cause of error. His theory of error is consistently developed only in the fourth *Meditatio*[111]. However, Regius was aware of the ideas of the Frenchman, later clarified in his *Meditationes*, as in their correspondence Descartes blamed him for having identified the cause of false judgements only in bodily constitutions; this would lead, in fact, to the underestimation of the role of will in judging[112]. The point, therefore, had been corrected by Regius in his *Physiologia*. However, in the definition of the causes of error Regius still relies on his theory of the human soul as organically depending on the body in its operations. Even after examining, after Descartes's advice, the role of the will in forming erroneous judgements[113], at the end of his considerations on perception and judgement, and before that of will,

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salutantes aperto capite resalutamus. Actiones automaticae sunt receptio, appetitus sensitivus simplex, et motus spontaneus», *ibid*., p. 46.

[110] *Ibid*., p. 43.

[111] AT VII, pp. 56-62.

[112] See the letter to Regius of 24th December 1639: «dicis etiam […] omnem praecipitantiam intempestivi iudicii pendere ab ipso corporis temperamento, tum acquisito, tum innato; quod nullomodo possum admittere, quia sic tolleretur libertas, et amplitudo nostrae voluntatis, quae potest istam praecipitantiam emendare; vel, si non faciat, error inde ortus privatio quidem est respectu nostri, sed respectu Dei mera negatio», AT III, p. 65.

[113] That will is implied by judgement will be openly stated, actually, only in Regius 1654, p. 403.

he still regards the passions as influencing our judgements[114]. On the other hand, in the treatises of Descartes or of more "orthodox" Cartesians, like Johannes de Raey, the consideration of passions is part of that of sensations[115].

In his *Physiologia* Regius holds some positions later discarded in *Fundamenta physices*, where he provides a different account of freedom as he rejects evidence – as meant by Descartes – as the mark of truth. In *Fundamenta* Regius maintains Descartes's theory of error, as he refers to the role of *culpa* in erroneous judgements[116]. However, he changes his account of human freedom when he states that we are free insofar as we can suspend or give judgements *indifferenter*:

> decisio est de re percepta et perpensa sententiae prolatio. […] Decisio potest libere, pro arbitrio nostro, suspendi vel proferri: eiusque libertas, seu indifferentia, non tantum in eo consistit, quod non sit coacta, sed quod semper decisionem possimus indifferenter, pro arbitrio nostro, suspendere, proferre, vel immutare; cum semper cogitationes nostras ad alias convertere, et saepissime, an rem satis bene perceperimus vel examinaverimus, dubitare queamus[117].

A similar account is provided for the freedom of the will. As in his *Physiologia*, will is conceived as being about good and bad[118] and as following perception and judgement[119]. However, the freedom of the will consists in the possibility of making choices different from those prescribed by the intellect itself[120]. Determination by perception is no longer regarded as the ultimate factor of freedom. This is due to the rejection of evidence as the ultimate criterion of truth in states of affairs.

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[114] Regius 1641a, pp. 43-44; Regius 1646, pp. 289-290. In his 1654 *Philosophia naturalis* the treatment of the passions follows that of the will and is more extensively developed than in the previous versions of the treatise (see Regius 1654, pp. 413-432). It is completed, also, with some considerations on the remedies for the passions, located in adequate judgements and in the modification of our habits (pp. 416-418). Such an extensive concern with passions and their functions seems to be a consequence of the publication of Descartes's *Les passions de l'âme* (Paris, chez Henry Le Gras 1649). In 1650, indeed, Regius published a separate treatise on the passions, *De affectibus animi dissertatio* (typis Theodori ab Ackersdijck, et Gisberti a Zijll). In any case, Regius still remarks that the passions affect judgement: see p. 421.

[115] R. Descartes, *Traité de l'homme*, part IV, AT XI, pp. 163-169. I will come back to De Raey's linguistic consideration of the passions: see *infra*, § 3.7.1.

[116] «Iudicii partes duae sunt: perpensio et decisio. Perpensio est rei perceptae […] examinatio. Haec nisi accurata et exacta fuerit, facile in decidendo committitur error, vel saltem culpa; cum, quae minus est accurata, in errrorem ducere possit», Regius 1646, pp. 286-287.

[117] *Ibid*., p. 287.

[118] Good and bad are conceived by Regius as what conserves or destroys us: *ibid*., pp. 293-294.

[119] *Ibid*., p. 290.

[120] «Libertas autem voluntatis, quae in rebus naturalibus est, in eo consistit, quod, quamvis ipsa fraequentissime iudicium et consilium intellectus […] sequatur et ea amplectatur, quae intellectus iudicavit esse bona […], ipsa tamen habeat plenissimam potestatem etiam illa volendi, quae intellectus iudicio quam maxime contrariantur […][…]. Atque hinc quilibet in se experitur, intellectum voluntatis esse consiliarium, non imperatorem, vel coactorem, vel ullius necessiatis autorem», *ibid*, pp. 290-291. See also p. 293: «possumus enim […] omnem finem, et omne bonum, etiam summum in rebus naturalibus nolle».

Such perception, indeed, is only apparently true and is subject to change according to new experiences:

an autem satis clare et distincte rem perceperimus et examinaverimus, mens secundum apparentiam tantum diiudicat. Illique tamdiu acquiescendum, donec contrarium vel aliud per experientiam vel alia ratione fuerit probatum. Alioqui enim nihil in humana vita decidi vel peragi posset[121].

The rejection of Descartes's theory of indubitable knowledge, based on evidence as pulling our will to give judgements on perceived things, leads Regius to define freedom as the possibility of indifferently choosing an alternative among the others. Moreover, he provides an account of philosophical truths according to which they have a provisional status. In this, they are not different from those truths leading us in everyday life. No boundaries between practical, everyday and philosophical knowledge are thus provided by Regius.

Such a provisional character of physical explanations is fully outlined at the end of the treatise, where Regius states – with polemical overtones – that his arguments are not intended to be compulsory for everyone, because human temperaments are various and no argument can convince everyone in the same way[122]. As he would state in his 1654 *Philosophia naturalis*, both false and true judgements on states of affairs are evident in the same way[123]. Regius thus confirms his rejection of a pure understanding that can carry out any reasoning independently of its conjunction with the body. In the light of this, he intends to provide a physics not different, in contents, from Descartes's, but meant only as a provisional explanation of phenomena. Regius's epistemology, in fact, can be defined according to the model of inference to the best explanation. In his 1654

[121] *Ibid*, p. 287.

[122] «Atque ita universae Physicae Fundamenta, brevi, quantum potui, systemate comprehensa […] absolvimus. Sicut autem, nullius consentientis vel dissentientis habita ratione, libere id proposui, quod mihi rationi maxime consentaneum fuit visum ita hic nemini assentiendi vel dissentiendi legem praefigo; […] imo, ex terentiano proverbio iam olim puer didici tot esse sententias, quot sunt homines. Neque hoc mirum. Cum enim infinita pene temperamentorum sint discrimina, quae iudiciorum producunt diversitatem, innumerae etiam de rebus humanis iudiciorum debent esse dissimilitudines. […] Dissentiat igitur quilibet», *ibid*, pp. 305-306.

[123] «Videtur manifestum, quod mens nostra aeque evidenter ab imaginariis, atque a veris in perceptione affici possit. Quodque ideo, non moralem sive probabilem verisimilemque, se exquisitam, accuratam, et indubitabilem veritatis cognitionem quaerenti, per naturam mentis iam propositam, dubium et incertum sit an ulla vera corpora, an vero imaginaria tantum phantasmata a nobis percipiantur, ullave de iis vera, an imaginaria nostra sint iudicia cum utrimque par possit esse perceptionum claritas et evidentia, ex eaque sola iudicia nostra, etiam optima, ferri queant, et soleant. […] Neque his quicquam obest, quod multae perceptiones et iudicia inde orta videantur evidentissima, nullusque error in illis ab ullo unquam deprehendatur. Nam hoc tantum magnam modo eorum verisimilitudinem, nullam vero apodixin arguit», Regius 1654, p. 347.

Philosophia naturalis Regius clarifies how he works in natural philosophy, that is, by observing phenomena and finding out an intelligible cause, which has to be retained until a better cause is found[124]. The cognitive process involved in the formulation of hypotheses is imagination alone: since in *Fundamenta physices* intellective processes are reduced to *sensus cogitativus*, *reminiscentia* and *imaginatio*[125], the operations of the intellect are performed through imagination or the manipulation of sense data. Making the point more explicit, Regius adds a reference to "imaginative deduction" in the 1654 edition, whereas in the first edition he attributed his hypotheses to the intellect only[126].

Given such an epistemology, Descartes's deductive method is never mentioned by Regius: his only words on method, in fact, reflect the traditional view of method as *ordo*, or the arrangement of propositions and syllogisms in a clear order[127]. Such order, however, is not observed in long treatises such as his own[128]. The method he follows, rejected in Descartes's 1645 letter, consists in proposing a series of definitions and explaining them in order to provide an ideal model for natural phenomena[129]. Another implication of this account of philosophical knowledge, which is open to change through new experiences, is the acknowledgment of the "social" nature of truth. As stated in *Brevis explicatio*, where Regius quotes Matthew's Gospel, all our knowledge of the external world is provided only with moral certainty as it is based, besides experience, on testimony. As concerns matters of fact, only what is stated by Revelation is indubitable[130]: on other matters, we cannot

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[124] Regius expresses what is to be a better explanation using adverbs as "*commode*", "*probabiliter*", "*intelligibiliter*": «cum enim problema aliquot in Physicis proponitur solvendum, primo excogitanda est causa intelligibilis, qua effectum, in problemate proposito observatum commode et intelligibiliter peragi possit. Deinde circumspiciendum an non alia commodior vel aeque commoda queat inveniri. Quae si inveniatur, commodior priori est praeferenda aequalis vero ipsi aequiparanda. Sin alia commodior vel aeque commoda excogitari nequeat, solutioni inventae tamdiu acquiescendum, donec melior vel aequalis alia fuerit inventa», *ibid*., p. 441.

[125] *Supra*, n. 67.

[126] «Per manifestam […] imaginationis demonstrationem», Regius 1654, p. 8. See Regius 1646, p. 3: «insensibiles sunt, quae, propter exiguitatem […] sensus fugientes, solo intellectu […] observantur»; Regius 1654, p. 6: «insensibiles sunt, quae, propter exiguitatem […] sensus fugientes, solo imaginationis et iudicii intellectu […] observantur».

[127] Regius 1641a, p. 44; Regius 1646, p. 288.

[128] «Talis, in rerum longioribus tractatibus, passim observatur», Regius 1646, p. 288.

[129] This is openly stated in 1661 *Philosophia naturalis*, p. 476. See also Descartes's letter to Regius of July 1645: *supra*, n. 60.

[130] «Atque ex his etiam apparet, citra divinam revelationem, nullam apodicticam, sed moralem sive probabilem tantum rerum extra mentem nostram existentium esse certitudinem, quae tamen omnibus vitae humanae regendis et peragendis actionibus sufficit. Cum ad illas nihil aliud, quam moralis et probabilis veritas sive cognitionis certitudo, requiratur. Quod ipse noster Servator innuit, cum dici: *in ore duorum vel trium consistit omnis veritas*. Moraliter scilicet, non apodictice; cum testimonium duorum vel trium saepe sit falsum. Cum autem, ut iam patet, fides testibus sit adhibenda, hinc iam facile intelligimus quam firmam fidem circumspecta nostra iudicia, a sensibus et rerum observationibus ac traditionibus petita, mereantur. Certe tantum ut, meo iudicio, sint inexcusabiles, qui iis fidem derogare audent», Regius 1648, pp. 11-12; it is repeated in Regius 1654, p. 351. See *Deuteronomy*, 19.15;

avoid accepting what is confirmed by the experiences of other men[131].

1.7 The rejection of *pura mathesis*

In *Philosophia naturalis* (1654), after remarking that God can be a deceiver, Regius concludes that we cannot avoid a natural scepticism[132]. Right perception can, at most, make us acquainted with the possible existence of things, if their concepts imply no contradiction. Such scepticism concerns mathematical truths and first principles in their application to an actual state of affairs, whereas we cannot doubt such truths when taken as merely conceptual:

neque etiam obstat, quod indubitatae per naturam veritatis videantur esse haec axiomata: totum est maius sua parte; centrum est in medio circuli; in omni triangulo sunt tres anguli duobus rectis aequales; idem non potest simul esse, et non esse; et c. Cum enim nullum totum, nulla pars, nullus triangulus, nulla essentia vel existentia, cogitatione et rerum apparentia excepta, sit indubitabiliter cognita. Cum horum cognitio a sola sensuum verisimilitudine dependeat, nihil etiam quicquam de iis certo et indubilitabiliter a quoddam enunciari potest[133].

Moreover, the precondition of such truths is the very existence of the state of affairs they represent:

attributa alicuius rei essentialia, in conceptu eius a mente tantum comprehensa, non sunt vera, nisi cum res ipsa mente a nobis concepta actu exisitit. Antequam enim ipsa res existat, quamvis eius ideam in mente habeamus, ipsa tamen est merum nihil, cuius nulla attributa existentiae necessaria vel contingentis, nec ulla alia esse possunt. Ita ex. gr. in conceptu trianguli comprehenditur haec proprietas, quod eius tres anguli sint duobus rectis aequales, quod tamen non est verum, nisi triangulus mente conceptus in rerum natura actu existat[134].

Matthew's Gospel 18.16.

[131] The point, already remarked in *Brevis explicatio*, is emphasized in *Philosophia naturalis*: «certe, cum nostrum ipsorum testimonium apud nos ipsos multo pluris sit, quam alienum, cui fidem tamen adhibendam iam probavi, tantam, quantam illa fidem merentur; ut, meo iudicio, in vitae humanae actionibus peragendis sint inexcusabiles, qui eis fidem derogare audent; quia sine ea nihil inchoari, nedum perfici, quicquam potest», Regius 1654, p. 351. Regius considers everyday knowledge: however, this can be extended to science also, as both scientific and everyday knowledge are based on experience, nor does he differentiate such knowledges in terms of method and *modum cognoscendi*. Their continuity is well established in his *Fundamenta physices*: *supra*, n. 121.

[132] «Quicunque […] omnipotentem et liberrimum cognoscit Deum […] talem omnium rerum verisimilitudinem, vel scepticismum naturalem […], qualem proposuimus, negari non potest», Regius 1654, pp. 350-351.

[133] *Ibid*., p. 350. Such truths are not innate: see *ibid*., p. 355; Regius 1661, pp. 420-421.

[134] Regius 1654, pp. 357-358.

The actual existence of things is the precondition of eternal truths also[135]. This position is due to the need to criticize Descartes's ontological argument, and, by extension, to reject that any evident perception allows us to infer the actual existence of what we conceive. The properties of a triangle, indeed, are compared to those comprised in the idea of God[136]: as the existence of God is necessary only if He exists, a triangle implies a sum of 180° of its internal angles only if it exists. Their truth in mere concepts, plainly, is indubitable, because their negation implies a contradiction: however, such a truth cannot be applied to states of affairs.

To sum up, according to Regius we can have apodictic certitude only of the existence of the mind, of the contents of Revelation, and of the truth of mathematical and logical principles. Despite the sensory origin of all knowledge we can recognize some apodictic principles, whose negation implies a contradiction. It is doubtful, however, whether we can successfully use them in describing reality. Moreover, we can question the models deployed to explain natural phenomena, since different natural laws are possible, while in choosing among them we are influenced by bodily temperaments. If it is indubitable that there is a world and that the soul is a substance, as declared in the Bible, we are provided only with a moral certitude on all the other truths concerning actual states of affairs. Revelation ensures us that we can successfully use our evident perceptions in life and practice, that is, that our models can have some degrees of truth in explaining phenomena, without grasping, however, the world in itself with absolute certainty. On the other hand, Descartes's physics is grounded on some evident, innate principles, deduced from the perfections of God. The correspondence of eternal truths with physical reality, in fact, is apodictically ensured by Descartes; according to Regius, it relies on sense experience. This is to be regarded as the ultimate reason of their quarrel, and of its non philosophical overtones as well. The unjust accusation of plagiarism by Regius brought forward by Descartes in the French translation of his *Principia philosophiae* (1647)[137] can be explained as a harsh reaction to the reduction of Cartesian physics to

[135] «Nec obest, quod huiusmodi axiomata […] eternae veritatis esse dicantur. Nam talis assertio hoc tantum significat, ab aeterno verum esse, fuisse et fore, quod quandocunque homo, ter tria, novem, et triangulus actu existerint, tum ter tria novem, et homo sit rationalis, et trianguli tres anguli duobus rectis aequales ita necessario sint futuri, ut nunquam haec falsa esse possint», *ibid*., p. 358.

[136] *Ibid*., pp. 357-358.

[137] AT IX-2, pp. 19-20. The quarrel on Regius's plagiarism is fully described in Verbeek 1994, pp. 541-544. Descartes refers to the contents of Regius's *Fundamenta physices*, taken, according to him, from his published works and from the proofs of his *De Homine*. However, the contents of the *Fundamenta* heavily rely on those of the *Physiologia*, which was an original work, and the proof of *De homine*, according to Descartes himself, had been read by Regius while the *Fundamenta* was under correction. From Descartes's *De homine*, actually, Regius borrowed only a detail in the explanation of muscular motion, as admitted by Descartes: see his letter to Mersenne of 23 November 1646

a mere hypothesis about the world.

1.8 The necessity of a foundation

Prima facie, the Regius's case can show that Cartesian physics did not need a philosophical foundation in order to be accepted in the University. In fact, Regius developed and taught his natural philosophy without the support of Descartes's theory of knowledge. Insofar as he did not assume Descartes's revolutionary standpoint on the sources of philosophical knowledge, he did not need to defend such a standpoint in the University. Accordingly, one can assume that Regius was not interested in metaphysical and foundational issues as such, since he did not need a metaphysics to develop his natural philosophy. On the other hand, Regius's solution of metaphysical problems through an appeal to the Revelation, i.e., his foundation of physics, is to be interpreted as the result of his genuine, metaphysical reasons to dismiss Descartes's foundation. Indeed, Regius rejected i) Descartes's notion of evident knowledge, as he maintained that the certainty of Descartes's "evident" truths is determined by bodily temperaments rather than by a logical necessity. Secondly, Regius dismissed ii) Descartes's theory of innate ideas, which are not required in the explanation of the sources of knowledge. Therefore, Regius could reject iii) Descartes's demonstration of the existence of God on the basis of His idea. In the end Regius dismissed both the reliability of present, evident perceptions, and those proofs used by Descartes to guarantee the reliability of past demonstrations on the existence and goodness of God. His assessment of the hypothetical and provisional status of physics, and of the empirical methodology to be followed in discovery is based on such an account of human knowledge. Since his theory of philosophical knowledge could not avoid the sceptical arguments, Revelation turned to be the only way to ensure the reliability of such knowledge in providing a hypothetical, consistent explanatory model for phenomena – even if it is not *scientia*. Moreover, one may assume that there is a further reason for his positions on the foundation of philosophy on Revelation alone. In fact, these can be interpreted as attempts to avoid dealing with theologians over metaphysical problems concerning the nature of the soul and to not give rise to quarrels on metaphysical and theological matters, such as the one that arose in 1641. Whether or not keenly interested in foundational issues, Regius still had to deal with them, and

(AT IV, pp. 566-567).

found in Revelation the only source of apodictic knowledge.

Regius's foundation turned to be unfeasible in the view of the other supporters of Cartesian philosophy in the Netherlands, who distanced themselves from his solution and attempted to provide philosophy with the status of *scientia*, facing the natural scepticism Regius set out. The evolution of Dutch philosophy can be interpreted as a reaction to Regius's approach, as well as to the problems he raised. First, Regius put into question the reliability of evidence as a criterion of judging the truth of concepts and natural philosophical theories, aiming to show that what is "evident" is convincing only according to some psychological (i.e. temperamental) conditions. The justification of the reliability of evidence would then be put at the top of the philosophical agenda of Arnout Geulincx, Burchard de Volder and Willem Jacob 's Gravesande. Secondly, Regius's development of a physics without a definition of its metaphysical assumptions would endanger the introduction of Cartesianism in the university as a whole corpus of disciplines, including ethics, logic, metaphysics as the science of being, and as the basis for law and theology, requiring a comprehensive conceptual and methodological apparatus. The problem of the academic uses of Cartesianism would be at the core of Clauberg's and De Raey's foundationalism. Thirdly, Regius raised the problem of the use of experience in natural philosophy, that is, as a source of "scientific" knowledge: he showed, in fact, that Descartes's physics could be developed on the basis of *ad hoc* hypotheses on the causes of phenomena, rather than "deduced" from metaphysical principles – such as the constancy of God. If the problem of the use of experience in a Cartesian natural philosophy would be mainly discussed by De Volder, the justification of the use of experience as a source of "*scientia*", or provided with evidence, will finally be addressed by 's Gravesande, whose foundation of science turned to be a reflection on the actual practice of physicists, that is, a philosophy of science.

2. The metaphysical foundation of philosophy by Johannes Clauberg

2.1 Introduction

Johannes Clauberg (1622-1665) is to be considered the first philosopher who attempted to make Descartes's philosophy the basis of all philosophical disciplines, that is, to develop a Cartesian scholasticism[138]. Since he wanted to supplant the entire Aristotelian corpus in the Academy, however, he had to provide the new philosophy with a justification and an introduction, aimed at demonstrating its reliability as the basis of every kind of knowledge, and to initiate students to a radically new way of thinking.

Born in Westphalia in 1622, Clauberg studied philosophy, theology and Hebrew philology in Bremen under the guidance of Gerard de Neufville, who first prepared him for the reception of a new philosophy[139]: indeed, his teaching brought the influences of Bacon and Comenius on the young Clauberg, as stated in recent literature[140]. The crucial part of Clauberg's studies, however, took place in the Netherlands: after having moved to Groningen in 1644, where he studied with the Cartesian philosopher Tobias Andreae and published the first edition of his *Elementa philosophiae sive Ontosophia* (1647), and after his grand tour in England and France, in 1648 he headed to Leiden in order to deepen his knowledge of Cartesian philosophy with Johannes de Raey. There, he acquired a full acquaintance with Cartesian philosophy, before moving to Herborn University to

[138] See E. Viola, *Scolastica e cartesianesimo nel pensiero di J. Clauberg*, «Rivista di Filosofia Neo-Scolastica» 67 (1975), pp. 247-266.

[139] J. Clauberg, *Logica vetus et nova modum inveniendae ac tradendae veritatis, in genesi simul et analysi, facili methodo exhibens, editio secunda*, Amsterdam, ex officina Elzeviriana 1658 (1st ed. 1654), *Tobiae Andreae epistola*, pp. II-III (unnumbered), also in J. Clauberg, *Opera omnia philosophica*, Amsterdam, ex typographia P. & T. Blaev 1691, p. 767.

[140] See U.G. Leinsle, *Comenius in der Metaphysik des jungen Clauberg*, in T. Verbeek (ed.), *Johannes Clauberg (1622-1665) and Cartesian Philosophy in the Seventeenth Century*, Dordrecht, Kluwer Academic Publisher 1999, pp. 1-12; Savini 2004.; id., *L'invention de la logique cartésienne: la Logica vetus et nova de Johannes Clauberg*, «Revue de Métaphysique et de Morale» 1 (2006), pp. 73-88: see pp. 85-88; id., *Johannes Clauberg: methodus cartesiana et ontologie*, Paris, Vrin 2011, pp. 25-33; A. 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, pp. 251-281: pp. 258-261, 267-270.

start his teaching activity in 1649[141], which he continued from 1651 at the University of Duisburg, where he maintained close contact with Leiden Cartesians[142] and died in 1665. In fact, in his Duisburg years he published most of his works: his *Defensio cartesiana* (1652), *Logica vetus et nova* (1654, 1658), *Initiatio philosophi* (1655), *Exercitationes de cognitione Dei et nostri* (1656), as well as his *Physica* (1664) and the second and third edition of his *Ontosophia* (1661, 1664), testifying to intense activities as teacher and as supporter of Cartesian philosophy.

The philosophy of Johannes Clauberg is the object of increasing interest: after Francesco Trevisani has reconstructed Clauberg's role within the dissemination of Cartesianism in German Universities[143], Massimiliano Savini more recently provided us with a comprehensive survey of Clauberg's views on the relations between ontology, metaphysics and logic, and of their development with respect to the parallel debates over Cartesianism in the Netherlands and to the internal progress of Clauberg's positions[144]. While taking into account the same topic studied by Savini, this chapter will assume a narrower focus and a more limited purpose: it will concern the relations among the disciplines in Clauberg's philosophy from the point of view of his foundational arguments. Accordingly, with this study I will offer an interpretative key for understanding the complex evolution of Clauberg's philosophy, to be read as an attempt to provide all academic disciplines with a foundation, and a rejection of Regius's approach to Descartes's metaphysics[145]

In this chapter I will maintain that even if Clauberg aimed at limiting his foundational arguments to metaphysics or first philosophy, which he detached from logic (designed to set forth the new methodology of philosophy) and *ontosophia* (focusing on the most abstract concepts the mind deals with), foundational arguments can be consistently found in his logical or ontological considerations. The involvement of metaphysics in logic and *ontosophia* can be explained by paying attention to the peculiarities of Cartesian metaphysics, since this concerns topics belonging

[141] Clauberg 1691, *Vita per Henninium descripta*, p. IV (unnumbered).
[142] For an account of their relations, see A. Strazzoni, *On Three Unpublished Letters of Johannes de Raey to Johannes Clauberg*, «Noctua» I/1 (2014), pp. 68-106 (a).
[143] F. Trevisani, *Descartes in Germania. La ricezione del cartesianesimo nella Facoltà filosofica e medica di Duisburg (1652-1703)*, Milano, Franco Angeli 1992
[144] Savini 2004; Savini 2006; Savini 2011.
[145] Whilst not openly aiming to refute Regius's arguments, Clauberg separated the Regius's thought from Descartes's original philosophy in his *Logica vetus et nova*: see Clauberg 1691, *Logica vetus et nova*, p. 859. Clauberg rejects Jacob Revius's assessment of Regius as drawing the necessary consequences from Descartes's metaphysics, i.e., that Descartes's philosophy leads to scepticism and to an appeal to Revelation as the only means to guarantee the truth of our statements. See A. Strazzoni, *A Logic to End Controversies: The Genesis of Clauberg's Logica Vetus et Nova*, «Journal of Early Modern Studies» II/2 (2013), pp. 123-149: pp. 130 and 143.

to these disciplines as well (i.e., the functioning of the human mind, and the basic set of concepts of philosophy). Moreover, they can be explained by considering the traditional order of philosophical disciplines Clauberg was willing to replace, in which logic as the organon of philosophy came first and metaphysics was the last discipline to be studied.

2.2 The introduction of philosophy as the initiation to philosophy

Clauberg's *Initiatio philosophi sive dubitatio cartesiana* (1655)[146] offers a first outlook on his metaphysical foundation of philosophy. As he has to face the problem of an introduction of the student to a new paradigm, together with the demonstration of its reliability, in this treatise Clauberg maintains that the initiation of scholars to the new philosophy through doubt is to be identified with the theoretical justification of philosophical knowledge itself. This introduction and justification is provided, first of all, by means of doubt. In accordance with a Baconian *expurgatio intellectus*[147], doubt serves as an emendative instrument through which it is possible to reach a metaphysical or absolute certainty on the notions of self, God and matter, and to become acquainted with a new way in reasoning. It is the very first step into the new philosophy[148], or the initiation to Cartesianism for everyone who has not been acquainted with clear and distinct perceptions, allowing no further dubitation or suspension of judgement[149]. Such a first, emendative step in philosophy belongs to metaphysics, *philosophia prima*[150].

The function of metaphysics is outlined by Clauberg against its Aristotelian definition as the discipline coming after physics: as he writes in his *Differentia inter cartesianam et in scholis vulgo usitatam philosophiam* (1657, 1680)[151], the very name of "*metaphysica*" suggests that this

[146] J. Clauberg, *Initiatio philosophi, sive dubitatio cartesiana, ad metaphysicam certitudinem viam aperiens*, Leiden-Duisburg, ex officina Adriani Wyngaerden 1655. Hereafter quoted from Clauberg 1691.

[147] Clauberg 1691, *Initiatio philosophi*, pp. 1125-1126, see § 7. On the use of Bacon by Clauberg, see Savini 2006, pp. 73-88; Strazzoni 2012, pp. 258-261, 267-270.

[148] «Dubitatio nostra, quae aliis debito generalior esse videtur non spectet ad eum qui firma iam philosophicae cognitionis fundamenta iecit, quasi ea deberet in dubium revocare ac reiicere; verum ad illum duntaxat, qui fundamenta eiusmodi nondum posuit quique non aliter consideratur, quam ut vulgaris homo, nihil adhuc scientifice demonstratum habens, nihil clare distincteque perceptum, cui iudicium superstrui queat indubitatum», Clauberg 1691, *Initiatio philosophi*, p. 1138.

[149] *Ibid.*, pp. 1142, 1144.

[150] *Ibid.*, pp. 1208-1209.

[151] The first, German edition appeared in 1657 (*Unterschied zwischen der cartesianischer und der sonst in Schulen*

discipline was definitively misplaced in the traditional order of sciences[152]. This order is reversed by Clauberg by embracing Descartes's plan of disciplines, according to which the tree of philosophy is composed of the roots of metaphysics, the trunk of physics, and the boughs of mechanics, medicine and moral philosophy[153]. Hence, Clauberg underlines the absence of a foundation in Aristotelian philosophy. Describing several differences between Scholastic and Cartesian philosophy, Clauberg counts among them a different introduction to philosophy:

vulgaris philosophiae sententia est, omnem scientiam ex praecognitis oriri debere […]: quamombrem illa multas res, praesertim illas, quas ab infantia ipsi vidimus, audivimus et sensimus, praesupponit tanquam certissima fundamenta quae nulla demonstratione indigeant […]. Atque hoc modo illa introitum suum facit[154].

Clauberg opposes to such a state of philosophy a consistent architectonic as a guarantee for the validity of the new philosophy. Descartes's architectonic metaphor, to which Clauberg refers also in his *Defensio cartesiana* (1652) when he considers a provisional ethics[155], is the starting point of the outline of a philosophy which has its first *introitum* into doubt as the "door" of metaphysics. The development of an architectonic structure of philosophy is made possible by Descartes's personal renovation of philosophy:

cartesiana philosophia similis est alii cuidam urbi, quam architectus unicus eodem tempore iuxta regulas artis suae dimensus est, et e fundamento exaedificavit. […] Et ut breviter […] dicamus quod res est, vulgaris philosophia farrago est ex opinionibus variorum hominum […]. Cartesiana philosophia solum unius viri opiniones comprehendit[156].

The peculiar character of Descartes's philosophy is to have been developed by a sole man. Its theoretical foundation coincides with the very initiation of the vulgar man to new thought, since it begins as an introspective endeavour based on suspension of judgement.

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gebraeuchlicher Philosophie, Duisburg, bey Adryan Wyngarten), followed by the Latin translation in 1680 (*Differentia inter cartesianam et in scholis vulgo usitatam philosophiam*, Berlin, Völckern 1680)

152 «Notabilis differentia inter cartesianam et aristoteleam […] siquidem illa a rebus spiritualibus aut intellectualibs et ratione utentibus, haec autem a corporalibus initium sui scrutinii atque doctrinae primum facit, atque ita in scholis prima philosophia dicitur, dignitatis et naturae, non cognitionis nostrae ordine; contra quam fit in philosophia cartesiana: atque etiam haec primum est inventa, illa autem postremo, indeque nominata metaphysica, quasi post-physica», Clauberg 1691, *Differentia*, p. 1226.

153 *Ibid*., p. 1157, quoting Descartes's words on the tree of knowledge, see AT IX-2, p. 14.

154 Clauberg 1691, *Differentia*, p. 1225.

155 Clauberg 1691, *Defensio cartesiana*, p. 1002. Originally published in 1652 (Amsterdam, Elsevier).

156 Clauberg 1691, *Differentia*, p. 1220.

2.3 Metaphysics and logic

For Descartes, as he is referred to by Clauberg, metaphysics is about the principles of human knowledge, among which the divine attributes are to be counted[157] as from them it is possible to deduce natural laws[158]. In fact, God is required both to ensure the reliability of our faculties, and to explain the ultimate cause of natural laws. Metaphysics first of all relies on the four precepts of method: as the rule of evidence is the cornerstone of all Cartesian philosophy, metaphysics implies doubting as the condition of the acquaintance of clear and distinct ideas[159]. The proper justification of philosophical knowledge – *scientia* – is developed in Clauberg's *Exercitationes centum de cognitione Dei et nostri* (1656)[160]. As stated in his *Defensio cartesiana*, metaphysics coincides with natural theology[161] and proceeds from the acknowledgment of the notions of self and God to that of bodily reality. In fact, such concepts lead to the demonstration of the reliability of the human faculties, as they include the acknowledgment of the goodness of God[162] and are, at once, the basis of natural philosophical explanations, like the notions of physical modes and natural laws. Foundation as the justification of *scientia*, therefore, goes together with the assessment of its basic concepts. As it is based on a unique introspective act, the Cartesian foundation is composed of a few simple rules and principles, whereas Aristotelian philosophy was grounded on several *praecognita* embodied by a logic reflecting a vulgar worldview:

illa, (cartesiana) sicuti unum tantum inventorem, et non tam varios auctores […] habet […] quemadmodum et pauciores

[157] «In praefat. Editionis Princip. Gallicae, ubi explicaturus ordinem, quem quis tenere debet in se instruendo hac philosophia, *cum iam*, inquit, *acquisivit habitum quendam inveniendae veritatis in his quaestionibus* (nempe mathematicis) *debet serio incipere se applicare verae philosophiae, cuius prima pars est metaphysica, quae continet principia cognitionis, inter quae est explicatio praecipuorum Dei attributorum, immaterialitatis animarum nostrarum et omnium notionum clararum et simplicium, quae sunt in nobis. Secunda est physica*», Clauberg 1691, *Initiatio philosophi*, p. 1154. See AT IX-2, p. 14.

[158] «Vide qui Cartesius regulas de motu et corporum existentiam ex Dei natura et existentia derivet», Clauberg 1691, *Initiatio philosophi*, p. 1155.

[159] «Talem introitum habet philosophia cartesiana, nec ullum alio ex rigoroso postulato primae inventionis regulae […] admittit», Clauberg 1691, *Differentia*, p. 1225.

[160] «Cartesiana philosophia seponit in principio omnia visibilia et corporalia, quo unusquisque philosophiae studiosus ante omnia in propriam suam mentem descendat. […] Porro menti nostrae nihil propius arctiorisque cognatione iuntcum est, quam ipse Deus. […] De hac materia latius egi in tractatu *de cognitione Dei et nostri*», *ibid*., p. 1226. See J. Clauberg, *De cognitione Dei et nostri, quatenus naturali rationis lumine, secundum veram philosophiam, potest comparari, exercitationes centum*, Duisburg, ex officina Adriani Wyngaerden 1656.

[161] «Theologiam seu metaphysicam», Clauberg 1691, *Defensio cartesiana*, p. 1011.

[162] *Ibid*., p. 1233.

regulas […] continet […]. Vulgaris philosophia e contrario assumit multa tanquam fundamenta. […] Quod autem cartesiana philosophia initium facit a paucis, altera e contrario multas res praesupponat, e sequentibus patet exemplis. Vulgaris philosophia decem categorias, seu summa rerum genera; cartesiana duo tantum statuit[163].

What issues from Clauberg's *Differentia* is the unclear status of Aristotelian logic. In fact, it is described as providing philosophy with the ten categories: in some manner, it is a foundational discipline, as it embodies the notions of Scholastic philosophy, besides being an instrumental, propedeutic discipline[164]. Aristotelian logic and metaphysics are thus paired in their corresponding inadequate concepts, whereas Cartesian metaphysics deals with the proper natures of things, acknowledged through the analysis of the contents of mind[165]. However, in order to enable students to deal with the method and the concepts of the new philosophy, a logical introduction was required.

The positions of Clauberg on logic are consistently presented in his *Defensio cartesiana* (1652). In his *Defensio*, Clauberg points out that insofar as Descartes was concerned with old logic he did not completely reject it: he underlined, however, its merely expository value and erroneous precepts[166]. In fact, Descartes just left syllogistic theory out of his arguments, without rejecting it[167]. In addition, his apparent rejection of old logic appears to concern dialectics more than syllogistic theory, that is, only the arguments contained in the *Topica*, as stated in Descartes's *Epistola ad Voetium*. Such a distinction is borrowed from the late Scholastic tradition, as Clauberg quotes Burgersdijk's *Institutiones logicae* to support it[168]. In sum, Descartes's purpose was not to reform

[163] *Ibid.*, p. 1223.
[164] See Savini 2011, pp. 55-61.
[165] Clauberg 1691, *Differentia*, p. 1229.
[166] Clauberg 1691, *Defensio cartesiana*, pp. 972-973. See also his *Differentia*, *ibid*., p. 1223.
[167] «Cartesius non oppugnat logicam, sed eam, quam in scholis didicerat, sibi minus prodesse asserit ad suum propositum, interim aliis quibus prodest eam relinquit», Clauberg 1691, *Defensio cartesiana*, p. 973.
[168] «Operae pretium fuerit etiam illum locum expendere, quandoquidem vix alibi occasio dabitur. Exstat autem in Epistola ad Voetium pag. 26. 27. […] *Artes quibus te uti ex scriptis tuis deprehendo, et* […] *tales esse mihi videntur, ut eas vilissima multa ingenia perfacile possint addiscere* […]. *Prima* […] *est puerilis illa dialectica, cuius ope olim sophistae, nullam solidam scientiam habentes, de qualibet re copiose disserebant ac disputabant*. […] Notandum est, Cartesium in citato Epistolae loco de logica universa non agere, sed tantum de dialectica. […] Notandum est, maximam esse differentiam inter logicam analyticam, demonstrativam, scientificam, de qua Aristoteles in Posterioribus Analyticis, et dialecticam, popularem, disputatricem, de qua Aristoteles agitur in Topicis […] Hinc Franco Burgerdicius in praefat. Logicae: *in Topicis traduntur praecepta disputandi ex iis, quae revera sunt probabilia. In Analyticis traditur ratio disputandi seria veramque scientiam adipiscendi*», Clauberg 1691, *Defensio cartesiana*, pp. 973-974. See AT VIII-2, p. 50; F. Burgersdijk, *Institutionum logicarum libri duo, decreto illustr. ac potent. dd. ordinum Hollandiae et West-Frisiae, in usum scholarum eiusdem provinciae, ex Aristotelis, Keckermanni, aliorum praecipuorum logicorum praeceptis recensitis, nova methodo ac modo formati, atque editi*, Leiden, apud Abrahamum Commelinum 1626, p. 45.

logic: Clauberg had such a purpose, and developed a new logic embodying the four rules of the method with a consistent syllogistic apparatus. This apparatus, indeed, finds its proper place in the second part of logic, *analytica*, whereas the first part, devoted to invention, is grounded on Descartes's four rules:

totam logicam, quam vocavi analyticam, tanquam a suo instituto alienam aliis reliquit. Cum etiam docere alios eo tempore non institueret, sed tantum mentem propriam vellet cognitione informare. […] Mero meridie clarius est; Cartesius non velle quatuor illa praecepta toti reipublicae literariae ad quoscunque logicae universae fines assequendos sufficere, sed sibi duntaxat ad scopum quem animo destinaverat. Observandum tamen est, me in explanatione istorum praeceptorum (ad priorem logicae geneticae partem […] proprie spectantium) ut usum eorum uberiorem patefacerem, etiam ad reliquas Logicae partes multis in locis respexisse. Illius enim quadripartitae prima portio simul est fundamentum sequentium[169].

Actually, Clauberg's considerations on the function of logic can highlight his overall strategy in grounding philosophy. Whereas De Raey would identify logic with metaphysics, in Clauberg's logic we can observe only some intersections with first philosophy. The main purpose of his *Logica vetus et nova* is not to justify the reliability of philosophical knowledge but to guide understanding[170].

The first task of logic, according to Clauberg, is to help man avoid error. This purpose is first stated in the *Prolegomena* to the second edition of his *Logica*, whose first chapter sounds as «futuro logico et philosopho errorum et imperfectionum humanae mentis in rebus cognoscendis orginem et causas investigandas esse»[171]. In fact, logic is conceived as *medicina mentis*, that is, something new (but not unheard of) in the history of philosophy[172]. Like his *Defensio cartesiana*[173], Clauberg's *Logica* focuses on the causes of error. Borrowing several arguments from Bacon, Clauberg lists the causes of error by paying attention to the ages of men and to the social context[174]. In fact, even if doubt is regarded as the main remedy against error, and the very first step into philosophy, in his *Logica* more specific tools are set forth against it, making logic more a practical art than a theoretical science[175]. For Clauberg, logic is a set of rules meant to avoid error not only in

[169] Clauberg 1691, *Defensio cartesiana*, p. 998. See also p. 1011.
[170] «Cum logica sit ars ratione recte utendi», Clauberg 1691, *Logica vetus et nova*, p. 784.
[171] *Ibid*., p. 769.
[172] «Novum hoc esse et insolitum in logicae vestibulum», *ibid*.
[173] Clauberg 1691, *Defensio cartesiana*, pp. 1050-1097.
[174] Clauberg 1691, *Logica vetus et nova*, pp. 770-778, see chapters II-IV
[175] *Ibid*., pp. 778, 800.

philosophy but also in everyday life. It is a *didactica*, serving to teach how to avoid error[176]. The functions of logic determine its structure, centred, like Pierre de la Ramée's *Dialectique*[177], on *Genetica* and *Analytica*. Maintaining its practical role, Clauberg's logic loses, however, the main rhetorical features that Ramistic dialectics had.

Logica is quadripartite: the first two parts, forming *genetica*, concern the formation of thoughts and their expression in speech[178]. *Genetica* is about definitions, divisions and syllogisms, being a *hermeneutica* or the interpretation of our own discourse[179]. The last two parts concern the interpretation or resolution (*analytica*) of the sentences of other men. The third part explains how to understand their meanings, while the fourth (*hermeneutica analytica*) expounds the rules for an analysis of their truth according to the precepts of *genetica*[180]. Actually, it is in the first and in the fourth section that metaphysical arguments can be found, as these parts concern the rules for the formation and analysis of thoughts. For the sake of the detection of error, ideas or the linguistic meanings of words are put into focus more than the organization of speech[181]. Thus, treating

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[176] «Iam quia in vitae societate alii saepe homines veritatis praeceptis imbuendi sunt, certe nulli unquam fallendi, nec voce, nec scripto, nec alio signo; inde hinc oritur secunda logicae necessitas, quae respicit eos, quos docemus, aut quibuscum disserimus. Quis enim neget, singulari nobis arte opus esse, ut homines a preaiudicatis infantiae opinionibus atque inde descendente erroneo iudicandi modo liberatos paulatim ad rectiorem rationis usum ducamus?», *ibid.*, p. 779. Logic is defined as dialectic and didactic in Clauberg's *Logica contracta*, a compendium of some sections of *Logica vetus et nova* appeared in 1660 *Ontosophia*: J. Clauberg, *Ontosophia nova, quae vulgo Metaphysica, Theologiae, Iurisprudentiae et Philologiae, praesertim Germanicae studiosis accomodata. Accessit Logica contracta, et quae ex ea demonstratur Orthographia Germanica*, Duisburg, typis Adriani Wyngaerden 1660. See Clauberg 1691, *Logica contracta*, p. 913.

[177] See Savini 2006, p. 75.

[178] «Prior pars tantum comparata est ad id, ut regatur sermo internus seu cogitatio: posterior insuper formare docet sermonem externum seu orationem, quae cogitationis est interpres», Clauberg 1691, *Logica vetus et nova*, p. 780.

[179] «Logicae geneticae pars posterior […] inservit menti ad suos conceptus, modo ad priorem partem accomodato, aliis explicandos. Itaque docet, quibus verbis definitiones, divisiones, syllogismi in mente formati sint efferendi. […] Quae praecepta hermeneutica a grammaticis et rhetoricis diversa esse nemo non videt», *ibid*. Clauberg's *Logica* loses, in the second and third part, the philosophical character of the first and last part as it mainly contains rhetorical suggestions on how to express our thoughts, such as on *perspicuitas* or *brevitas* (see chapters IV and VII) or by similitude (see chapter XI). Such suggestions taken from rhetoric are even more present in the third section, on the recognition of the real meaning of words and sentences of other people (being, in fact, a *hermeneutica* as well): here the appeal is to philological arts (*lexica*, grammar and rhetoric, see ch. V).

[180] «Inquirendum est an cogitationes scriptoris, externo sermone nobis explicatae, regulis illis, quas non solum de percipiendi, iudicandi, et recordandi, verum etiam de tradendi modo praescripsit logica genetica, sint conformes», Clauberg 1691, *Logica vetus et nova*, p. 866. See also *ibid*. p. 781.

[181] «Analysi quidem logica potiori iure dicitur, quia logica magis circa sermonem internum quam externum occupata est, et quia in sermone interno, quem vocant, plura et potiora investiganda sunt quam in externo, idcirco analysis […] nuncupatur», *ibid*., p. 867. See also p. 870: «adeo involutae atque inter se mistae sunt vocum et rerum apprehensiones, ut inter potissima sit analytica officia in cogitationibus hominum externo sermone expressis videre, quid ad verba, quid ad res pertineat, separare notionem vocabuli et notionem rei, et quomodo ex illa mixtura et confusione errores quam plurimi oriantur ostendere».

«inveniendi veri methodum»[182], the first section expounds the conditions for clear and distinct perception. Three main questions are put forward: «quid sit cognoscendum», «quis ipse sit, qui vult cognoscere», «quomodo possit cognoscere, ubi de methodo»[183]. Stating the basics of Cartesian metaphysics, some words are devoted to the objects of knowledge, matching Descartes's hierarchy of knowledge:

quod omnibus necessario cognoscendum est, ante omnia cognoscamus, v.g. Deum et nos ipsos, in caeteris vero eorum, quae potioris sunt dignitatis et usus, potiorem rationem habeamus, non necessariis atque inutilibus omissis, cum sapientia non paretur ex quarumvis rerum notitia, sed ex earum duntaxat quae maioris sunt momenti[184].

The subsequent considerations are on the division of knowledge into practical and theoretical: according to Clauberg, indeed, even the knowledge of God is ultimately practical, as it grounds disciplines such as medicine or law[185]. This consideration of the role of natural theology corresponds to the positions supported in his *Exercitationes*. With them, a continuity is established between arts and philosophy, making logic itself useful in every field. Being a guide for the use of reason in every context, the logical examination of the knowing subject is carried out from a pragmatic point of view, or considering the age, the dispositions to knowledge and its aids. Such aids, in fact, are the very object of *logica seu methodus*[186]. More than surveying ideas or human faculties – as in the case of other Cartesian logical treatises – *Logica* focuses mainly on method, or the last topic discussed in contemporary logical treatises such as those of Arnauld or Malebranche[187]. In fact, it is in the considerations on method that the most relevant foundational arguments of Clauberg's logic can be found. In *Initiatio philosophi* he states that the first part of

[182] *Ibid*., p. 780.
[183] *Ibid*., p. 783.
[184] *Ibid*., p. 784.
[185] «At nunquid caeli notitia ad Creatorem agnoscendum ac celebrandum adducimur, et nunquid sequitur, omnem cognitionem quodammodo practicam esse oportere, nullam otiosam aut sterilem», *ibid*.
[186] *Ibid*., p. 786. See also pp. 784-785: «quid in mei ipsius consideratione primum est? Resp. Primum ratio habenda est aetatis, non enim omnia conveniunt aetati. Prima versari debet circa linguas, rudimenta arithmetica, geometrica, astronomica […]. Matura demum aetas crescente iudicio ad accuratiorem philosophiam. […] Quid […] secundum est? Resp. Explorandum est ingenium. […] Alii ad mathesin, alii ad oratoriam […]. Quid […] tertium est? Resp. Ut expendam profectus meos […]. At haec ad cognoscendi modum nos deducunt id quod potissimum est in rationis usu, ita deinceps».
[187] See P. Schuurman, *Ideas, Mental faculties and Method: The Logic of Ideas of Descartes and Locke and Its Reception in the Dutch Republic, 1630-1750*, Leiden-Boston, Brill 2004, pp. 34-55.

logic teaches how to acquire clear and distinct perception[188]: it is thus a crossroads between logic and metaphysics[189].

As stated by Savini, the Cartesian character of Clauberg's *Logica* is to be looked for in the replacement of the treatment of *themata* with the consideration of clear and distinct perception[190]. *Themata* are actually considered as whatever the mind can acquaint itself with[191]; the modalities of such acquaintance, however, are now at the top of Clauberg's agenda, as set out in the considerations on method. The actual condition of clear and distinct perception is *attentio*, which is a methodological tool making the classical tools of logic – definition, division and syllogism – unnecessary in the acknowledgement of clear and distinct notions, that is, *themata* or ideas:

quid omni primum est , sine quo mens clare ac distincte rem percipere non potest? Resp. attentio debita, et iusta in rebus considerandis mora. Nam eius demum rei clara est perceptio, quam mens attendens quasi praesentem intuetur, et multa e uno manifesta fiunt, quod attenduntur, ita ut alia instrumenta logica, v.g definitionem, divisionem, syllogismum adhibere non sit necesse[192].

This is a Cartesian novelty in a logic still regarding definition, division and syllogism as tools in arriving at conclusions, whereas clear and distinct perception is now the ground of all the logical inferences. Attention, in any case, is considered by Clauberg more in the light of the practical conditions of perception – for example, by considering morning the best time for studies[193] – than from the perspective of metaphysics, i.e. within a theory of human faculties. Moreover, the emphasis given to attention seems to be inconsistent with a further consideration of the role of division in clear and distinct perception. While discussing the problem of the order in perceiving and judging, division is regarded as the condition of perception itself: «ad definiendum opus est divisione, opus eadem ad res omnes distincte percipiendas»[194]. Such apparent inconsistency, in fact, is determined by the multiple functions of *Logica* and by the different influences undergone by Clauberg. The implications of hermeneutics, of Cartesian metaphysics and of the adoption of a

[188] «Claram distinctamque perceptionem, logicae meae pars prima docet abunde, quomodo ea possit acquiri, et tota nostra philosophia eam promittit ac praestat unice», Clauberg 1691, *Initiatio philosophi*, p. 1144.
[189] «Nimirum, tantum abest ut Scepticis faveamus, ut eos non solum initio philosophiae, verum etiam in logica refellamus», ibid.
[190] Savini 2006, p. 77.
[191] Clauberg 1691, *Logica vetus et nova*, p. 788.
[192] *Ibid*., p. 786.
[193] *Ibid*, p. 787.
[194] *Ibid*, p. 796.

syllogistic apparatus determine different kinds of conditions for perception. Indeed, whereas attention is regarded as the condition of clear and distinct perception in everyday practice, division is the basic mental activity in discerning ideas, allowing also the formulation of definitions and syllogisms. Ideas are for Clauberg the very definitions of things: dividing, therefore, is the condition of defining or explaining ideas.

Because division is conceived by Clauberg as the mental activity allowing clear and distinct perception, a survey of the kinds of order becomes necessary in the definition of the means of obtaining *scientia*. What is divided needs to be ordered. This leads Clauberg to examine the proper contents of Descartes's method[195], adding to them the syllogistic of Aristotle's *Analytica*. *Ordines percipiendi* are traditionally regarded as analytic or synthetic (i.e. resolutive or compositive), universal or particular (on single or composite entities), natural or artificial (as perception follows either the nature of things or an arbitrary order)[196]. The main rule in ordering perceptions prescribes, plainly, to proceed from easy to complicated matters[197]. *Ordines iudicandi*, on the other hand, bring the reader to the second logical *gradus*[198] (the first being perception), which comprehends judgements and arguments. Syllogisms and induction[199] are presented by Clauberg as the master argumentative tools, according to which conclusions are derived from causes or from effects, that is, from universals or particulars. The syllogism, therefore, is perfectly integrated into Cartesian logic as the proper instrument in reasoning.

The most important foundational point in such considerations, however, is to be found in the treatment of the different degrees of certitude of judgements. More than in the theory of knowledge, indeed, it is in the knowledge of the attributes of God that Clauberg's foundation finds its proper place. This leads him to consider the epistemic status of sentences expressing eternal truths, such as

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[195] In the 1647 *Ontosophia*, however, *ordo* and *methodus* are clearly separate, as method concerns the way in which we acquire knowledge, whereas *ordo* is its disposition in teaching. Such considerations will disappear from the second and the third editions. See Savini 2011, pp. 45-46. In Clauberg's *Logica*, in fact, this distinction is less emphasized, because he considers the kinds of *ordo* as an aspect of the more general problem of method. Indeed, *ordines percipiendi ac iudicandi* are treated in the light of the first two logical degrees, or perception and judgement, which are to be guided by method itself: «cognoscendi modum rectum tenebit, sive methodum facilem, brevem ac tutam, id est, humanae mentis naturae congruam, plenam et perfectam, sic iuvantem, ut nulla parte noceat. Hanc methodum focet logica, cuius tres gradus sunt», Clauberg 1691, *Logica vetus et nova*, p. 785.

[196] *Ibid.*, p. 799.

[197] *Ibid*., pp. 797-799.

[198] Clauberg discusses three logical steps or degrees: perceiving, judging and remembering, see *ibid*., p. 783. These *gradus* are involved in demonstrations, as memory is what allows the retaining of previous conclusions.

[199] *Ibid*., pp. 837-840. The reference is to the two classical means of discovery and demonstration described in *Analytica posteriora*, see Savini 2011, p. 46.

those embodying the demonstration of God's existence. Two degrees of certitude and truth are outlined: contingent (or moral) certitude, and necessary certitude, embracing in turn three further degrees: *certitudo physica sive de omni*; *certitudo metaphysica per se* and *certitudo metaphysica universaliter prima*[200]. Metaphysical or eternal truths are grounded on the clear and distinct perception of the connection of subject and predicate[201]. A difference, however, is made among those metaphysical truths, whose utmost certitude relies only on the definition of the subject, as in the sentences «omnis homo est animal rationale»[202] or «Deus necessario existit», analysed in the last part of Clauberg's *Logica*:

examinantur veritas et falsitas, et gradus utriusque in enunciationibus […] ubi illa […] Deus necessario existit, habet certitudinem […] metaphysicam, estque per se et universaliter primum, ideoque magis necessaria hac, binarius est par[203].

Because God is defined as *ens summe perfectum*[204], this definition implies a necessary existence. Therefore, «Deus necessario existit» is to be considered even more necessary than «binarium esse parem», because the truth of the former sentence depends on the definition of the subject, whereas that of the latter relies on the notion of the predicate[205].

Ultimately, Clauberg finds in logic the proper place for an analysis of the degrees of certitude of the bases of Cartesian metaphysics, which is treated according to the Cartesian criterion of truth perception and by paying attention to the kinds of subject-predicate connection. This analysis is applied to the *a priori* proof, but also to Descartes's *a posteriori* argument. In the last section of *Logica*, indeed, the principle of causality is examined from an analytical point of view[206], involving, in fact, metaphysical considerations; it is considered in the light of the concepts of efficient and

[200] Clauberg 1691, *Logica vetus et nova*, p. 801.
[201] «Unde vero existit summa illa seu metaphysica de axiomatibus nonnullis in animo nostro certitudo? Resp. Certitudo axiomatis affirmantis proficiscitur e subiecti et predicati nexu insolubili a mente clare et distincte percepto», *ibid*., p. 802.
[202] *Ibid*., p. 803. This, in fact, is the vulgar definition of man: regarded, however, as absolutely necessary in the light of its clear and distinct perception.
[203] *Ibid*., p. 891.
[204] *Ibid*., p. 892.
[205] *Ibid*., p. 893.
[206] «Examini analytico subiecimus veritatis certitudinisque gradus ac differentias, iam etiam, Logicae nostrae ordinem secuti, gradus universalitatis in axiomatibus, et quae quibus superiora, quibus inferiora sint, expendamus: hoc enim multum prodesse ad iudicium formandum ipsa nos docuit. Sumamus vulgatissimum illud: quod quid non habet, id alteri dare non potest», *ibid*., p. 894.

exemplary cause, which in the case of God's idea must be identified as it contains perfection in its objective being[207]. This argument will be properly developed in *Exercitationes de cognitione Dei et nostri*, Clauberg's main treatise on metaphysics along with *Ontosophia*. However, before turning to such treatises in order to show their connections with logic, I will devote some words to Clauberg's physics. More than in his other works, in fact, it is in *Physica* that he develops his overview on the system of sciences[208], devoting his considerations to the preliminary role of natural philosophy.

2.4 Physics and natural theology

In physics, the interests of Clauberg are in phenomena concerning living bodies[209]. He is thus concerned with the study of the mind insofar as it can allow a better explanation of the experiences of man[210]. The treatises included in his *Physica* (*Physica contracta*, *Disputationes physicae*, *Theoria corporum viventium* and *Corporis et animae in homine coniunctio*) start with the definition of the basic concepts of physics and end in the analysis of human nature. Clauberg's main focus is on human nature as a premise for the other disciplines. His consideration of the human mind concerns its union with the body, fully analysed in his *Corporis et animae in homine coniunctio*, aimed to further the progress of physics, medicine, theology, law, ethics, didactic and logic[211]. Many metaphysical studies carried out in physics, like those on actions and passions of the mind, however, have to be considered as the conclusions rather than the premises of natural philosophy.

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[207] *Ibid*., p. 897.

[208] On the use of the category of system, see L. Catana, *The Historiographical Concept 'System of Philosophy': Its Origin, Nature and Legitimacy*, Leiden-Boston, Brill 2008.

[209] «Spectata in te rerum cum metaphysicarum tum physicarum peritia, et qui ex familiari conversatione tua percipi poterant fructus id effecere […], solidiorem tamen mentis pariter et corporis scientiam […] cum ratione optabam. […] Quando enim cum scientia physicam artem medicam feliciter sociando, et rectiorem philosophandi viam diutius ac frequentius, quam ego pluribus aliis rebus occupatus facere potui, terendo, particularia multa naturae arcana detexisti; magnopere mihi rogandus es, ea, quae de viventibus et plantis nec non corporis cum anima coniunctione scripsi», Clauberg 1691, *Physica*, *Johanni de Raei epistola*, p. I (unnumbered). Originally in J. Clauberg, *Physica, quibus rerum corporearum vis et natura, mentis ad corpus relatae proprietates, denique corporis ac mentis acta et admirabilis in homine coniunctio explicantur*, Amsterdam, apud Danielem Elzevirium 1664.

[210] «Inscriptio libri huius tria tibi promittit. Primum est explicatio virium et naturae rerum corporearum. […] Alterum est explicatio proprietatum mentis, non absolute spectata, nam eo intuitu ad scientiam physicam reduci non solet, sed relate ad corpus, quod proprium naturalis philosophiae subiectum censetur. […] Mens humana quomodo corpori imperet agendo, quomodo item a corpore patiendo sentiat, imaginetur […] similesque functiones exerceat, […] tractatur. Tertium est explicatio coniunctionis illius hypostaticae, qua mens et corpus ad unum hominem constituendum admirabili modo conveniunt», Clauberg 1691, Physica, *Lectori salutem*, p. I (unnumbered).

[211] Clauberg 1691, *Physica*, p. 209.

His *Physica* ends with an explanation of body-mind interaction designed to implement our grasp of phenomena rather than to establish such a grasp[212]. In any case, the metaphysical points entailed by Clauberg's *Physica* deserve some attention, especially in their intersections with the themes of his *Exercitationes* and *Ontosophia*. In fact, also in his *Physica* Clauberg develops some foundational arguments: he expounds some elements of an ontology of body and mind; moreover, he is concerned with the role of God in the creation of natural laws.

In his *Disputationes*, refining Descartes's metaphor of the tree of knowledge[213], Clauberg outlines the relations among the sciences: he regards law and medicine as badly grounded if they are detached from philosophy. In such a case, they will be only a study of the Prince's decrees and an empirical practice[214]. On the contrary, the proper architecture of the sciences includes metaphysics or first philosophy as the discipline grounding physics, on which moral theory and medicine are based. From moral philosophy, furthermore, law and politics flow[215]. Clauberg underlines the practical value of philosophy, as politics is put at the top of the architecture, while medicine and law are firmly based on physics and metaphysics[216], or the worthiest sciences[217]. Politics, in fact, acquires the nature of *scientia* only if it is based on a philosophical theory of man, as in the case of medicine: this theory is fully developed in the *Coniunctio*. Two foundational topics are discussed by Clauberg for the sake of this development: the nature of the actual features of the world, and the role of God in establishing natural laws.

The first topic, or the definition of an ontology for physics, presents some Scholastic overtones. This is the case with the distinction between first and second matter, that is, pure and

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[212] See the *Corporis et animae in homine coniunctio*, «illud reale et elegantissimum physicis thema nobis hic tractandum est, quomodo universi conditor […], nihil impediente tanta naturae corporeae et incorporeae diversitate, unum ex utraque hominem composuerit», Clauberg 1691, *Physica*, p. 213.

[213] «Philosophia, et praesertim physica, licet iurisprudentiae ac medicinae radix ac fundamentum recte iudicetur», *ibid*., p. 53.

[214] «Quamvis enim illae disciplinae sine philosophia tractari soleant a multis, quatenus iurisprudentia leges a principis voluntate pendentes, medicina observationes et experientiam sequitur; nemo tamen preaeclarum et solidum quid in iis praestare novit, nisi philosophiae praeceptis imbutus ante fuerit», *ibid*.

[215] «Nam facile est ostendere, veram iurisprudentiam in morali doctrina, doctrinam moralem una cum medicina in physica, physicam denique in metaphysica vel prima philosophia radicari ac fundari», *ibid*.

[216] «Quod si forte alia de causa, veluti regiminis civilis intuitu, caput philosophiae iurisprudentia censeatur, id non magis in ipsam iurisprudentiam, quam in politicam, quae pars est philosophiae, quadrare certum est: cum plures legum civilium, quatenus a politica distinguuntur prudentia, imperiti summa cum laude respublicas olim gubernairnt atque etiamnum gubernent. Porro philosophiam cum radicem et fundamentum iurisprudentiae et medicinae affirmo, veram et sanam intelligo», *ibid*.

[217] *Ibid.*, p. 54.

modified extension, outlined in the *Disputationes*[218]. The sixth disputation concerns the real nature of matter[219], followed by a study of its modes, like figure or *terminus extensionis*[220], determined by place, distance, motion: «situs autem adeoque locus, distantia et motus ponunt esse figuram in corporibus, quae iam in mundo divisa sunt ac distincta»[221]. In fact, all Cartesian objective qualities are ranged under the traditional name of "form"[222] and are mathematically defined:

at quibus usi sunt mathematici principiis […] in illo subiecto extenso considerarunt 1. quantitatem continuam et discretam […]. 2. Figuram seu modos varios quibus extensio terminatur. 3. Situm seu dispositionem partis unius inter alias. 4. Motum seu mutationem situs. 5. Quietem seu permansionem in eodem situ[223].

Their differences constitute the principle of the individuation of bodies[224]. Scholastic terminology can also be discovered in the *Physica contracta*, where the explanation of earthly phenomena is provided by the concept of heat[225].

Besides his terminology, Clauberg assumes that all the kinds of modes are equally present in matter, adding to them even relative qualities such as length and breadth[226], namely, the results of a mental activity about reality. Physical properties are considered in the light of their relation with the mind: the point of view of Clauberg is that of body-mind union, which crowns his natural philosophy. He is not interested in a careful distinction of what belongs to mind and to matter, that is, of *modi considerandi* and *essendi* (like the respective concepts of measurement and those of actual features like motion). In other terms, he includes among primary qualities also relative concepts like those of measurements, which are based on things but are, ultimately, second notions.

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[218] «Itaque distinguendum est inter materiam prima, hoc est extensum simpliciter et universe consideratum, quod mera substantia est, a solo Deo pendens; et materiam secundam, hoc est aliquid hoc illove modo extensum, hac illave forma praeditum, in certo rerum genere collocatum», *ibid*., p. 58.

[219] «Vera sententia de essentia rei corporeae hactenus exposita, quae universae physicae fundamentum est, a praeiudicatis opinionibus accuratius vindicata ac defensa», *ibid*, p. 62.

[220] «Figura vero ipsa ponit esse extensionem, ex cuius terminatione oritur», *ibid.*, p. 64.

[221] *Ibid*.

[222] «Ab una et uniformi totius universi materia hactenus pensitata ad examinandas formas transitur, unde corporum varietate ac distinctio», *ibid*., p. 79.

[223] *Ibid.*, pp. 80-81.

[224] *Ibid.*, p. 83.

[225] «Aer perpetuo est calidus, sinon respectu ad sensum habito, saltem absolute», *ibid.*, p. 38.

[226] «Motus […], figura, situs, locus, magnitudo; […] raritas, densitas, longitudo, latitudo, profunditas, denique omnia desunt, quae a Deo materiali substantiae fuerunt attributa quaeque voluit conditor optimus percipi ab homine sapientiae ac perfectionis suae spectatore», *ibid*, p. 66. Anyway, Clauberg considers motion as the main mode of matter: see *Disputatio* XXIV, pp. 117-118.

Such a disregard for the distinction between first and second notions, as well as the retaining of Scholastic concepts, is present above all in his *Ontosophia* and has relevant consequences for his foundational theory[227].

The second metaphysical or foundational topic in Clauberg's *Physica* concerns the role of God, defined in traditional terms. He considers God the creator and conserver of matter and motion[228], and assigns to *res* and *leges* an effective, secondary causality, because laws are the causes that nature follows[229]. Such laws are deduced from divine perfection[230], whose definition is borrowed from the *Ethica Nicomachea*[231]. This perfection or constancy is in balance with divine freedom[232], which is another of the attributes of God. In any case, it is in the *Exercitationes* that the pivotal topic of the role of God in the foundation of philosophy finds its systematisation. Not as regards the deduction of natural laws, which have their justification only in the *Physica*, but as regards the truth of our concepts.

2.5 The place of natural theology in the foundation of philosophy and arts

Clauberg's *Exercitationes centum de cognitione Dei et nostri* is a miscellaneous treatise, covering topics belonging to natural theology, ontology, theory of knowledge and ethics. As it is first of all devoted to the foundation of philosophy, it is to be analysed in the light of two main topics: the demonstration of the existence of God and the theory of ideas[233]. The properties of thought, indeed,

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[227] *Infra*, § 2.6.

[228] «Materiae substantia servante Deo semper manens», Clauberg 1691, *Physica*, p. 57.

[229] *Ibid.*, pp. 97-98, 103.

[230] «Permanet, quantum in se est, constantia Dei illud non deferente […]. Enimvero um sine causa haut quicquam fieri possit, citra actionem causae status demutari nequeat. […] Unde natura lex nata est prima, a divinae conservationis simplicitate et constantia pendens. Eadem haec Dei perfectio alteri quoque naturae legi finis et origo est», *ibid.*, p. 6.

[231] «Perfectionem artificis ex eo elucere, quod tale opus fabricarit, cui nihil addi, nihil demi possit. His enim verbis describere solemus id quod perfectum appellamus. Et nunquid opera, quae scite affabreque facta sunt, hoc nomine commendantur, quid nihil illis detrahi aut addi possit; ut bene Aristoteles 2 Eth. cap 5», *ibid.*, p. 100. See *Ethica Nicomachea* V, 2, 1106a 26-1106b 35.

[232] «Deum equidem liberrime omnia agere in omnibus nullo modo imus inficias; sed affirmamus insuper, perpetuo eum agere caeteris perfectionibus suis congruenter, adeoque sapienter et constanter; nec uni libertatis attributo sic esse insistendum, ut reliquae eius virtutes, quae non minus in eo spectandae nobis exhibentur, minus a nobis praedicari videantur», *ibid.*, p. 101.

[233] «Quibus de rebus tractat metaphysica sive prima philosophia, illa inprimis quae a Renato Cartesio publico data? Resp. Tractat de principiis cognitionis humanae, sive de primis initiis et fundamentis omnis nostrae scientiae, quam ex naturae lumine possumus haurire. Ita mens cuiusque hominis philosophaturi primo incipit a cognitione suae

are examined by Clauberg in the light of the proofs expounded in Descartes's *Meditationes*.

The rational theology developed in his *Exercitationes* is not only meant to ground physics. Since Clauberg conceives of all disciplines as relying on philosophical knowledge, even disciplines like law find their foundation in *philosophia prima*, in accordance with an attempt to integrate Cartesianism in the academic curriculum[234]. God, as the first cause – whose acknowledgement allows for the attainment of *scientia* as the knowledge of first causes –, is to be taken into consideration in all disciplines, not only in the deduction of physical laws[235]. Natural theology is thus present from the first to the last step of philosophy[236], which ends in physics, ethics and politics[237].

His *Exercitationes* contain the presentation and clarification of Descartes's proofs, enriched with corollary considerations borrowed mainly from Scholastic and Renaissance authors. Actually, Clauberg does not add any new points to such proofs: with his considerations, however, he discloses some points implied in Descartes's arguments. His first focus is on the imitative nature of ideas, which can be thus conceived as images, in accordance with the views of Bartholomäus Keckermann and Rudolph Goclenius. Presenting the first proof, in addition to the twofold nature of ideas – formal and objective – Clauberg highlights the relation between human and divine ideas,

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existentiae, qua nihil ei notius esse potest. E sui notitia provehitur deinde in cognitionem Dei creatoris et consevatoris, hunc necessario existere, omnisque datorem luminis esse demonstrat», Clauberg 1691, *De cognitione Dei et nostri*, p. 592.

234 «Utilis […] est naturalis Dei cognitio propter alias omnes humanas disciplinas, quarum firma et evidens notitia expetitur. Non enim possunt satis refutari sceptici neque conclusionis ullius vera certitudo haberi, nisi ante probetur, Deum summe veracem et causam omnis veri et boni necessario existere, a quo proinde accipiamus omnem intellectum, quo si recte utamur, hoc est, si non nisi de clare distincteque perceptis iudicemus, fallere aut falli nequeamus. Et constat inter cunctos logicos et philosophos, non posse obtineri ullius rei creatae veram scientiam, nisi perspectis causis; causas autem non posse perfecte cognosci, nisi ad primam et supremam causam, quae Deus est, recurratur», *ibid*., p. 594.

235 «Addo peculiari de causa tractationi de Deo locum esse dandum in primis philosophiae principiis, quoniam perfecta rerum scientia, quam philosophando acquirere laboramus, ex causarum praecipue notitia resultat. At prima rerum omnium causa, et sine qua reliquarum causalitates nec sunt, nec accurate cognosci possunt ullae, est Deus», *ibid.*, p. 596.

236 «Nam initio philosophiae non ulterius agitur de Deo, quam quatenus eius cognitio ad iacenda omnis scientiae humanae fundamenta desideratur. Sed in fine absoluta de Deo tractatio instituitur, omniaque eius attributa, quae ex naturae lumine cognosci queunt, expenduntur, quod initio necessarium non erat, quoniam non omnia Dei attributa se habent ut principia rerum creatarum, et quae huiusmodi relationem possunt recipere, non tamen absolute ideo aut planius, quam originis illa relatio postulat, opus est explicare. Nec possunt sane attributa Dei absolute et plene satis explanari, antequam rerum ab eo creatarum tractatio praecesserit», *ibid.*, p. 596.

237 «Dico per universam philosophiam diffusam esse theologiam naturalem, quia dum in operibus Dei rite contemplandis occupamur, fieri nequit, quin ipsius opificis potentiam, bonitatem, sapientiam passim admirando, in eius notitiam magis magisque assurgamus. Quaecunque enim sunt in rerum natura creata et ordinata, ad ipsum tanquam suum principium et originem sunt referenda. Quod respiciens S. Augustinus in Epist. ad Volusianum, ipsam quoque physicam, ethicam, politicam aliasque disciplinas theologiae terminis contineri asseruit», *ibid.*

envisaged as ectypes and archetypes[238]. God, therefore, is at the same time the efficient and the exemplar cause of our innate ideas. As these are conceived as images or imitations, they cannot be more perfect than what they are images of, as stated by Aristotle and Keckermann:

imago est, inquit Aristoteles lib. 6. Top. cap. 2, *quae per imitationem efficitur*, sive cuius generatio est per imitationem. Imitatio autem, veram eius naturam si intueamur, per se nihil aliud est, quam *conformatio imperfectioris ad perfectius*, ut bene inter alios definit Keckerm. Syst. Phys. Lib. 4 cap. 8[239].

Assuming the existence of an imitation or an *esse obiectivum seu vicarium* (a term borrowed from Goclenius[240]), an archetype is thus required[241]. Besides Aristotle, Keckermann and Descartes[242], the position of Clauberg relies on Eustache de Saint-Paul and Goclenius' works[243]. Clauberg's strategy is to refer the basics of Descartes's arguments to the Scholastic theories. However, it is not clear to what extent Clauberg supports the view that ideas are truly mental images or visual contents: «imago quaedam», «tanquam imago» or «per modum imaginis»[244] suggest that Clauberg is only using a comparison with images more than identifying ideas with them[245], following a philosophical terminology adopted by Descartes himself[246]. In fact, the status of ideas remains ultimately

[238] «Observo 1. conceptum seu ideam omnem habere duplicem dependentiam, unam a concipiente sive cogitante intellectu […] altera, a re concepta aut simili, cuius scilicet repraesentatio sive imago est, sive unde per imitationem expressa est. […] Observo 2. intellectum esse causam conceptus efficientem, […] rem vero conceptam […] esse causam conceptus exemplarem (quae quidem etiam ad efficientem reducitur) atque eo modo ad conceptum referri, quo archetypon ad ectypon», *ibid.*, p. 606. See p. 618: «ex ideis aliae sunt ectypae, qualis est idea Dei et aliarum rerum ab homine non factibilium, aliae archetypae, quae rerum faciendarum formulae et exemplaria sunt et a philosophis ad causam efficientem referuntur».

[239] *Ibid.*, p. 606. See Aristotle, *Topica*, 140a 14-15; B. Keckermann, *Systema physicum*, Hannover, impensis Ioannis Stockelii 1623 (3rd ed., 1st ed. 1610), p. 564.

[240] R. Goclenius, *Lexicon philosophicum*, Frankfurt, typis viduae Matthiae Beckerii 1613., p. 1047.

[241] «Idea secundum esse vicarium spectata non potest esse perfectior sua causa, hoc est, suo exemplari, imperfectior esse potest. Imo nulla imago plus realitatis et perfectionis repraesentare, quam reperitur in ea re, unde talis imago desumta sive expressa est. […] Probatum […] tum ex natura imaginis atque imitationis, tum ex illo axiomate, quod effectus non possit esse nobilior causa. Et sane, quam necessarium est, ut omnis idea habeat causam exemplarem, tam necessarium est, ut omne praeclarum quod habet idea, procedat ac derivetur ab exemplari illa causa. […] Ut ex nihilo nihil fit a natura: ita nec potest mens nostra ullum realem conceptum formare, nisi rem aliquam imitata: et cuius totum esse in imitatione consistit, id non potest plus continere, quam est in imitabili sive exemplari. […] Si ergo […] summae perfectiones non sunt in mente […] sequitur eas esse extra mentem nostram […] hoc est, in Deo», Clauberg 1691, *De cognitione Dei et nostri*, p. 609.

[242] *Ibid*., pp. 608, 609-610, quoting the *Meditatio prima* and *tertia*: see AT VII 19-20, 40, 51-52.

[243] See Eustache de Saint-Paul, *Summa philosophiae quadripartita, de rebus dialecticis, moralibus et metaphysicis*, Paris, Chastelain 1620 (1st ed. 1609), pp. 54-55; Goclenius 1613, pp. 208-209.

[244] Clauberg 1691, *De cognitione Dei et nostri*, p. 617

[245] See *Exercitatio* VIII: «cogitationis et picturae comparatio, ad melius intelligendum pro Dei existentia allatum argumentum utilis», *ibid*., p. 609.

[246] See Descartes's *Meditatio tertia*, AT VII, 37. On the use of the term in coeval philosophical tradition, see Savini 2004, pp. 170-181.

unexplained, even if Clauberg maintains Descartes's classification of ideas into fictitious, innate and sensory.

Clauberg's alternative in characterizing ideas is to describe them as definitions. The propositional nature of ideas is supported by Clauberg in reporting Descartes's argument for the existence of the idea of God. It can be acknowledged, indeed, by understanding the very definition of "God", which is not just an idea[247]. Actually, such a characterization does not add anything to our comprehension of the nature of ideas, stating only the linguistic meanings of words and sentences. This is confirmed by the identification of ideas with *themata*, or with whatever can be conceived by mind, following Descartes and the traditional logic. In *Logica vetus et nova* Clauberg states that the difference between the first and the second logical degree, or perception and judgement, matches the difference between simple and complex *themata*[248]. Complex *themata*, actually, are propositions[249]. Therefore, insofar as every simple *thema* can be rendered into a complex one, every idea is expressed by a definition. Such intersections of logic and metaphysics, again, do not put light on how ideas represent things. This is also the case with the epistemological considerations developed in physics. Clauberg's *Theoria corporum viventium* contains, as stated above, an overview of mental faculties. He defines the functions of the soul as thoughts (*cogitationes*), divided into actions and passions. Passions are perceptions or *conversiones mentis ab obiecto*, that is, modifications of the soul determined by a form or figure. Actions are wills, or *lationes animi ad obiectum*: «adeo ut voluntas latio quaedam animi esse videatur, tendens ad obiectum in idea propositum; perceptio autem quaedam eius figuratio vel in varias formas conversio, veniens ab obiecto»[250]. "*Obiectum*", "*idea*", "*figuratio*" and "*forma*" are the terms used by Clauberg to express what is involved in mental activities. Thus, the conceptual apparatus of Descartes's theory of knowledge is rendered by Clauberg into Scholastic terms. Eventually, these metaphysical insertions into logic and physics show that the justification of philosophical knowledge is provided by an appeal to the veracity of God rather than by a consideration of the actual ways in which ideas match things. Ultimately, the nature of ideas is considered insofar as it serves the demonstration of the

[247] «Addo, quod definitio rei nihil aliud sit, quam clara et distincta rei idea, ita ut, si omnia vocabula in definitione Dei adhibita sint intelligibilia, necessum sit, quid Deus sit, intelligi, Deus, aiunt, est maximum id, quod cogitari potest. Inde sic infero: ergo Deus cogitari potest, hoc est, Dei idea, sensu cartesiano, haberi potest», Clauberg 1691, *De cognitione Dei et nostri*, p. 604.
[248] Clauberg 1691, *Logica vetus et nova*, pp. 799-800.
[249] *Ibid*., p. 829.
[250] Clauberg 1691, *Physica*, p. 190.

existence of God.

In the same manner, the second demonstration of the existence of God is borrowed from Descartes's writings and is clarified through references to Scholastic philosophy. The proof is based on the experienced continuity of our existence, due to Divine conservative action[251]. According to Clauberg, since it is not possible to infer our persistence in being from our past existence, a conservative cause is to be postulated[252]. The demonstration relies on the principle of the successive nature of time and is supported by quotations from Samuel Desmarets's *Systema theologicum* (1645)[253], used to prove that time is experienced in the same way by men and angels. The reference confirms Clauberg's theological interests: he also demonstrates that we cannot be conserved by angels[254].

Finally, the third proof is explained by Clauberg in the light of his logic, stating that Descartes did not develop his *a priori* argument according to the canons of the *Topica* but from the intuition of the idea of God:

> ille canon logicus: quod convenit definitioni […] etiam convenit definito (v.g. Deo) […]. Quaeris, si canon ille definitionis […] cur eum non retinuit, cur alio potius loquendi modo, quam vulgato et communi usus fuit? Responsionem pete ex Logicae nostrae part. 2 quaest. 134. Voluit potius a notione prima naturae atque ideae, quam a notione secundae definitionis argumentum ducere; […] cartesiana maior clarius exponit quam definitionis canon […]. Hae et similes rationes fuerunt Cartesio, cur non uteretur topico isto canone[255].

The introduction of a logic guided by the criterion of clarity and distinctness supersedes the use of dialectic canons in philosophy. Indeed, in his *Logica vetus et nova* only the syllogistic theory of Aristotle's *Analytica* is accepted, whereas the dialectics of the *Topica* is not considered as being admitted by Descartes[256]. This acceptance is ultimately allowed by the propositional nature of ideas, which enables the inclusion of a proceeding based on the intuition of clear and distinct ideas into a

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[251] As *duratio* is existence, conservation and creation are the same thing: see Clauberg 1691, *De cognitione Dei et nostri*, pp. 645-646.

[252] *Ibid*., p. 636.

[253] *Ibid*., pp. 637. See S. Desmarets, *Collegium theologicum sive systema breve universae theologiae*, Groningen, ex officina J. Nicolai 1645, V, § 34; see 2nd ed. (Groningen, ex officina J. Nicolai 1649), pp. 97-98.

[254] «Quod difficilius sit aliena curare et conservare, quam propria et sua, unde sequitur, si anima mea non possit suas proprias cogitationes […] nec suum corpus […] conservare, tum nulla probabili ratione posse angelo tribui potentiam consevandi animam meam», Clauberg 1691, *De cognitione Dei et nostri*, p. 639.

[255] *Ibid*., p. 648.

[256] It is to be noted, however, that Clauberg himself refers to Aristotle's *Topica* in order to show the premises of Descartes's first proof: *supra*, n. 239.

demonstrative, syllogistic system. The use of the notion of *thema complexum*, in fact, is what allows such insertions of ideas into syllogisms. Since *themata* or ideas have a propositional nature, they can be combined in demonstrations. Descartes's third proof, indeed, is presented in a syllogistic form by Clauberg[257].

The demonstrations of the existence of God open two ways to ensure our knowledge. First of all, Clauberg supports an "ontological" criterion of truth, according to which an idea is more true insofar as it represents something more real than other beings, such as God is. If truth is a matter of correspondence between model and imitation, or between thing and idea, it is still maintained by Clauberg that truth is first of all in the model and by consequence in its ectype. *Veritas rei*, thus, is the condition of truth as correspondence[258]. Since it contains more perfection, the idea of God is the truest: moreover, the ideas of eternal essences are intrinsically truer than all the others. A traditional point that has its counterpart in Clauberg's theory of transcendentals, which is maintained by him in a Cartesian context[259]. The ultimate argument in the foundation, however, is that of *veracitas Dei*, confirming the validity of Descartes's criterion of truth (or evidence in perception) and to be defined as *veritas ethica*:

quoniam philosophaturus ante omnia certam habere debet hanc regulam: quicquid clare et distincte percipio, verum est. Haec autem e veracitate Dei eruitur et a priori demonstratur in metaphysica, licet etiam propriam mentis attendentis conscientiam testem suae certitudinis habeat. […] Quid intelligitur per Dei veracitatem? Resp. illa quae in scholis veritas ethica dicitur, et a logica nec non metaphysica et physica veritate distinguitur. Consistit autem in dictis, factis, promissis, signis aliis.[260]

This statement of God's truthfulness is to be related to the other proof of divine veracity: as *summum ens*, God is the most true being[261] and cannot deceive us. The ontological *veritas* of God

[257] «Sic proponi potest: quod continetur in idea seu conceptu, id ipsum de ea verum est. Atqui existentia necerssaria continetur in idea seu conceptu Dei, seu, necessitas existendi in Dei idea continetur. Ergo verum est Deum necessario existit. Maior probatur inductione […]», Clauberg 1691, *De cognitione Dei et nostri*, p. 647.

[258] In fact, *veritas rei* is the very correspondence of something with its own idea or definition: «quam ad rem observa, quod alii veritatem rei censent consistere in conformitate eiusdem cum sua idea, alii in convenientia cum sua definitione, ubi res eadem diversis tantum modis effertur», Clauberg 1691, *De cognitione Dei et nostri*, p. 648.

[259] «Per se esse manifestissimum, quod idea Dei mihi exhibeat omnem realitatem, est enim idea Dei, hoc est, entis perfectissimi sive realissimi […] exhibitio sive repreaesentatio. […] Et hinc sequitur, ideam Dei esse maxime vera, id est, maioris perfectionis, realitatis, veritatis, bonitatis repraesentatricem, quam ulla alia in mente nostra idea, cum nulla alia omnimodam nobis perfectionem repraesentet. […] Habent etiam realitatem aliae aliis maiorem: veritas enim, realitas, entitas, perfectio hoc loco idem revera sunt», *ibid*., p. 616.

[260] *Ibid*., p. 651.

[261] This is suggested by Clauberg in proving the ethical truthfulness of God, through a quotation from Descartes's

leads to His *veracitas*. That is, the divine attribute of perfection – or His very reality, goodness and unity – it the ultimate guarantee of the truth of our judgements. God is regarded as the most perfect being, thus as the first cause of things, of truth (as He is truth itself) and therefore as ethically trustworthy: these points are the very ground of every science.

A further point is to be stressed on Clauberg's *Exercitationes*. Even if primarily intended to ground physics, they are about topics belonging also to the other parts of philosophy. They focus on a broader scope of subjects: some considerations concern the demonstration of the immortality of the soul[262], the ethical problems related to Descartes's theory of passions (focusing mainly on wonder)[263] as well as the topic of body-mind relation studied in *Coniunctio*[264]. His *Exercitationes* are functional, ultimately, to the development of a Cartesian Scholastic, or a comprehensive system designed to replace the whole philosophical *curriculum* as the foundation of superior studies. Moreover, his *Exercitationes* reveal some intersections with the last part of philosophy. According to him, rational theology has to be developed as the concluding part of the system:

nam initio philosophiae non ulterius agitur de Deo, quam quatenus eius cognitio ad iacienda omnis scientiae humanae fundamenta desideratur. Sed in fine absoluta de Deo tractatio instituitur, omniaque eius attributa, quae ex naturae lumine cognosci queunt, expenduntur, quod initio necessarium non erat, quoniam non omnia Dei attributa se habent ut principia rerum creatarum, et quae huiusmodi relationem possunt recipere, non tamen absolute ideo aut plenius, quam originis illa relatio postulat, opus est explicare[265].

Clauberg will not develop such a complete rational theology. In fact, he will develop only a Cartesian ontology, or a branch of philosophy that replaces the old discipline μετά τα φυσικά. Such a discipline finds its systematization in Clauberg's renowned *ontosophia*, or the first attempt to develop a theory of being in a Cartesian context. *Ontosophia* is the crown of the system, or a metaphysics that can only be developed after the other disciplines have been established. It can gain the original place of metaphysics and, insofar as it is not designed to ground the knowledge of things as they are, it can deal with mere concepts besides the actual features of substances. It is a

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Secundae responsiones: «probatur […] a summi entis et non-entis oppositione. Resp. 2. p. 76. *Qui est summum ens, non potest non esse etiam summum bonum et verum, atque idcirco repugnat, ut quid ab eo sit quod positive tendat in falsum*», *ibid*., p. 652. See AT VII, p. 144.

[262] Clauberg 1691, *De cognitione Dei et nostri*, pp. 675-684.

[263] *Ibid*., pp. 722-735.

[264] *Ibid*., pp. 752-755.

[265] *Ibid*., p. 596. See Savini 2011, pp. 184-185.

replacement, thus, of the traditional *metaphysica*, and can be legitimately developed after physics. However, first philosophy, logic and ontology are ultimately interconnected.

2.6 The role of *ontosophia* in the system of sciences

Clauberg's metaphysics is to be evaluated in the light of the end of his system. That is, the study of *ens quatenus ens*, or a metaphysics that goes beyond Descartes's foundation of philosophy. "*metaphysica*" has in Clauberg's philosophy a double meaning. Besides being a *philosophia prima*, it is also a *philosophia universalis*, *ontosophia*, or the discipline concerning all the attributes of being, no matter if they are only our modes of thinking. It comes after first philosophy: however, like logic, it has some intersections with foundational theory. An examination of it can highlight the whole structure of Clauberg's system.

Ontosophia had three main editions[266]. Whereas the 1647 version precedes Clauberg's adoption of Cartesianism, the other editions contain Cartesian notions and omit some parts of the first edition (*Prolegomena*, *Didactica* and *Diacritica*), retaining only *Primae philosophiae elementa*[267]. Cartesian insertions can be noticed, for instance, in the definition of being as extended or immaterial substance, or in the note on the distinction between first philosophy, based on *cogito*, and *ontosophia*, based on the non-contradiction principle[268]. Even if Clauberg rejects Aristotle's ten categories as the principles of being, he still finds in the Scholastic tradition those concepts allowing the development of a science of being.

Clauberg proposes, in all the editions of *Ontosophia*, a threefold distinction of the meaning of "*ens*": *intelligibilis*, *realis* and *res*. His 1664 *Ontosophia* is mainly devoted to the properties of *ens* in the third meaning. However, as *philosophia prima* begins with the consideration of the mind, *ontosophia* begins with that of intelligible being[269]. *Ens*, in this meaning, cannot be opposed to

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[266] J. Clauberg, *Elementa philosophiae seu Ontosophia. Scientia prima, de iis quae Deo creaturisque suo modo communiter attribuuntur*, Groningen, typis Joannis Nicolai 1647; Clauberg 1660; *Metaphysica de ente, quae rectius Ontosophia*, Amsterdam, apud Danielem Elzevirium 1664.

[267] Clauberg 1647, pp. 37-102. See Savini 2011 p. 189.

[268] Clauberg 1691, *Metaphysica de ente*, pp. 283, 286 (references are to the third edition).

[269] *Ibid*., p. 283. According to Carraud, the Cartesian foundation of ontology relies on the identification of being with *ens cogitabile*: the Cartesian concept of *mens*, indeed, becomes central in the 1660 and 1664 editions. See V. Carraud, *L'ontologie peut-elle être cartésienne? L'exemple de L'*Ontosophia *de Clauberg, de 1647 à 1664: de l'*ens

anything: indeed, if intelligible being is opposed to a non-intelligible entity, this, in turn, will become intelligible[270]. The second meaning is *aliquid*, or whatever can have a formal being[271]. *Aliquid*, thus, can be opposed to *non ens* as whatever has no formal being[272]. *Non ens* can be, therefore, a sort of *ens* according to the first meaning: even if in this case it is only an *ens rationis*[273]. The third meaning of *ens* is a sub-class of the second one: it is substance as opposed to modes[274]. However, "*ens*" in third signification does not only mean mind and extension: it can also mean modes modified by other modes: that is, *modi mediati* and *immediati*[275]. Therefore, more than substances in a strict sense, *res* are substances or modes (*sensu cartesiano*) conceived as subjects of other modes. Rather than to Cartesian real substances, Clauberg seems to refer to the notions of *subiectum* and *adiunctum* as described by Franco Burgersdijk[276], which Clauberg himself counts among the relative attributes of being in his *Logica contracta* and in *Ontosophia*[277]. This

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à la mens, in Verbeek 1999, pp. 13-38.

[270] «Non posse quicquam opponi enti sive intelligibili, de quo in praesentia agimus, ne per mentis quidem fictionem. Nam si quid proprie ei opponi posset, id utique foret non ens sive non intelligible. At eo ipso quo non ens sive non intelligibile opponimus, hoc intelligimus, quia per intellectum ista fit oppositio. Ergo quod non intelligibile tunc dicitur in oratione, fit intelligibile in ratione, unde rationis ens nominatur», Clauberg 1691, *Metaphysica de ente*, pp. 283-284.

[271] «Aliquid igitur est, quod non tantum mente cogitatur vel cogitari potest, sed alio praeterea modo est aut certe esse potest: sive in mente, ut omnes cogitationes nostrae, sive in mundo», *ibid*., p. 285.

[272] «Nihilum, quod alicui generatim opponitur […] non ens appellatum, est quicquid nullum esse reale habet, hinc dicitur aliquid negativum et sua natura, hoc est, cum nulla accedit fictio, tantum negative, id est, per remotionem et absentiam entis animo concipitur, et negativo solum nomine dignum est», *ibid.*, p. 286.

[273] «Haec dicta sunt de nihilo sive non ente, quod enti in secunda significatione accepto contradictorie vel privative opponitur. Hoc vero non obstat, quo minus ipsum quoque nihilum in prima et generalissima significatione ens dici queat. Nempe omnis privatio et negatio, dum rationis nostrae obiectum est, utcunque proprium, hoc est, negativum tantum, de ea conceptum ratio formet, ens rationis dici potest», *ibid.*, pp. 288-289. *Entia rationis*, in fact, must be distinguished: as the fiction of a golden mountain does not imply contradiction, whereas that of square circle does (see *ibid*., p. 289).

[274] «Ens in significatione tertia acceptum propriissime quoque res dicitur […]. Vulgo quidem substantia, id est, rei quae ita existit, ut aliquo ad existendum subiecto non indigeat, opponitur accidens, quod in alio existit, tanquam in subiecto; sive, cuius esse est inesse. At non omnia, quae in substantia considerantur, accidentia […] dici debent; cum plurima sint entis attributa essentialia et inseparabilia, a quibus distinguuntur accidentalia […]. Et haec proprie modi appellantur, nempe modi rerum ipsarum, a quibus illae afficiuntur et variantur, ut pilei a suis formis», *ibid.*, p. 290.

[275] «Porro res cum opponitur modo […] non perpetuo significat substantiam; sed interdum etiam accidens, cui alius modus specialior additur, cuius intuitu prior modus tunc res appellatur. Hinc modi alii mediati, alii immediati perhibentur», *ibid*. As Clauberg's *Exercitationes de cognitione Dei et nostri* were published in 1656, well before the circulation of Spinoza's works, this expression cannot have been borrowed from them. An influence of Clauberg on Spinoza, on the other hand, is discussed in J. Lagrée, *Sens et vérité chez Clauberg et Spinoza*, «Philosophiques», 29, vol. I (2002), pp. 121-138. It concerns, however, biblical hermeneutics rather than ontology.

[276] See M. Karsksen, *Subject, Object and Substance in Burgersdijk's Logic*, in Bos-Krop 1993, pp. 29-36.

[277] «Essentiae nomine non intelligimus omnia quae rei insunt vel adsunt, sed primum et praecipuum aliquid in ea […]. Et quicquid praeter illam in re consideramus ut additum et, vel accedens vel accidens (quod neque consituit neque consequitur necessario essentiam, utpote inseparabilem cum ea nexum non habens) adiunctum vocamus», Clauberg 1691, *Metaphysica de ente*, pp. 334-335. See his *Logica contracta*, Clauberg 1691, p. 918.

categorization can be explained by recalling the proper place of Clauberg's *Ontosophia* in the system: its concepts are not designed to be employed in other disciplines but are the result of a speculation on being in its most abstract meanings. Such meanings, therefore, are not regarded as matching the actual features of extended and spiritual substances.

In his *Exercitationes*, moreover, Clauberg states that even if it is possible to find some attributes common to God and creatures[278], this does not justify ontosophia's status as *scientia*. In other words, even if *ontosophia* is the crown of his system, it is not grounded on first philosophy, since it does not deal with clear and distinct concepts:

> hactenus dicta eo faciunt, ut rerum omnium similitudo et convenientia quaedam agnoscatur: at si quis putet me existimare, illis ipsis satis esse probatum tradendam esse ontosophiam seu universalem […] scientiam, is a mente mea aberrat. […] Nam si conceptus illi quos habere potest mens nostra, a Deo et creatura quodammodo abstracti et utriusque conceptui communes, non sint satis clari et distincti, sed confusi nimis, et quae mentem veritatis studiosam non satis afficiant, multo minus impleant, dubitari sane cum ratione poterit, an pertineant ad scientiam, utpote quae obiectum requirit quod clare distincteque percipiatur[279].

Clauberg, however, sets aside the deeper consequences of Descartes's metaphysics for the theory of being. His *Ontosophia* has a heterogeneous composition, according to which a Cartesian distinction of being in extended and spiritual substance[280] is followed by a survey of its attributes given in traditional terms. As *ens* is first of all a concept or a second notion, *ontosophia* is first of all a study of concepts or *modi considerandi*. However, because it is not a foundational discipline, according to him it is still possible to pursue it as a branch of philosophy, or the "science" dealing only with abstract concepts. An evaluation of Clauberg's use of ontological concepts and of his definition of their status, however, reveals some other ambiguities in this architectonic of philosophy.

An emphasis on attributes of being reduced to mere concepts or *modi considerandi* can be found in different places of the treatise. Discussing real, modal and rational distinctions and the notions of identity and difference, Clauberg admits that

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[278] See *Exercitatio* LX: «Deum et creaturam habere aliquam in re similitudinem et convenientiam», Clauberg 1691, *De cognitione Dei et nostri*, p. 694.

[279] *Ibid*., p. 703.

[280] «Primaria igitur entis realis divisio est illa sine dubio, quae maxime opposita et contraria attributa (intellige positiva) in rebus divisis menti nostrae consideranda exhibet. Nulla autem realia attributa magis opponi sibi queant, quam ex una parte longum, latum et profundum esse […]; ex altera parte intelligere, velle, nolle et c.», Clauberg 1691, *Metaphysica de ente*, p. 291.

tota haec disputatio de eodem ac diverso potius ad modum cogitandi et loquendi pertinet, quam ad res ipsas in se spectatas. Quod nihil hic novi videri debet, cum similis aliorum generalium entis attributorum sit ratio.[281]

Moreover, in the dedicatory letter he states that he is speaking only about our ways of considering things, without clarifying, however, to what extent our abstraction of their attributes is legitimate[282]. Despite these remarks, there is a foundational reason for treating transcendentals as real attributes, in Clauberg's perspective: that is, to ground truth on the notion of God as the utmost being, whose archetypes are more real, true and good than any other created thing. The definition of God as ethically veracious, provided on the ground of divine perfection and goodness[283], is laid down in the light of the doctrine of transcendentals. The ontological proof of the existence of God has its counterpart in the consideration of being as perfect, true and good. Our thoughts, moreover, are true insofar as they imitate divine archetypes. The correspondence truth is based on the ontological truth, since our ideas of things are more true to the extent that they imitate the models present in the divine mind[284].

Clauberg's *Ontosophia* reveals, in sum, a problem intrinsic to Cartesianism: that of the adherence to classical metaphysics within a philosophy based on the *cogito*. A tension, therefore, is to be noticed in his metaphysics: between *philosophia prima* and *ontosophia*. Indeed, his metaphysics implies an overestimation of the ontological value of the attributes of being, accordingly of a foundation of truth on a theory deploying the notions of transcendentals. At the same time, it is stated that they are mere ways of considering substances. In any case, insofar as *unum*, *verum* and *bonum* are deemed as actual attributes of things, *ontosophia* seems to have a foundational value more consistent than that admitted by Clauberg himself.

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[281] *Ibid*., p. 331.

[282] «Generalissimos istos conceptus et terminos, uti vocant, ad certum prorsus numerum atque ordinem reduci non posse experiendo didici. Adeo transcendentia illa non solum connexa, verum etiam innexa sibi sunt. Quin imo nihil aliud sunt, quam diversi de re eadem cogitandi modi, qui, animo iam huc iam illuc se convertente, mille formis variari solent et possunt. Id quod hac editione tertia vel inprimis demonstrare studui», Clauberg 1691, *Metaphysica de ente*, *Lectori salutem*, p. 279 (unnumbered).

[283] *Supra*, n. 260-261.

[284] *Supra*, nn. 260-261.

2.7 A "threefold" foundation: logic, metaphysics and ontology

In conclusion, some words are to be devoted to the relations between logic, first philosophy and *ontosophia*, or the study of being[285]. In the first edition of his *Ontosophia*, before the conversion to Cartesianism, Clauberg states that logic has a priority in a didactic order, as it teaches how to use the intellect, whereas metaphysics (still identified with *ontosophia*, as Descartes's *philosophia prima* has not been yet received by him[286]) comes first in the natural order of the sciences, since it deals with the first genres of things[287]. Therefore, students are introduced to logic through some "anticipations" of metaphysical concepts[288]. In the following editions of Clauberg's *Ontosophia*, and along with the development of his more mature views, the plan of the disciplines changes. As a Cartesian *philosophia prima* is introduced, logic and *ontosophia* come after it. Logic is based on the evidence criterion prescribed by the method. It maintains, however, its instrumental role[289]: it teaches how to organize and interpret speech in the light of an adequate formation of concepts. Such a logic is implied by Descartes's metaphysics because it makes explicit the rules of reasoning underlying that part of philosophy[290]. Moreover, it shares with first philosophy its starting points, or the assumption of the evidence criterion and doubt[291]. If first philosophy discovers the first notions and truths, according to the evidence criterion, logic teaches, at least in principle, its proper method. It is, somehow, a corollary discipline of first philosophy. The natural order of disciplines outlined by Clauberg prescribes starting with first philosophy and to end, with the help of logic, in *ontosophia*, after all the other disciplines have been established: physics (the trunk of philosophy, also embodying foundational arguments), moral philosophy, medicine, politics, law, mechanics. In fact, their development is interconnected, since metaphysical considerations are implied both by

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[285] This topic is well considered in Savini 2011, pp. 44-69 (*Le rôle de la logique dans l'instauration de la metaphysique*, *La configuration du rapport entre logique et* ontosophia *dans la fondation de la métaphysique*) and pp.184-193 (*Philosophie première et ontologie*).

[286] Savini 2011, pp. 25-27, 44; see Clauberg 1647, p. 2.

[287] Clauberg 1647, pp. 33-34; see Savini 2011, pp. 64-65;

[288] Clauberg 1647, pp. 291, 309; see Savini 2011, pp. 54-55, 61-63.

[289] Clauberg 1691, *De cognitione Dei et nostri*, p. 592.

[290] This is stated in Clauberg's *Exercitationes de cognitione Dei et nostri*: «nuspiam apertius Cartesius est logicus, quam in libello de Passionibus animae; sed maxime etiam logicus est, ubi artem celat, ut in Meditationibus metaphysicis. Confer. Log. II. 14. […] Ad recte *definiendum* opus esse praemittere divisiones, sancit Logica I. 103. Id quod videmus factum esse ab auctore», Clauberg 1691, *De cognitione Dei et nostri*, p. 723. See Savini 2004, pp. 378-379.

[291] *Supra*, nn. 175, 188-189.

logic and ontology. Eventually, such interconnectedness of logical, metaphysical and ontological problems will be addressed by Johannes de Raey by proposing a simplification of the system of knowledge. In doing this, he aimed at defining the proper scope and the boundaries of Cartesian philosophy.

3. The logico-metaphysical foundation of physics of Johannes de Raey

3.1 Introduction

Whereas Regius provided his physics with a foundation on Revelation, and Clauberg aimed to develop a metaphysical, rational-theological foundation of all the academic disciplines – with relevant implications for logic and *ontosophia* –, Johannes de Raey (1620-1702) embraced a different foundational theory. Still assuming that metaphysics is the foundational theory, De Raey considered logic as metaphysics itself, aimed at showing how mind can reach philosophical knowledge, and what are the main concepts of philosophy. Moreover, De Raey considered as characterized by *scientia* or philosophical knowledge – besides such metaphysics or logic – only natural philosophy and mathematics, while leaving all the other academic disciplines outside the boundaries of philosophy.

Born in Wageningen in 1620, De Raey first studied at Utrecht University under the guidance of Henricus Regius, being the *respondens* of some of his theses on *Physiologia* in 1641. He then studied at the University of Leiden, where he graduated in arts and medicine with Adriaan Heereboord and Adolf Vorstius in 1647. In 1648 and 1649 he gave private lectures on Cartesian philosophy, which were attended by Johannes Clauberg, while in 1651 and 1652 he held a series of disputations *Ad Problemata Aristotelis*, later published in his *Clavis philosophiae naturalis* (1654)[292]. After having been appointed extraordinary and ordinary professor of philosophy at Leiden in 1653 and 1661, in 1669 he assumed the position of primary professor at the *Athenaeum Illustre* of Amsterdam, where he died in 1702. He thus witnessed the evolution of Cartesian philosophy during the greater part of the seventeenth century. At first, he defended Cartesian natural philosophy in his *Clavis philosophiae naturalis*, showing its agreement with what he thought to be

[292] J. de Raey, *Clavis philosophiae naturalis, seu introductio ad naturae contemplationem, aristotelico-cartesiana*, Leiden, ex officina Joannis et Danielis Elsevier 1654. Cf. his *Disputationes philosophicae ad Problemata Aristotelis*, Leiden, et e typographeo Francisci Hackii, ex officina Joannis Maire 1651-1652.

the original Aristotelian philosophy[293]. However, he did not limit himself to a defence of Cartesian physics by trying to convince his Aristotelian colleagues that there were no contradictions with Aristotle's philosophy. He also provided it with a foundation in several texts published in the second edition of his *Clavis* (1677)[294] and in his *Cogitata de interpretatione* (1692), aimed at justifying the reliability of Cartesian methodology and at defining its conceptual apparatus.

In this chapter I will highlight the foundational role of De Raey's logic. The topic has been barely discussed in the secondary literature on De Raey, which mainly concerns his early defence of Cartesianism[295]. Hence, this study will be a contribution to an unexamined topic. I will maintain that De Raey provided natural philosophy with a logical foundation, which was functional to avoid the misuses of Descartes's philosophy: namely, the rejection of Descartes's metaphysics, and the application of a philosophical canon to practical disciplines. Since De Raey considered the linguistic consequences of the missing foundation of Cartesian philosophy and of its application to every discipline, logic, as the science of signs, became the natural place to carry out such analysis and to provide philosophy with a foundation. De Raey developed his logical theory on the basis of Descartes's metaphysics, providing an analysis of language from a Cartesian point of view, that is by researching the actual meanings and references of words, in accordance with Descartes's dualistic worldview. Accordingly, he justified both the use of Cartesian notions, even those which do not match a mental content, and those employed in the disciplines *ad usum vitae*. In this way, De Raey provided a reflection on the actual practices of philosophers, scholars and practitioners, and set a foundation of philosophy which can be labelled as a meta-philosophy, or – *in nuce* – as a philosophy of science.

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[293] See A. Strazzoni, *La filosofia aristotelico-cartesiana di Johannes de Raey*, «Giornale critico della filosofia italiana» Settima serie – VII/1, 2011, pp. 107-132.

[294] J. de Raey, *Clavis philosophiae naturalis aristotelico-cartesiana. Editio secunda, aucta opuscolis philosophicis varii argumenti*, Amsterdam, apud Danielem Elsevirium 1677.

[295] See Ruestow 1973, pp. 61-72; P. Schuurman, *Ex naturæ lumine et Aristotele: Johannes de Raeys verdediging van de Cartesiaanse fysica*, «Algemeen Nederlands Tijdschrift voor Wijsbegeerte» 23 (2001), pp. 237-254; id., *De Raey, Johannes (1620-1702)*, in W. van Bunge, H. Krop, B. Leeuwenburgh, H. van Ruler, P. Schuurman, M. Wielema (eds.), *The Dictionary of Seventeenth and Eighteenth-Century Dutch Philosophers*, Bristol, Thoemmes Press 2003, vol. I, pp. 813-816; T. Verbeek, *Tradition and Novelty: Descartes and Some Cartesians*, in T. Sorell (ed.), *The Rise of Modern Philosophy: the Tension between the New and Traditional Philosophies from Machiavelli to Leibniz*, Oxford, Clarendon Press 1993, pp. 167-196.

3.2 The radical Cartesians

De Raey's logical foundation was functional in the sense that it discarded some interpretation of Descartes's philosophy, labelled today as "Radical Cartesianism"[296] and considered by De Raey as the misuse (*misbruyk*) of philosophy. In his *Cogitata de interpretatione* De Raey clearly defines the two main philosophical standpoints he was willing to refute, that is,, the rejection of Descartes's metaphysics, carried out by "*mali*" partly inspired by Hobbes's philosophy, and the application of a philosophical standard to practical disciplines, the endeavour of the "*boni*":

ut hic iterum vitanda duo extrema sint, in quorum unum vel alterum deflectunt non pauci Cartesii sectatores: siquidem mali, suo proprio vel Hobbesii errore seducti, prima philosophiae quam Cartesius tradidit, fundamenta evertunt, destruuntque communem inter homines sermonem. Boni philosophiae istius principiis sive fundamentis propriis aliena superstruunt, atque intellectum humani sermonis abstractum, quem admittunt, ut et illum nudum et simplicem, qui est proprius philosophiae, in communem vitam, in alias artes, et disciplinas, ipsamque theologiam intrudunt, quantum audent et possunt. Ac si unus et communis debeat omnium hominum sermo, unus et communis in sermone intellectus esse absolutam et intrinsecam veritatem comprehendens[297].

The identities of *mali* and *boni* can be unveiled through the texts published as an appendix of the *Cogitata de interpretatione*. In a letter to Christopher Wittich (1680), where De Raey outlines the emergence of his views on the limits of Cartesian philosophy from the 1660s[298], De Raey mentions

[296] On this categorization, according to which "Radical Cartesians" were, first of all, Meijer, Spinoza and Koerbagh, as these applied a method inspired by Descartes's to Biblical hermeneutics and politics, see J. Israel, *Radical Enlightenment. Philosophy and the Making of Modernity*, Oxford, Oxford University Press 2001; Tammy Nyden-Bullock, *Spinoza's Radical Cartesian Mind*, New York, Continuum 2007; W. Mijnhardt, *The Construction of Silence: Religious and Political Radicalism in Dutch History*, in Van Bunge 2003, pp. 231-262. On the other hand, Tad Schmaltz has labelled Pierre-Sylvain Régis and Robert Desgabets "Radical Cartesians" as some of their Cartesian standpoints undermined Cartesian philosophy itself. See T.M. Schmaltz, *Radical Cartesianism: The French Reception of Descartes*, Cambridge, Cambridge University Press 2002.

[297] J. de Raey, *Cogitata de interpretatione*, Amsterdam, apud Henricum Wetstenium 1692, p. 215.

[298] «Accessit occasio sive nova excitatio ultima, quando, circiter una cum Sylvio, Spinoza et cum ipso quoque Scripturae interpres coepit inclarescere, ut iam de pluribus aliis non dicam. […] In hisce ab initio cogitatis ultra annos circiter decem vel duodecim subsistebam in Academia Lugd. Batava. [...] Et sic denique ab anno 1669 in Illustri Athenaeo Amstelaedamensi, ea ipsa qua plus quam annos viginti, et privatim et publice, coeperam via, dum progredi conor continuo, ista quoque ultima in quibus subsistendum dixi cogitata magis elaborata, de interpretatione et natura humani sermonis in mentem venerunt», De Raey 1692, *Epistola ad Wittichium*, p. 660. On the development of De Raey's positions according to this letter, see T. Verbeek, *Les cartésiens face à Spinoza: le cas de Johannes de Raey*, in P. Cristofolini (ed.), *The Spinozistic Heresy. The debate on the Tractatus Theologico-Politicus, 1670-1677 and the immediate reception of Spinozism. Seminar Cortona 1991*, Amsterdam-Maarssen, APA-Holland University Press 1995, pp. 77-88. On De Raey's friendship with Wittich and Abraham Heidanus, see Strazzoni 2014a. In this letter De Raey states that he formulated his thoughts on the boundaries of philosophy in Leiden, therefore before he came to Amsterdam in 1669 and before the appearance of Spinoza's *Tractatus* (1670). This is the basis of Verbeek's claim that De Raey was referring to Spinoza's *Principia philosophiae cartesianae*

Franciscus Sylvius's mixing of philosophy and medicine[299] and the Cartesian exegesis of the Bible by Spinoza[300] and Lodewijk Meijer. In the same letter, the application of the philosophical standard to upper arts is criticized to Tobias Andreae, whereas he admired the distinction between philosophy and theology of Johannes Coccejus and Christopher Wittich[301]. In a second letter, addressed to an anonymous theologian and published in his *Cogitata*, besides blaming the use of philosophy in theology by Ludwig Wolzogen and Hermann Alexander Röell[302] (the former being a colleague of De Raey at the *Atheneum Illustre*, and the latter a professor at the University of Franeker, where Cartesianism became the philosophical background of theological teaching[303]), De Raey uses as his main polemical target Henricus Regius, considered to be the first misuser of Cartesian philosophy and forerunner of Spinoza[304].

(1663), viz. to the *Cogitata metaphysica*, involving a rational theology (see Verbeek 1995, p. 82). Moreover, both in the *Praefatio* and in the *Notae* to his *Cogitata* De Raey seems to refer to Spinoza's *Tractatus*, as he mentions two occasions in which Cartesianism had been misused: one approximately fifty years before 1692 – thus, in the early polemics over Cartesianism, such as those involving Regius –, the other, a bit more than twenty years before, hence, around 1670: De Raey 1692, *Notae*, p. 338 (quoted *infra*, n. 304). In the *Praefatio*, moreover, he explicitly refers to theology and law, and mentions the same years: De Raey 1692, *Praefatio*, p. IV.

299 «Franciscus Sylvius vocatur ad medicinam docendam in Academia Leidensi, atque conatur physicam scientiam miscere et confundere cum medica arte, confidenter docens tam in phyisica quam in medicina id omne quod vere scitur sola experientia sciri. Quo solo propria physici-philosophi cognitio secundum sublimiorem intellectum reiicitur, revocanturque omnia ad intellectum communem, qualis a natura iunctus cum sensu in omni homine invenitur, etiam absque philosophiae studio», De Raey 1692, *Epistola ad Wittichium*, p. 659-660. De Raey refers to the period of Sylvius's *Oratio inauguralis de hominis cognitione*, Leiden, ex officina Joannis Elsevier 1658.

300 Moreover, in 1685 De Raey attacked Spinoza in a disputation dedicated to the Cartesian critic of Spinoza Willem van Blijenbergh: see J. De Raey (*praeses*), J. Targier (*resp*.), *Miscellanea philosophica*, Amsterdam, apud Joannem Rieuwertsz 1685, *Praefatio*, quoted in D. van Miert, *Humanism in an Age of Science: The Amsterdam Athenaeum in the Golden Age*, Leiden, Brill 2009, pp. 271-272.

301 *Ibid*., p. 655. De Raey refers to Coccejus's treatment of doubt in theology as "*pestis*": see J. Cocceius, *Ad ultima Mosis, hoc est, sex postrema capita Deuteronomii considerationes*, Franeker, s.n. 1650, § 74. On Wittich's philosophy, see T. Verbeek, *Dutch Cartesian Philosophy*, in S.M. Nadler, *A Companion to Early Modern Philosophy*, Oxford, Blackwell 2002. On the Cartesio-coccejans, see W. J. van Asselt, *The Federal Theology of Johannes Cocceius: (1603-1669)*, Leiden, Brill 2001, pp. 77-81. In any case, according to De Raey Wittich did not pay due attention to the abuses of Cartesianism: see De Raey 1692*, Epistola familiaris altera*, p. 667.

302 De Raey 1692, *Epistola familiaris altera*, pp. 664-665. De Raey mentions H.A. Roëll (*praeses*), D. Brouwer (*resp*.), *Disputatio philosophica de principio veritatis cognoscendae*, Franeker, apud Johannem Gyselaar 1686, § XII, and L. Wolzogen, *De Scripturarum interprete adversus exercitatorem paradoxum libri duo*, Utrecht, apud Johannem Ribbium 1668, § IX. The unknown theologian is identified by C.L. Thijssen-Schoute as Gisbertus Wesselus Duker (see Thijssen-Schoute 1954, pp. 131-132). Verbeek and J. van Sluis identify him as Melchior Leidekker: see Verbeek 1995, p. 130, n. 146; J. van Sluis, *Hermann Alexander Röell*, Diss. R. U. Groningen, Leeuwarden, Friske Akademy 1988, p. 78.

303 See R. Bordoli, *Dio ragione verità. Le polemiche su Descartes e su Spinoza presso l'Università di Franeker*, Macerata, Quodlibet 2009.

304 «Dixi et inculcavi ab initio muneris academici, […] facilius cum Voetio quam cum Regio redibimus in gratiam. Quam verus in eo vates fuerim, experientia coepit longo tempore docere. Regius in corrumpenda philosophia antecessor fuit, Spinozae etc. a quorum ille erroribus infandis alienus non erat», De Raey 1692, *Epistola ad theologum qui latere voluit*, p. 666. Regius is referred to also in the *Notae* to De Raey's *Cogitata*, as De Raey mentions the emergence of a radical Cartesianism approximately fifty years before 1692, which led to harsher

Even if not openly mentioned by De Raey, a further name can be added to the misusers of Cartesianism: that is, Lambertus van Velthuysen, who is probably referred to in the *Praefatio* to the *Cogitata*, where De Raey says a radical philosophy inspired by Descartes and Hobbes appeared in a period starting fifty years before the publication of the *Cogitata*[305]. If the main target is still Regius Regius, who claimed that soul can be a modification of the body and who embraced a crypto-materialist position, the main purporter of Hobbes's ideas in the Netherlands was Van Velthuysen, who published a defence of Hobbes's *De cive* (1651) and provided a combination of Descartes's and Hobbes's philosophy in a disputation *De finito et infinito* (1651)[306]. Van Velthuysen also outlined a biblical hermeneutics on a philosophical basis in an anonymous text that appeared in 1655[307], as well as in his *Dissertatio de usu rationis in theologia* (1668), which may be considered as the cause of De Raey formulating his thought on the boundaries of philosophy in his Leiden years[308].

Finally, Clauberg must be added to such a categorization of *boni* and *mali*. In his first letter, indeed, De Raey mentions Clauberg's improper mix of Cartesian and Aristotelian methodologies in

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polemics in the 1670s: «neque enim uno in loco dicere satis est de errore, qui semper idem saepius recurrit et renascitur hydrae instar; postquam ab annis plus minus quinquaginta, primum quidem occulte atque inconsiderate sensim sine sensu, paucorum, his vero proxime labentibus annis plus quam viginti, quia commentum pluribus lacuit, etiam plurimorum caepit animos et linguas et calamos occupare», De Raey 1692, *Notae*, p. 338

305 «Qui hac tandem forma in lucem prodit commentarius de natura et recto usu humani sermonis omnisque in eo verae interpretationis, non uno loco libera quoque cogitata comprehendit de remedio erroris, qui ab annis potissimum quiquaginta eruditorum coepit animos occupare, eorum prae caeteris qui ex parte sunt, ex parte videri volunt novi philosophi tum Cartesii galli, tum Hobbesii angli sectatores», De Raey 1692, *Praefatio*, p. I (unnumbered).

306 L. van Velthuysen, *Epistolica Dissertatio de principiis iusti et decori, continens apologiam pro tractatu clarissimi Hobbaei De Cive*, Amsterdam, apud Ludovicum Elzevirium 1651, recently edited and translated by M. de Mowbray: L. van Velthuysen, *A Letter on the Principles of Justness and Decency, Containing a Defence of the Treatise De Cive of the Learned Mr Hobbes*, Leiden, Brill 2013. L. van Velthuysen, *Disputatio de finito et infinito, in qua defenditur sententia clarissimi Cartesii, De Motu, Spatio et Corpore*, Amsterdam, apud Ludovicum Elzevirium 1651. On the reception of Hobbes in the Low Countries, see C. Sécretan, *La réception de Hobbes aux Pays Bas*, «Studia Spinozana» 3 (1987), pp. 27-46, Van Bunge 2001, pp. 75-119, H. Krop, *Spinoza and the Calvinistic Cartesianism of Lambertus van Velthuysen*, «Studia Spinozana» 15 (1999), pp. 107-132.

307 L. van Velthuysen, *Bewys dat het gevoelen van die genen, die leeren der sonne stilstandt en des aertrycks beweging niet strydich is met Godts-Woort*, s.l (Utrecht), D. van Ackersdijck & G. van Zijll, 1655. In 1656, Wittich asked De Raey to present to Van Velthuysen his *De stylo scripturae* (1656): see the letter of Wittich to Van Velthuysen of 28 February 1656 (Leiden University Library, Bibliotheca Publica Latina 750), quoted in R. Vermij, *The Calvinist Copernicans. The Reception of the New Astronomy in the Dutch Republic, 1575-1750*, Amsterdam, Royal Netherlands Academy of Arts and Sciences 2002, pp. 185-186.

308 *Supra*, n. 298. Van Velthuysen would later criticize Spinoza in an analysis of his *Tractatus* sent to Spinoza by the Rotterdam Collegiant Jacob Ostens (1671), and in two treatises published in his *Opera omnia*: *Tractatus de cultu naturali* and *Tractatus de Articulis Fidei fundamentalibus*, in L. van Velthuysen, *Opera omnia*, Rotterdam, typis Reineri Leers 1680. On Van Velthuysen and Spinoza, see W. van Bunge, *Van Velthuysen, Batelier and Bredenburg on Spinoza's Interpretation of the Scriptures*, in Cristofolini 1995, pp. 49-65; H. Krop, *Spinoza and the Calvinistic Cartesianism of Lambertus van Velthuysen*, «Studia Spinozana» 15 (1999), pp. 107-132.

his *Logica vetus et nova* (1654), combining old and new notions and giving rise to a confusion of worldviews. Clauberg's attempt to provide a comprehensive Cartesian curriculum of studies, while legitimate in principle, is rejected by De Raey as not carefully dealing with the philosophical assumptions of Cartesian philosophy[309].

The targets, then, of De Raey's foundational theories are the "radical Cartesians" Regius, Van Velthuysen, Meijer and Spinoza, who can be labelled the *mali*, the Cartesian theologians Andreae, Röell and Wolzoguen, who used Cartesianism in theology *bona fide*[310], and Clauberg, who misunderstood the differences between Aristotelian and Cartesian methodologies and ways of understanding. Moreover, De Raey considers the dissemination of Thomas Hobbes's theories as leading to a misuse of philosophy. The most dangerous consequence of Radical Cartesianism disclosed by De Raey through his linguistic analysis is, indeed, the adoption of a materialist ontology, entailed by both the misinterpretations of Descartes's thought – as by Regius – and Hobbes's theses. Besides being philosophically untenable, materialism does not allow to account for our linguistic practices and it makes everyday speech senseless, as one has to use a terminology often referring to sensory data and mere concepts rather than to real modifications of bodily substance. Actually, this is not only the result of the rejection of Descartes's metaphysics, but also the consequence of the application of a philosophical standard to practical disciplines, as to comply with such a standard one should avoid to refer to subjective qualities or mere mental contents. The two main kinds of misuse of Cartesianism, therefore, result in a corruption of speech[311]. Therefore, De Raey would provide with a foundation both the philosophical and the commonsensical, "vulgar"

[309] «[…] neque me neque alios sentiebam sine logicae cognitione, commode posse docendi munere fungi. […] Editur in lucem Logica Claubergii. Hanc tracto et praelego in scholis privatis, at sine eo, quem desiderabam, successu. Inquiro causam atque […] intelligo, omnem in his errorem omnemque de arte logica, an necessaria sit, dubitationem confusionemque in eruditorum cogitatis, quae tot malorum in studiis causa fuit, ex hoc uno procedere quod non intellexerint duplicem posse ac debere logicam esse, sicut ostendimus, quod in uno homine possit duplex intellectus esse», De Raey 1692, *Epistola ad Wittichium* pp. 658-659.

[310] In 1689 De Raey denounced the abuse of philosophy in a pamphlet written with Wolzogen himself and the Coccejo-Cartesian Gerbrandus van Leeuwen: *Copie van de acte van de heeren professoren der Illustre Schoole tot Amsterdam, J. de Raei, L. Wolzogue, en G. van Leeuwen, in dato den 6 October 1689, tegen het misbruyk der philosophie*, Amsterdam, s.n. 1689. Also De Raey was friend of Andreae: see Strazzoni 2014a.

[311] «Adeo rarum et difficile est sobrie et modeste philosophari, intra certos se terminos continere, scientiarum fines vocabulorumque definitas significationes loco non movere, atque ulterius non provehere, neque etiam magis in arctum cogere quam id recta ratio atque usus in humana vita permittit. [...] Tam hi cartesianam, ut vocant, philosophiam corrumpunt et coeperunt corrumpere a multis annis, ut iam de corruptela, quae hinc sequitur, aliarum disciplinarum non dicam quam isti a multis seculis corruperunt aristotelicam, et fere inutilem in aliis disciplinis reddiderunt figmentis atque additamentis suis. Sicut his quoque temporibus fere inutilis et plena periculi suo insigini abusu facta est magni usus philosophia, quam ab autore cartesianam appellant, cuius fines dum conantur sine fine extendere, novis additamentis fundamenta bene posita evertunt atque nae [sic] intelligendo faciunt tandem, ut nihil intelligant», De Raey 1692, pp. 208-209.

meanings of words, which reflect a dichotomy between Cartesian and Aristotelian worldviews.

3.3 Philosophical and vulgar knowledge

De Raey assesses the distinction between philosophical and commonsensical or vulgar knowledge in his early *Dissertatio de cognitione vulgari et philosophica* (1651), the prologue to his *Disputationes ad Problemata Aristotelis* and *Clavis*. This text is devoted to showing the errors characterizing the commonsensical way of understanding nature, based on sensory experience, memory, imagination[312]. According to De Raey, Scholastic philosophy reflects such "understanding" of natural phenomena as it ascribes visible effects of bodies to occult qualities[313], whereas philosophical knowledge (*scientia*) is based on concepts graspable by intellect alone, namely, the *praecognita* or common notions and axioms matching the first causes of observable phenomena[314]. The *praecognita* of physics are the notions of extended matter, of the origin and the principles of motion, and of subtle matter[315]. According to De Raey, such *praecognita* can also be found in Aristotle's philosophy, and allow the explanation of all observable phenomena. Yet, while identifying the origin of motion in God and claiming that divine constancy accounts for the conservation, inertia and the straight propagation of movement, as well as for Descartes's rules of impact[316], in his *Clavis* De Raey does not develop a comprehensive metaphysics. It is likely that this was a measure to avoid any controversy on the new philosophy, as De Raey aimed at showing its concordance with Aristotelian philosophy, and complied with a 1648 prohibition by the Curators

[312] «Plurima eorum quae cognoscit sapiens cunctis mortalibus communia sunt, ac iis etiam obvia, qui vel mente capti, vel barbari, vel […] in sapientiae studio exercitati non sunt […]. Talisque maximam partem est omnis ea vulgi notitia, quae sensuum experimentis primam originem, memoriae conservationem, imaginationi ac discursui ab uno ad aliud, perfectionem atque incrementum debet», De Raey 1654, *Dissertatio de subsidiis, gradibus ac vitiis notitiae vulgaris*, p. 8. First edition as J. De Raei, *Oratio inauguralis de gradibus et vitiis notitiae vulgaris circa contemplat. naturae et officio philosophi circa eandem*, Leiden, F. Hack, 1651.

[313] De Raey 1654, *Dissertatio de subsidiis, gradibus ac vitiis notitiae vulgaris*, pp. 18-19.

[314] These are evident as the truths of mathematics, the principles of metaphysics (as "nihili nullae sunt affectiones"), and those concernign immaterial entities. See De Raey 1654, pp. 36-37. See also p. 41: «quantum denique ad corporum naturalium, quae physica considerat, scientiam, ad eam imprimis opus est praecognitis […]. At vera et prima axiomatum seu notionum communium, unde solidior, certior ac profundior naturae contemplatio pendet, evidentia ac demonstratio, non ab externo sensuum sed ab interno solius mentis lumine est petenda, quia, haud secus atque axiomata multa mathematica, […] fugiunt omnem sensum».

[315] For a more detailed overview, see Schuurman 2001, Strazzoni 2011. The concordance between Descartes and Aristotle is also claimed by De Raey in his *De Aristotele et Aristotelicis* (1669), published in the second edition of his *Clavis* (pp. 201-236) and in the *Cogitata* (pp. 453-489).

[316] De Raey 1654, pp. 100, 106-107, 111-120.

of Leiden University to teach Cartesian metaphysics[317]. Therefore, in his *Clavis* De Raey does not provide a Cartesian foundation for the reliability of *praecognita*. In fact, the only foundation is provided by Aristotelian arguments, that is, by claiming that such *praecognita* are evident to anyone provided with a healthy mind, in accordance with Aristotle's *Analytica posteriora* and *Topica*. Thus, De Raey's Cartesian *praecognita* can become the principles for demonstrative knowledge[318].

De Raey became interested in the foundation of the principles of physics in the 1660s, when he came to be fully aware of the fundamental difference between practical and philosophical knowledge, as it is clarified in his *De constitutione logicae and De constitutione physicae* (1668)[319]. Such a difference depends on the difficulty of applying Descartes's method to medicine, law and theology, whose objects are complex and impossible to grasp with clarity and distinction, being thus beyond the capacities of mental faculties[320]. For this reason, practical knowledge ascertains the observable connections among phenomena and is based on experience, opinion and authority, as well as on imagination and witnesses[321], whereas natural philosophy concerns intelligible causes[322] and deals with certain and evident knowledge, that is, *scientia*[323].

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[317] See P.C. Molhuysen (ed.), *Bronnen tot de Geschiednis der Leidsche Universiteit 1574-1811*, 's-Gravenhage, M. Nijhoff 1913-1924, vol. III (1918), p. 11.

[318] De Raey 1654, pp. 37-38, referring to Aristotle, *Analytica posteriora* I, 10, 76b, 10-14, and *Topica*, VI, 4, 141b, 7-13.

[319] These texts were published as disputations in 1668, included in his 1677 *Clavis* (pp. 707-721), repeated as a speech in 1684 and finally printed in his *Cogitata* (pp. 596-618).

[320] «In medicina, iurisprudentia ac theologia adeo insignis et facilis usus logicae his quatuor regulis comprehensae non est: verum rarus ac difficilis, ut vix dici possit in iis locum habere. Et recte Arist. adevrtit, τὸ άκριβὲς mathematicum non esse pariter in omnibus spectandum. Quod maxime verum est de regulis istis, quatenus unice comprehendunt omnem άκρίβειαν quae locum potest in usu rationis habere. Primum enim hae tres disciplinae, non ut mathematicae scientiae, circa simplicia et cognitu facilia versantur, verum circa valde composita et magis difficilia, quae non ita possumus clare, distincte ac singula seorsim, certo semper ordine cognoscere, ut nihil omitti certi simus; verum saepe plura simul confuse ac sine ordine spectanda sunt, et multa omittenda quoque», De Raey 1692, *De constitutione logicae*, p. 600.

[321] *Ibid*., pp. 600, 605-606.

[322] «In artibus invenitur causarum cognitio et effectuum per causas [...] nititur observatione connexionis sive coniunctionis, quae ab una parte causa, ab alia effectus notionem atque nominationem parit. *Id quo tangente fit quo separato cessat effectus, rei causam nominamus,* in medicina inquit Galenus. Haec solum notio causae ad communem sensum accomodata in omni arte supponitur. Ut necesse non sit artis exercitationem et propriam cognitionem quod attinet, distincte er clare intelligere, qua virtute agat causa et effectum producat, sicut in scientia physica id diximus necessarium esse. […] Quamquam illa cognitio multum possit in vera scientia prodesse, quae cognitio intellectualis per causam est, in omnibus valde diversa ab ea cognitione quam a sensu habemus, in multis, ut videtur, etiam contraria. Ex quo perspicue sequitur artes omnes (quarum genitrix debet esse partim nostra propria, partim aliorum experientia) medicinam, agriculturam, fabrilem etc. separatas esse a philosophica scientia natura sua sive secundum naturam cognitionis humanae (quod notandum) ut non possint unquam ex natura sua pars quaedam physicae sive philosophicae naturalis scientiae esse», De Raey 1692, *De consitutione physicae*, pp. 616-617. See Galen, *De Locis Affectis*, I 2 (cf. Galen, *Opera Omnia*, ed. by C.G. Kühn Leipzig, C. Cnobloch 1821-1833, vol. 8, p. 32)

[323] «Physica scientia dicitur, quatenus certa et evidens per naturae lumen notitia est, sive per causam et

Moreover, arts concern sensible bodies[324] and have a practical purpose. Therefore, in such fields one has to study phenomena *relate ad nos* instead of grasping their "objective" nature[325]. Medicine, for instance, has to be based on a natural history cleared of the main errors of Scholastic physics, but is still based on the use of the senses, and law and theology can still be based on Scholastic moral philosophy and metaphysics[326]. In the *Praefatio* to his *Cogitata* De Raey criticizes the application of a philosophical canon to medicine, the progress of which does not depend on the acknowledgment of the first constitution of human body[327]. Besides Sylvius, De Raey seems to criticize Theodoor Craanen's attempt to develop a medicine based on the notions of subtle matter, pores and fermentation as explanatory principles[328], and on the medical practices of Regius, who had been Craanen's mentor at Utrecht University[329] and whose physiology was partially based on the insensible, mechanical features of bodies[330].

In his *De constitutione logicae* and *De constitutione physicae* De Raey shows his first concern

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demonstrationem, sive alio quocunque modo comparata», De Raey 1692, *De constitutione physicae*, p. 609.

[324] *Ibid*. pp. 608-609.

[325] De Raey 1692, *De constitutione logicae*, p. 596. This thesis is also maintained in his *De cognitione vulgari*: see De Raey 1654, *Dissertatio de subsidiis, gradibus ac vitiis notitiae vulgaris*, p. 24.

[326] De Raey 1692, *De constitutione logicae*, pp. 605-606. See also his *De Aristotele et aristotelicis*, De Raey 1692, pp. 478-479, and his *Cogitata*: «verbo monemus medicinam cum physica (de qua diximus) iurisprudentiam cum ethica et politica, theologiam cum metaphysica atque ethica, saltem in aliquibus videri aliquam cognationem habere. Praterquam quod hae tres disciplinae, quatenus ad usum vitae referuntur pariter habeant cognationem cum illo communi sensu et qualicunque intellectu, quem in vita et rebus agendis extra atque citra omnem philosophiam communiter omnes homines sequuntur», De Raey 1692, *Cogitata de interpretatione*, pp. 11-12. On De Raey's emendation of Aristotelian physics, in order to make it a natural history capable to lead medicine to consistent progresses, see Strazzoni 2012, pp. 262-264.

[327] «Hoc ipsum dicere voluit Hippocrates, quando defendit veterem medicinam, quae, uti tot saeculis sine hac nova in diverso genere cognitionis potuit subsistere progressione, ita debet natura sua (sive secundum naturam et conditionem cognitionis humanae communis) porro subsistere, fallunturque et fallunt Hippocratis iudicio qui aliter hic sentiunt, vocanturque sophistae. Medici, dicit divinus Senex, quidam et sophistae fieri non posse dicunt ut quis artem medicam cognoscat, nisi idem noverit, quid sit homo et quaenam eius prima generatio et compositio. Ac si horum quoque temporum philosophos et medicos sophistas describeret in hoc ipso errore haerentes» De Raey 1692, *Praefatio*, pp. III-IV (unnumbered).

[328] See *infra*, chapter V.

[329] Craanen's theories are presented in his *Oeconomia animalis in duas partes distributa. Nec non Oeconomiae animalis ad circulationem sanguinis et chyli dispositae, brevis delineatio*, Gouda, ex officina Guilhelmi vander Hoeve 1685; *Lumen rationale medicum, hoc est Praxis medica reformata sive Annotationes in praxin Henrici Regii*, Middelburg, apud Johannem de Reede 1686; *Tractatus physico-medicus de homine, in quo status eius tam naturali, quam praeternaturalis, quoad theoriam rationalem mechanice demonstratu*r, Leiden, apud Petrum vander Aa 1689; *Observationes, quibus emendatur & illustratur Henrici Regii Praxis medica, medicationum exemplis demonstrata*, Leiden, apud Petrum Vander Aa 1689. On him, see A. M. Luyendijk-Elshout, *Oeconomia Animalis, Pores and Particles*, in Th. H. Lunsingh Scheurleer, G. H. M. Postumus Meyjes (eds.), *Leiden University in the Seventeenth Century, An Exchange of Learning*, Leiden, Universitaire Pers Leiden/E. J. Brill 1975, pp. 294-307; H. Krop, *Medicine and Philosophy in Leiden around 1700: Continuity or Rupture?*, in W. van Bunge (ed.), *The Early Enlightenment in the Dutch Republic, 1650-1750*, Leiden-Boston, Brill 2003, pp. 173-196.

[330] This is stated in the first of his 1641 disputations on physiology, where De Raey acted as *respondens*: *De Sanitate*, in Bos 2002, pp. 199-202. On Regius's account of "*partes insensibiles*", see Verbeek 2000.

with the problem of the foundation, which he would elaborate upon in the later texts. His foundation was brought about by a reflection on the method and the concepts of philosophy. Whereas Clauberg proposed a project for a renewal of all philosophy based on a Cartesian methodology, De Raey's foundation is a reflection on the actual practices of philosophers and practitioners, whose work and progresses would be endangered by an application of a Cartesian methodology to their field. De Raey's logic, therefore, can be considered a meta-science, providing the other disciplines both with a justification of their status and a prescription of their methods and aims.

3.4 The task of logic

De Raey explains what he means by "*logica*" in the *De constitutione logicae*. According to this text, logic consists, first of all, in the four Cartesian rules of method: these can be easily used in mathematics, whose objects are simple[331]. However, in addition to these four rules a *scientia logica* is needed in order to apply them to physics, a field obscured by prejudices which need to be wiped out by logic itself[332]. As for Clauberg, thus, logic is a *medicina mentis*[333]. Moreover, it is meant to

[331] «Logica philosophiae propria, quam etiam philosophicam vocamus, imprimis quatuor potest regulis comprehendi. Quae quo breviores et pauciores, eo magis ad rectum, quem philosophia quaerit, rationis usum accomodatae sunt. Et praeter regulas has, quarum exercitatio artem parit, adhuc logicam scientiam requirimus. Regulas quod attinet, eas ispsismet authoris verbis tradimus, ex Dissertatione de methodo. […] Quae totidem verae ac perfectissimae scientiae conditiones sunt. Deinde hae adeo breves atque tam paucae regulae imprimis insignem ac facilem usum habent in mathematicis disciplinis; quatenus circa res simplicissimas ac cognitu facillimas versantur, atque verae ac proprie dictae scientiae sunt, quarum finis in contemplatione veritatis consistit. Neque alia logica […] in mathematicis scientiis opus est: et in ipsis quoque primus et maxime facilis harum regularum usus est», De Raey 1692, *De constitutione logicae*, pp. 598-599.

[332] «Denique Philosophiam quod attinet, et physicam imprimis quae praecipua philosophiae pars est, in ea hae regulae maiorem difficultatem habent, quam in mathematicis scientiis; quia circa ea versatur physica ac tota Philosophia, quae instar eorum quae mathematici tractant, simplicia et cognitu facilia non sunt, sed composita et difficilia. Quorum notitia idcirco, non videtur posse certitudinem et evidentiam habere, quae in mathematicis demonstrationibus est. […] Haec difficultas ut superetur, quantum potest superari, praeter regulas logicas, logicam scientiam requirimus de principiis cognitionis humanae, quae prima scientia, in philosophia summe necessaria sit», *ibid.*, pp. 600-601. Later on he adds: «ut autem sit vera scientia, quantum potest, non sufficere regulas logicas, sed logicam diximus scientiam requiri. Atque eam ostendimus Platonis dialecticam esse, quae seposito sensu, sublata suppositione, et omissa fide, ad primas simplicissimasque veritates adscendit. Atque hae demum verae suppositiones in physica sunt, secundum quas facienda ratiocinatio est, ut vera scientia sit», *ibid*., p. 606.

[333] De Raey writes: «logica philosophica emendat rationem et orationem […] quatenus verbis alligamus omnia iudicia», *ibid.*, p. 597. It is interesting to note that the topic of *repurgatio intellectus* as well as the reference to the language as vehicle of error is present only in the edition of his *De constitutione logicae* appeared in 1692.

be a science and a way to science at once («scientia» and «modus sciendi»[334]) and the leading part of philosophy, «imperans ac praescribens obiectum suum, suo modo domina et architectonica»: that is, a *philosophia prima*[335]. Hence, it is to be defined as metaphysics itself[336], and is paired with Plato's dialectics[337], as it considers the first causes and principles[338] and does not work but by immediate intuition, whereas even mathematics relies on suppositions and long chains of deductions[339]. Whereas Clauberg distinguished logic from metaphysics, at least in principle, De Raey considers metaphysics as logic itself.

After his *De constitutione logicae,* which is, according to its name, a programmatic text, De Raey develops his metaphysics in a more consistent manner in his *Pro vera metaphysica, quae de principiis humanae cognitionis tractat*, included in the second edition of his *Clavis* (1677). In this texts he deals with the very contents and proceeding of logic or metaphysics. According to him, it consists of two parts. The first concerns the foundation of human knowledge through Descartes's metaphysics, that is, the demonstration of the reliability of evidence as the criterion of truth, and of the existence of God. The second is a careful analysis of our concepts, *summa rerum genera*, which was not fully carried out by Descartes and which is the main issue of De Raey, examined by him through linguistic considerations mainly in his *Cogitata de interpretatione*. The two parts of logic are naturally connected, since the analysis of concepts and language is carried out from the point of view of Descartes's metaphysics, which is completed by De Raey through a full analysis of the contents of the mind, i.e., of the meanings of everyday and philosophical terminology. According to De Raey, therefore, logic first has to study what is found in the intellect, such as the idea of God and other innate notions, to be considered as the first principles and causes. Hence, it serves to analyse all the concepts we deal with, and to justify their reliability.

The first part of De Raey's foundation begins with the Cartesian path of the *cogito*, proceeding by doubt, up until the demonstration of the existence of God as the guarantee for the

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[334] De Raey 1692, *De constitutione logicae*, p. 601.
[335] *Ibid*.
[336] «Qua ratione logica verae philosophiae propria […] ut potest scientia cum vera metaphysica esse», *ibid*. De Raey was not the first to underline the coincidence of logic and metaphysics. This is the case, for instance, with Maccovius, whose assessment of the close link between the two disciplines was recognized in Heereboord's preface to his *Metaphysica.* Heereboord, in turn, was De Raey's teacher in Leiden. See J. Maccovius, *Metaphysica ad usum quaestionum in philosophia ac theologia adornata et applicata. Tertium edita et explicata, vindicata, refutata, per Adrianum Heereboord*, Leiden, ex officina Francisci Hackii 1658 (1st ed. 1645), *Praefatio*, pp. II-IV.
[337] De Raey 1692, *De constitutione logicae*, pp. 602-603.
[338] *Ibid*., p. 602.
[339] *Ibid*., p. 605.

truth of our knowledge. Doubt enables a *repurgatio intellectus* against prejudices, anticipations, sensory notions and doubts, and allows us to do philosophy in an orderly way[340]. After doubt has prepared our mind, we can start to analyse its contents: first of all, the mind is aware of itself and of its being a thinking thing, whereas it is not immediately conscious of the existence of the body: in this way, the distinction of mind and body, and of mind and other incorporeal entities is demonstrated[341]. In strict accordance with Descartes's metaphysics, thus, the mind discovers in itself the presence of ideas, and, from the idea of God, one can demonstrate His existence according to the *a priori* and *a posteriori* proofs[342], to which the third proof, based on our very existence, which had to be provided by something different from ourselves, is added[343]. Eventually, the demonstration of the existence of God and the consequent acknowledgment of His attributes as the perfect being allow De Raey to ground the truth of clear and distinct knowledge on a Cartesian, metaphysical basis, since God is defined as *dator luminis* and the source of every knowledge[344], or the cause of whatever clear and distinct ideas we can find in our perceptions[345]. Given this first, metaphysical basis of the truth of our knowledge, one needs, in accordance with the program set forth by De Raey in his *De constitutione logicae*, to analyse the very contents of our mind in order to distinguish obscure from clear notions, this being the main task of the *scientia logica*, i.e., of the *vera metaphysica*[346].

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[340] «Praemittit primum praeparationem quandam humani intellectus, ut tam sublimis cognitionis capax sit. […] Consistit ea praeparatio in dubitatione, quae quasi mortificatio quaedam veteris hominis est, aut si mavis corruptae rationis repurgatio. Cuius immensa, quoad veritatis contemplationem, est utilitas, et tanta necessitas, ut sine ea nulla esse possit vera philosophia. […] Imprimis enim ab omnibus praeiudiciis nos liberat, atque adeo non solum praecipitantiam, verum etiam anticipationem in iudiciis nostris vitare […] docet. […] Deinde via facillimam sternit ad mentem a sensibus abducendam, quod tam ad rerum materialium ac sensibilium, quam ad mentis ac Dei cognitionem, et universim ad omnem rerum scientiam necessarium est: quatenus evidentia et certitudo in scientiis non tam a sensu quam ab intellectu pendet. […] Efficit praeterea, ut possimum ordine philosophari», De Raey 1677, *Pro vera metaphysica*, pp. 412-413.

[341] *Ibid.*, pp. 413-414.

[342] *Ibid.*, pp. 414-415.

[343] *Ibid.*, p. 416.

[344] «Sic ordine philosophando, advertimus imprimis, nos existere, quatenus sumus naturae cogitantis; et simul etiam, et esse Deum, et nos ab illo pendere. Unde porro sequitur, ex eius attributorum considerationis, caeterarum rerum veritatem posse indagari, quatenus ille est ipsarum causa. Ut ita scientiam perfectissimam quae est effectuum per causas, acquiramus», *ibid.*, p. 417. See also p. 420.

[345] *Ibid.*, pp. 421-422.

[346] «Sic ergo satis non erit novisse, id omne quod clare et distincte percipitur, a quocunque demum percipiatur, verum esse: sed opera danda est, ut ea dignoscere possimus, quae revera clare percipiuntur, ab iis quae clare percipi tantum putantur. Quod non alia via fieri potest, quam summatim enumerando simplices omnes notiones, ex quibus nostrae cogitationes componuntur, et quid in unaquaque sit clarum, quidve obscurum, sive in quo possimus falli, distinguendo. Quod antehac non fecerunt logici et metaphysici, ut facere debuissent», *ibid.*, pp. 423. The inclusion of metaphysics in the theory of knowledge was, in the same years, carried out by Lambert van Velthuysen in his *De initiis primae philosophiae, nec non de Deo, et mente humana* (Utrecht, apud Theodorum ab Ackersdijck 1662).

In his *Pro vera metaphysica*, De Raey performs a first analysis of the notions philosophers deal with. He distinguishes between the notions of *res*, which can exist outside the mind, and *veritates*, that is, propositions which cannot exist but in our mind, even if they express principles that are to be used in order to understand external reality itself[347]. De Raey rejects the Scholastic way of proceeding in metaphysics, adopted by Clauberg in his *Ontosophia*, as this consists of a consideration of the notion of being from its most abstract to the particular, concrete notions[348]. The new metaphysics does not concern substance, duration, number considered in their abstract meaning, i.e., apart from any consideration of the actual entities these are to be applied to, but it takes into account things: namely, body, mind and their actual modifications[349]. In fact, De Raey attempts to give an order to the system of disciplines as this was conceived by Clauberg: that is, to unify logic, metaphysics and ontology. This attempt is carried out by an analysis of the actual contents of the notions traditionally considered by logicians and metaphysicians, in the light of the new world-view proposed by Descartes. Moreover, those things that cannot be referred to body or to mind alone, but which result from their union, must be considered by such new science, these being appetites, sensations and passions[350]. Also, the new metaphysics considers *veritates*, that is, the very principles, common notions or axioms (as the Cartesian *praecognita*) to be used in philosophy. Having a propositional nature, these notions do not match any specific entity: yet, these *veritates* are to be adopted in order to understand reality itself, either mental or physical[351].

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[347] «Quicquid cadit sub cogitationem nostram ad duo genera potest referri. Primum continet res, quae qualemcunque existentiam habent, alterum veritates, quae tantum in nostra cogitatione sunt»,De Raey 1677, *Pro vera metaphysica*, p. 424.

[348] «Ex iis quae tanquam res, consideramus, maxime generalia sunt, substantia, duratio, ordo, numerus, et si quae alia sint, quae ad omnia rerum genera se extendunt. Quae valde multa et operose tractat vulgaris metaphysica, quatenus pro obiecto assumit ens qua est, in latissima acceptione sua, qua idem est, quod in communi sermone res dicitur», *ibid.*

[349] «Summa rerum genera, atque adeo particularia illa, quorum distinctas in nobis notiones habemus; duo tantum novimus: unum est intellectualium sive cogitativarum, ut sunt substantiae intelligentes sive cogitantes, una cum proprietatibus et accidentibus, quae referri ad eas debent; alterum materialium sive extensarum, ut sunt substantiae corporeae, una cum suis proprietatibus et accidentibus. Sic enim intellectus et voluntas, omnesque modi percipiendi […] et volendi […] pertinent ad substantiam cogitantem, quae nomine mentis venit. Ad extensam vero, quae dicitur corpus […] sive ipsamet extensio in longum, latum, et profundum, figura, motus, istius partium et talia», *ibid.*, pp. 424-425.

[350] «Sed et alia quaedam in nobis experimur, quae nec ad solam mentem, nec etiam ad solum corpus debent referri, sed ab arcta et intima mentis cum corpore unione proficiscuntur, qua homines sumus. Nempe appetitus, fames, sitis, et c. Affectus sive animi pathemata, quae non in sola cogitatione consistunt, ut commotio ad iram, hilaritatem, tristitiam, amorem et c. ac denique sensus omnes», *ibid.* This categorization matches that of the primitive notions expounded by Descartes to Princess Elizabeth in their correspondence: see Descartes's letter to Elizabeth, May 21st, 1643, AT III, p. 665.

[351] «Qui vero cogitat, factum non posse esse infectum, non de ulla re, sed de veritate cogitat, quae mente concipi quidem et ex recta rerum perceptione affirmari potest, non vero existere. Et quia pro diversa rerum inter se

In conclusion, in his *De constitutione logicae* and in his *Pro vera metaphysica* De Raey sets forth the basics of a new science that includes both Descartes's methodology and metaphysics, as this concerns the demonstration of the existence of God and of the reliability of clear and distinct perception. Moreover, such a science is aimed at pursuing a Cartesian analysis of all our notions, since these are formed according to a puerile, commonsensical worldview and make the understanding of reality intricate and obscure, especially in physics. This worldview, in fact, is characterized both by the errors coming from the use of the senses in philosophy, and by those characterizing the functioning of intellect itself, that is, the consideration of *modi considerandi* as something existing outside the mind. These errors, ultimately, are reflected and increased by the use of language[352]. De Raey thus distinguishes between two kinds of logic and metaphysics: the "vulgar" logic and metaphysics of the Aristotelians, which concern only the notions drawn from experience (*modi sentiendi*) and the mere ways to organize and express concepts (*modi disserendi* and modi *considerandi*)[353], whereas the new logic concerns concepts of things as they are, either mental or physical. The old logic grounds medicine, theology and law, as these are based, according to the *Praefatio* to his *Cogitata*, on Aristotelian physics, metaphysics and ethics respectively[354]. De Raey carries out an analysis of the concepts expressed by ordinary language – reflecting the

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collatione, quam infinitis modis facimus, infinitae esse possunt affirmationes et negationes, infinitae veritates sunt, etiam de genere earum, quae vulgo communes notiones et axiomata dicuntur, quia adeo generales et obviae sunt. Quae generalia axiomata idcirco facile recenseri non possunt, sed nec etiam ignorari, quando in particularibus occurrit occasio, ut de iis cogitemus et praeiudiciis non excaecamur. Ut hac de causa etiam necessaria non possit censeri vulgaris metaphysica: ut multorum opinio est, peculiarem scientiam requiri, quae notiones communes exponat, atque omnium aliarum scientiarum principia demonstret», De Raey 1677, *Pro vera metaphysica*, pp. 427-428.

[352] «Mirum non est, quod tanta […] sequatur repugnantia in cogitationibus nostris, ut quod unice reale ac positivum et res subsistens est in rebus corporeis, pro nihilo habeatur, et contra illud nihil dicatur esse aliquid, longum, latum, profundum et c. […] Atque hac de causa tota scholarum philosophia, saltem in physicis, una et perpetua sine fine disputatio et contradictio est, quam fovet vulgaris metaphysica, per eam simplicium notionum confusionem, multiplicationem et eversionem, quam primo ex sensu oriri, perspicuum fecimus. […] Consequens est, ut paucis detegamus alteram simplicium notionum confusionem, multiplicatione et eversionem, quae ad intellectum referenda est. […] Imprimis notari velim, intellectum haud ita primo et per se huius mali causam esse, per ipsasmet primitivas ideas suas, ut sensus per inanes et fallaces species, quibus res aliter quam sunt percipimus; sed multiplex modus considerandi, cui imprimis per sensum assuescimus, huius mali causa in intellectu est: quatenus etiam per intellectum ad res ipsas referimus, quod non in rebus, sed tantum in nostra cogitatione est, uti id facere soliti fuimus per sensum. Quod maxime sit ex usus sermonis, quo tam considerandi et sentiendi modos, quam realia attributa praedicamus de subiectis suis. Quia id usus vitae exigit», *ibid.*, pp. 436-437.

[353] See the previous note, and De Raey's *De Aristotele et aristotelicis*: «verum loco logicae istius posse ac debere aliam esse, quae […] philosophiae propria, atque adeo prima pars eius est, et commune instrumentum. […] Quod neque de metaphysica, neque de logica Aristotelis dici potest, quatenus in metaphysica generales et nimios abstractos modos considerandi, in logica modum disserendi ac disputandi tradit», De Raey 1692, *De Aristotele et aristotelicis*, pp. 470-471. See also his *De constitutione logicae*: De Raey 1692, pp. 597-598.

[354] De Raey 1692, *Praefatio*, pp. XI-XII (unnumbered).

Scholastic commonsensical worldview[355] – in order to show which kinds of uses such concepts are suited for. Insofar as Cartesian philosophy is explained by such language, moreover, De Raey can define what the philosophical and the vulgar meanings of ordinary language are. This analysis is logical, as logic deals with concepts and signs. In fact, according to De Raey it is not possible to carry out such linguistic analysis from an Aristotelian point of view, insofar as the very Aristotelian philosophy reflects the immediate, commonsensical perception of things, rather than guiding it. The Cartesian world-view, as it goes beyond a childish, intuitive understanding of reality, allows De Raey to carry out such analysis. Like Clauberg's logic, De Raey's concerns language. However, whereas that of Clauberg was a *hermeneutica* adapted to the interpretation of the meaning and truth of texts, De Raey's logic is fully concerned with the ontology entailed by everyday language, deepening the focus on the objects referred to by words. To that extent De Raey could unify logic and metaphysics as both concern, through concepts, things as they are, that is, he provides a logic, a metaphysics as foundational theory, and an ontology as the science of being all at once. Indeed, De Raey does not consider logic and metaphysics as two parts of first philosophy, but rather as one and the same discipline.

3.5 A Cartesian philosophy of language

A complete analysis of linguistic meaning is the purpose of De Raey's *Cogitata de interpretatione* (1692), his last work. The analysis of Aristotelian logical and metaphysical concepts, in fact, had already been carried out in different texts published as disputations, in the second edition of his *Clavis* (1677), and in the appendix of the *Cogitata* themselves. This is the case of his *De Aristotele et aristotelicis*, where De Raey announces the development of a new logic, aimed at replacing both the old logic and metaphysics[356]. Finally, a sample of such logic is provided by his *Specimen logicae interpretationis*, based on some disputations held between 1669 and 1671 and published in his *Cogitata*, containing a long and detailed analysis of the logical and metaphysical notions presented in Franco Burgersdijk's *Institutiones logicae* (1626) and of their *Synopsis* (1645)[357], as

[355] See De Raey's S*pecimen logicae interpretationis*, stating the Aristotle's categories match just *modi loquendi*: De Raey 1692, S*pecimen logicae interpretationis,* p. 558.
[356] *Supra*, n. 353.
[357] Burgersdijk 1626; *id*., *Institutionum logicarum synopsis, sive Rudimenta logica. In quibus praecipuae definitiones,*

such notions are intended to refer to any entity besides themselves. De Raey rejects the philosophical use of *predicabilia* and *praedicamenta*, being the most general relations the mind imposes on things. He says they have no use in the new philosophy[358]. These concepts are considered from the point of view of a new logic, which focuses on language as a vehicle of errors[359]. Finally, this logical or philosophical analysis of language is carried out in his *Cogitata de interpretatione*, where De Raey provides a justification of the correct use of the Aristotelian concepts. For this purpose, in addition to the three traditional ways to consider speech, namely, those of the *trivium* (grammatical, rhetorical and dialectical), which respectively concerns the formal structure of language, its *ornatus* and its meanings according to an Aristotelian or commonsensical standpoint[360], De Raey finds a fourth kind of consideration of language. Besides the common *sensus* or *intellectus* of words, or their widely accepted linguistic meanings, it is possible to find a philosophical sense of words, that is, their Cartesian meaning, examined by the new logic, which De Raey traces back to Plato's dialectics, as in his *De constitutione logicae*[361]. The first part of De Raey's *Cogitata*, therefore, contains a theory of meaning or signification deeply rooted in Descartes's theory of knowledge. De Raey's account of signification is the core of his theory of knowledge, presented, in fact, as a theory of those processes involved in the use of language.

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divisiones, et regulae, ad artem logicam pertinentes, per quaestiones et responsiones, breviter et dilucide proponuntur; in usum scholarum Hollandicarum, Leiden, apud Abrahamum Commelinum 1645.

358 «Huiusmodi enim relationes generalissimae et ad omnia rerum genera applicari aptae, sunt omnes notiones logicae, quas secundas vocant», De Raey 1692, *Specimen logicae interpretationis*, p. 543.

359 «Logicam philosophicam voco, quae sic ratione uti docet, ut occulta eius vitia emendet, secundum simplices et primitivas notiones, in quibus veritas est rerum in se ipsis spectatarum. Quae emendario se potest ad orationem extendere, quatenus omnes conceptus nostros alligamus», *ibid.*, p. 535.

360 De Raey 1692, pp. 1-6.

361 «Quarta et nova consideratio sermonis secundum intellectum, qui ita communis sive vulgaris non est. Proinde si praeter communem sensum atque intellectum communem possit aliquis esse proprius et singularis, qui communi sermone non comprehenditur; perspicuum fit, quia et hunc intellectum intepretari possumus, atque etiam communem sermonem ad eum applicare; novam et quartam hanc posse intepretationis considerationem esse. Atque consideratio haec quarta in eo posita erit, quod non tam in sermone spectetur communis sensus sive intellectus qui consuetudine sermonis cum verborum significatione iunctus est, quam veritas quae censeri possit ipsa rerum veritas esse», De Raey 1692p. 6. Later on, De Raey writes: «ad quam partem philosophiae pertineat hic tractatus, non iam difficile est porro ostendere; […] patet, hanc scientiam ad primam philosophiae partem pertinere: quae hac de causa prima philosophia vocatur, cuius aliud minus proprium nomen metaphysica est […] Atque a metaphysica, de qua hic nobis sermo est, physica accipit primas et simplicissimas notiones. […] At non male etiam logica appellatur sive dialectica, haec ipsa prima philosophiae pars; quia rationem informat quae potest explicata oratione esse in ratiocinando et disserendo, quatenus λόγος unde logica dicta est […] quatenus ut cum Platone loquamur», *ibid*., pp. 18-19.

3.6 The theory of meaning

Before carrying on the analysis of language according to a Cartesian standpoint, De Raey outlines a theory of linguistic meaning. According to him, words have a *sensus* or *intellectus*, and a *significatio*. *Sensus* or *intellectus* are the mental contents "attached" to the body of the words, that is, the ink or the sound as they exist outside the mind. *Significatio* is the act of meaning of words, according to the definition of Franco Burgersdijk[362]. In his *De cognitione humana*, a text present in the appendix of the second edition of his *Clavis*, De Raey writes that to signify means «potentiae cognoscenti […] facere praesens»[363]. Broadly speaking, a name signifies some thing when it recalls the idea of that thing to our mind. Hence, ideas are the linguistic meanings of terms, and through them names refer to those things ideas represent[364]. Ideas, indeed, can be considered as definitions[365], and linguistic definitions are explanations of ideas themselves[366]. This characterization fits the linguistic role of ideas as meanings of terms. Therefore, signification is first of ideas, and secondarily of things[367], according to a tripartite scheme. Therefore, speech or interpretation (*sermo sive interpretatio*) is a verbal string which signifies a concept or sense (*sensum sive conceptum*) in the soul, which is voluntarily joined with an external sign[368]. Following Aristotle's *De interpretatione*, according to De Raey written words signify spoken words, or they are their *notae* and *indicia*, whereas spoken words signify senses and thoughts in the soul (*sensum et cogitatio*). Thoughts, finally, refer to things or are *notae rerum*[369]. This tripartite scheme of signification turns out to be necessary for De Raey to allow the use of many terms which do not have a reference in bodies even if they are supposed to, that is, the most part of Aristotelian

[362] For an account of early modern theories of meaning, see E.J. Ashworth, *Do Words Signify Ideas or Things?*, «Journal of the History of Philosophy» 19 (1981), pp. 299-326.
[363] De Raey 1677, *De cognitione humana*, p. 244.
[364] «Nomen […] interventu ideae […] refertur ad ipsummet corpus […] in extantibus», De Raey 1692, *Cogitata de interpretatione*, p. 313.
[365] «Idea seu definitione», De Raey 1677, *De cognitione humana*, p. 288.
[366] «Unius rei una tantum vera imago et idea esse potest, non solum in uno homine […]. Et mathematici ex ideae illius intuitu eodem modo definiunt illa (cum omnis definitio, ideae, quam in animo habemus, expressio tantum sit, verbis facta)», De Raey 1677, *De mentis humanae facultatibus*, pp. 389-390.
[367] «Advertamus, significationem quae de passione vel cogitatione in apparentibus aut cogitatis intelligitur, in humano sermone primam, maxime propriam et minus promotam; eam vero quae de qualitate corporis […] intelligitur, secundam et quasi translatam magisque promotam esse, ut consistere sine ea ac vera esse possit prima et propria significatio, cum qua altera tantum coniuncta est», De Raey 1692, *Cogitata de interpretatione*, p. 216.
[368] «Interpretatio sive sermo inter homines est vox articulata animi conceptum (aut si mavis animi sensum) ex instituto significans. […] Quibus libera voluntate et cogitatione iungimus animi sensus et conceptus nostros. Quae idcirco propria notio interpetationis est, quatenus illius species quaedam in voce articulata consistit», *ibid.*, p. 24-25.
[369] De Raey 1692, pp. 27, 61-62, 108.

language. In fact, the theory of signification De Raey provides is the ground for his emphasis of the semantic value of second intention terms, the names of thoughts, which can still be used along with those words referring only to material or mental entities. What makes signification possible (its *ratio* or *fundamentum*) is the conjunction of the external body of the word with the sense in our soul (*animi sensum*). According to De Raey, this sense is the "soul" of a word, as a human being is composed of soul and body. The word as a body is the antecedent of its sense or soul, and recalls the sense attached to it to our memory: in this way it is its sign[370]. However, this leads to dealing more with mere words than with the very concepts of things, that is, an imprecise grasp of the meaning of words[371].

Signification concerns natural and artificial signs. Whatever is not an idea is not a natural sign. Thus, bodily manifestations like crying, even if "natural" in the sense that they are not fully voluntary, are not natural signifiers[372]. Even pictures, images, statues and everything that has a resemblance with something is just a sign by convention and will[373]. Also things which have a causal connection among themselves, such as the dawn and sun, are not natural signs, as we have to know previously that dawn comes before sun. Thus, if formal signs did not exist or were not joined to any body, nothing would be a sign[374]. In this case, only thoughts (*res cogitatae*) would be signs, as they are in our mind[375].

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[370] «Non iam difficile est porro ostendere, quae idcirco ratio, quod fundamentum proximum significationis in voce articulata sit. Ratio enim sive causa proxima est unio sive coniunctio vocis articulatae externae, cum aliquo interno animi sensu. Quatenus ut animus iunctus cum corpore et cum eo unum sive unus homo est, ita potest animi actus cum actu corporis iungi, et unum esse, ut una vox. […] Quia igitur, quando profertur et auditur ea vox, se cum ea et per eam ingerit auribus ac mentibus nostris, internus sensus et conceptus aliquis, illius signum dicere possumus vocem esse, eamque ut priorem sive antecedentem spectare», *ibid.*, p. 29.

[371] «Conceptus, qui modo vocibus comprehensi sunt, ita iis alligamus, ut facilius et prius vocum, quam conceptuum recordemur, videaturque saepe ratiocinatio non tam rationum sive conceptuum in cogitatis, quam vocabulorum in dictis subductio aut copulatio esse. […] Sicut pueri in scholis hoc pacto ante res nomina supponunt, quae audiunt, vel legunt, et valde multas voces addiscunt, quarum intellectum vel nunquam vel admodum obscure assequuntur. Quod sic non faciunt alii homines qui prius res ipsas quam nomina cognoscunt quorum hinc ingenium saepe magis aptum ad veram scientiam est», *ibid.*, p. 30.

[372] *Ibid*., pp. 32-35.

[373] *Ibid.*, p. 35.

[374] «Sique adeo tale signum formale, sive ea propria forma signi non esset, vel cum aliorum signorum materia non iungeretur, ut quidem in nobis ea coniunctio debet facta secundum cogitationem esse, quia eam ipsae per se res, neque habent neque faciunt inter se. Tum inquam non esset quoque res ulla quae significaret, vel representaret ac notum faceret quicquam», *ibid.*, p. 36.

[375] «Quae si ita sint, non erit signum ullum extra cogitationem nostram, verum res cogitatae signa erunt, ut sunt in cogitatione: quia sine cogitatione et extra eam non esset ea habitudo atque connexio et forma rerum, quae ad significandum necessaria est, et cognitio non esset, sine qua significatio non est, si significare est notum facere», *ibid*.

3.7 The analysis of language

The main part of the *Cogitata* is devoted to the analysis of the meanings of terms. De Raey answers the question *what do* voces *signify?*[376] by analysing terms according to an eightfold categorization, determined by the actual things terms denote according to Descartes's metaphysics. Through this De Raey stresses the semantic value of all those terms meaning sensations, passions and *modi considerandi*, that is, mental contents we use to refer to external reality. His polemical targets in the analysis of the meanings of words are Hobbes and those who adopted a materialist standpoint on the nature of soul, or attempted to reduce all the references of words to bodily reality[377]. This error comes from a misuse of Descartes's philosophy, but also from a misinterpretation of Bacon's critique of Aristotle's logic, as Bacon criticized it for being a sterile means of knowledge[378]. Moreover, one must consider Regius's account of the nature and functioning of the soul among De Raey's targets, as he states, in his 1654 *Philosophia naturalis*, that the mind may be an atom, given that thinking can belong to matter also[379].

Through his work De Raey provides an ontological study. This can be acknowledged as De Raey considers words according to their references, not according to the features of the ideas they

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[376] *Ibid.*, p. 61.

[377] «Uti hoc putavit Thomas Hobbesius […] hi inquam mali, quorum error etiam antiquus est, omne iudicium quo affirmamus, omnem in nobis veram et liberam ratiocinationem, quae plus quam copulatio nominum, plus quam imaginum corporearum necessaria incursio est, evertunt», *ibid.*, p. 215. «Errore ab una parte in Aristotelis, ab alia opposita, in Cartesii sectatoribus notatus, quatenus illi multiplicant, hi minuunt entia sine necessitate. […] Sectatores non paucii Cartesii, suum proprium, vel Hobbesii errorem secuti, peccant in altero extremo», *ibid.*, pp. 207-208. «Si pro cogitatione motum corporis, pro idea in cogitatis nescio quae simulacra corporea, denique pro ipsa in nobis mente corpus supponas, ac si ut aliqui fingunt *cogitatio opus corporis cogitantis sit, et similis esse possit in homine et bestia cogitatio, non quicquam amplius quam corpoream rei similitudinem complectens*. Quibus ita positis, sequitur id quod Dicearchus apud Ciceronem libro I Tusc. dicit, *nihil esse omnino animum, et hoc esse totum nomen inane*, inania omnia, quae mentibus sensibusque hominum accommodate, cum nominibus diversis, consuetudine sermonis, ut diversa a corpore supponimus. Quod sane est evertere horum nominum significationem, atque eam removere a sermone inter homines, ut vellent, si possent, ipsas res removere», *ibid*., p. 211. See AT VII, p. 182; Cicero, *Tusculanae*, I, 21 (cf. Cicero, *Tusculanae Disputationes*, ed. by M. Pohlenz, Leipzig, Teubner 1918, p. 43).

[378] «Sumus [...] plus satis persuasi his nominibus solis, quibus olim nimium tribuebant Aristotelici, internam rerum veritatem comprehensam non fuisse nude et distincte, idque ab initio monuimus [...] observatum a Verulamio fuisse. Hinc vero non sequitur, ut multi putant, et forte Verulamius putavit, huius adeo nessariae observationis veram causam non intelligens, quod inania haec nomina sint, sive voces insignifcantes, uti supra audivimus Hobbesium loquentem, atque suo hoc insigni errore abutentem ista Verulamii, et imprimis Cartesii observatione. Siquidem saltem in cogitatus inania non sunt nomina», p. 306. De Raey refers elsewhere to Bacon's critique of Aristotle's *Categories*, see the *Specimen logicae interpretationis* (De Raey 1692, p. 536), referring to Bacon, *Novum Organum*, I, 97 (cf. F. Bacon, *Novum Organum*, London, apud Joannem Billium 1620, p. 43.)

[379] «Illa tum in minima sensorii communi atomo, sive corpusculo propter parvitatem et soliditatem suam naturaliter indivisibili, posset existere», Regius 1654, pp. 345-346. See Strazzoni 2014b, p. 149.

mean. In other terms, he considers the meanings in the light of the named things more than according of the characteristics of ideas themselves. Still, he does not address the problem of the validity of what he called "*veritates*" in the *Pro vera metaphysica*, that is, of the very principles of sciences, the discussion of which is considered by De Raey one of the duties of logic or metaphysics. In any case, he takes into account all those notions which have a use in physics, which had to be cleansed from obscure notions, as he distinguishes between names of passions, mere concepts, and physical objects. Hence he provides physics with a foundation and addresses the basic concepts related to a study of human being as such, as he provides an ontological catalogue of body and mind.

3.7.1 The names of passions

De Raey's considerations concern eight categories of words. Their analysis is functional to the foundation of philosophy as the different categories roughly correspond to different uses. Through his linguistic analysis De Raey can clarify what are the objects of different disciplines, insofar as their terminology refers to different kinds of entities. Hence, through his linguistic analysis he can give a definition of the objects of philosophy, in accordance with his definition of logic. His analysis illustrates which are the *summa rerum genera* and the principles of knowledge, among which one has to count the mind itself[380]. De Raey's *Cogitata* are the completion of his *scientia logica*, announced in his *De constitutione logicae*. Accordingly, he faces the philosophical problems involved in the use of language both in philosophy and in everyday usage.

The perspective De Raey adopts in his analysis of speech is different from that of grammarians, rhetoricians and scholastic logicians[381]. However, De Raey takes into account also the grammatical characterization of words: indeed, the first order outlined by De Raey is that of interjections. Interjections are almost "natural" signs of passions, as they are less conventional and more determined by the body than other kinds of words. De Raey defines interjections as «notae

[380] «Philosophia […] primum quidem, quae sunt summa et simplicissima genera rerum, deinde quis demum verus rerum intellectus sit, quis modus sciendi sive intelligendi. Neque horum unum sine altero cognoscitur, quia cohaeret cum altero; quatenus inter genera rerum imprimis debet ille ipse intellectus esse, quo res ut sunt possint cognosci. […] Ut iure merito, primum quidem cognitionis humanae et tunc quoque humani sermonis atque omnis rectae interpretationis […] dici possint principia esse generalia et simplicia ista», De Raey 1692, pp. 26-27.

[381] *Supra*, n. 360.

passionum inter loquendum»[382]: they are marks, not names[383] of actual passions. In any case, their utterance involves the concept of a passion, which is always brought to our mind when someone uses them[384]. Thus, they can be regarded as having a meaning. The other orders are more guided by a philosophical perspective, as they include names and verbs considered only according to their meanings[385]. The second order contains names and verbs signifying passions. Actions are those modifications of the soul which do not follow a modification in the body. Passions are those modifications of the soul which come after a bodily modification and of which we are aware. These terms signify passions by means of thoughts or concepts, which in turn are actions as they do not depend on the body for their creation, even if they are about a passion, being thus a «libera cogitatio»[386]). Whereas interjections signify a passion and a concept confusedly, the terms of the second class properly signify the ideas of passions, and through these the passions themselves[387]. Signified passions are 1) the *affectus*, such as wonder, fear, hope, joy; 2) the natural appetites, such as hunger and thirst, 3) the sensations caused by something internal to the body, such as pain or pleasure. In the case of 1) the words signifying *affectus* can signify even the sole act in the soul, without the passion which comes after the body. Indeed, to act and to undergo a passion can be conceived as one process, that is, as a modification of the soul that we can consider in different ways, either as a passion or as an action, since the soul cannot be truly modified by the body and is

[382] *Ibid.*, p. 63.

[383] The difference between names and *notae*, or marks, is not important in the context of De Raey's works. For instance, he takes as paradigm of signification Aristotle's statement in the *De interpretatione*, translating it as «*in voce sunt notae passionum*», *ibid.*, p. 62.

[384] *Ibid.*, pp. 63-66.

[385] De Raey usually takes as examples of words signifying something the double expressions such as *sensus sentire*, or *lumen lucere*, assuming that they have the same meaning, i.e., a passion or modification in the soul. He states also that names denote a quality or a thing, whereas verbs denote an action or a passion (*ibid*., p. 116). Moreover, he states that verbs (*verba adiectiva*, those others than the verb "to be") can be paraphrased by the union of the verb "to be" (or *verbum substantivum* as in this way it is the common substance of verbs) and the participle form of a *verbum adiectivum* (as it is the "accident" which distinguishes the verbs): *amo* is *amans sum*. According to De Raey, participles work, from a semantical point of view, as names. They are simply joined to the verb "to be" which is the sign of an internal act of affirmation, joined to all our concepts and names. Thus, adjective verbs, as they have a nominal part, have a semantical status similar to names. But they do not signify a passion or an action in the same sense as a name does, like qualities of the soul, but as they are considered as motions in the soul: «quae interpretatio non sic est accipienda ac si verbum ullum in his, activum actionem, passivum passionem significaret ut rem aut qualitatem rei, in statu non in motu, sicut priorem de statu significationem in nominibus separatis esse, sive substantivis, amor […] sive adiectivis, amans […], posteriorem de motu, in verbis, comparanti haec nomina cum suis verbis cognatis manifestum fit. Non inquam ita in statu horum verborum qualiscunque nominalis significatio intelligitur, verum in motu, fluxa, fugitiva, evanida, relate ad tempus fugitivum», *ibid.*, p. 318. Thus names and verbs signify the same things according to two different perspectives, or *modi considerandi*: *in statu* and *in motu*.

[386] *Ibid.*, p. 66.

[387] *Ibid.*, pp. 66-67.

the source of its own modifications[388]. Moreover, they can signify, according to their proper meaning, that modification of the soul which comes after that of the body. Finally, they can improperly signify the *nota passionis* in our body, such as blushing. The case is analogous for the 2) natural appetites, which can signify something pertaining to the sole mind, such as the *voluntas bibendi*, a modification of the body, or, more properly, a modification of the mind coming after a bodily motion. 3) Also among the names of sensations we find similar improper significations: that is, by "hot" we can mean just a bodily modification[389]. In this way De Raey provides a Cartesian analysis taking into account the commonsensical meaning of terms. The terms of the third order are addressed in the same way, as they refer to passions coming from a cause external to our body, like coldness, warmth, or Aristotle's five *sensibilia propria*[390]. As in the case of the previous category, these terms have a proper meaning, that is, passion in the soul, and an improper meaning, or the bodily modification. These improper significations are legitimate, even if in different manners: indeed, the passions named in the second order often have a unique and determined cause in the body, which can be univocally referred two by such names, whereas those of the third can have more than one cause, located outside our body. Thus, the words of the third order are less useful to speak about bodies than those of the second order[391], which can be used with some legitimacy in everyday speech.

Finally, the fourth category includes words which signify a passion (more properly, a sensation) and through it and along with it («secundum passionem atque una cum passione», or «secundum speciem apparentem»[392]), something really existing in the physical world. These are the names of quantities, numbers, figures, positions and places, movement and rest, time. Even if there are many problems in the empirical proof of these qualities, which are the objective or primary qualities, through their names we can speak about the world. Indeed, their reference is apparent to the senses or can be defined by the intellect, whereas in the second and third order it is difficult to

[388] «Agere et pati in animo ex parte unum sunt, etiamsi una consideratio non est, qua dicitur agere vel pati», *ibid.,* p. 73. In this way, however, signification is to be put in the sixth order, which contains names of passions which have their sole cause in the soul, and in this they are no more passions but actions.

[389] *Ibid.*, pp. 66-75.

[390] *Ibid.,* pp. 75-78.

[391] *Ibid.*, pp. 81-93. See p. 81: «haud facile erramus, quando generali saltem notione alia videtur qualitas et conditio nostri corporis esse, sicut alius sensus est, atque unus certus sensus, puta doloris, frigoris, caloris, videtur unius creatae qualitatis esse. Quamvis enim speciatim dicere non possimus, quam in nostro corpore qualitatem sensus internus significet, quia particularem de ea notionem non habemus; idcirco omnino falusm non est id quod ita universim de ea cogitamus et voce aliqua significamus».

[392] *Ibid.*, p. 93.

understand what are we talking about when we refer such terms to the physical world[393]. Furthermore, according to De Raey through these terms we deal with the sensory ideas of primary qualities, but also with their innate ideas, which belong to the intellect, even if this is «communiter […] coniunctus cum sensu»[394].

3.7.2 The names of thoughts

The discussion of the words of the first four orders does not conclude either De Raey's foundation of philosophical knowledge or the justification of the use, in everyday language, of words meaning modifications of the soul in order to refer to bodies. Both these ends are achieved by De Raey by him taking into account four additional orders of terms, which means the modifications of the soul as these are produced by the soul itself, that is, its actions. This analysis is made possible by a different conception of the soul, that is, from the point of view of its being active and independent from the body[395]. This topic is related to the more general problem of the union of soul and body, solved by De Raey by stating that passions do not result from the union but are the very union, that is, the correspondence of the modifications of soul and body guaranteed by God, as he argues in his *De forma substantiali et anima hominis*, included in the second edition of his *Clavis*[396], and in his *Unio mentis humanae cum suo corpore*, printed in his *Cogitata*[397]. De Raey can thus take into consideration passions and sensations independently from their bodily cause, as well as the *modi considerandi* or second notions used by Scholastic metaphysics, which do not result from a bodily

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393 *Ibid.*, pp. 93-101.

394 *Ibid.*, p. 95.

395 «Inter patiendum est, quo agere potius dicatur quam pati, et in aliquibus ex se ipse revera agit animus, atque tam in nobis agens, qui sua libertate utitur, quam patiens, corpori mancipatus, intellectus est: haec diversa animi sive intellectus humani consideratio una quasi in statu servitutis, altera in statu qualiscunque libertatis […]. Haec diversa animi sive intellectus humani consideratio, una quasi in statu servitutis, altera in statu qualiscunque libertatis, quem intellectum Aristoteles, libro III de anima cap. 5 vocat unum *patientem, alterum agentem, cuius non recordamur, quia est passionis expers*, haec inquam diversa consideratio et distinctio non contemnenda humani intellectus, censeri potest», *ibid.*, p. 109. See Aristotle, *De anima*, 430a 22-25.

396 See De Raey 1677, *De forma substantiali et anima hominis*, pp. 569-570, where he uses such terms as «sympathia», «harmonia», «consensum», «conspiratio». See also p. 524: «non […] ab eo producantur, ut efficiente, sed quod ad eorum in mentem productionem et existentiam, corpore opus sit, ut incitamento».

397 «Dici non potest, cur ex hac vel illa cogitatione sequatur motus in corpore. Sed quisquis novit, quod anima non possit habere aliam relationem ad corpus, quam quod ab eo sic debeat pati et affici in sensu, et in illud vicissim agere, in motu. Satis intelligit, rationem sensu et motus indemonstrabile esse, uti indemostrabilis ratio unionis est. […] Sentire et movere […] in anima quae unita supponitur cum corpore, intima et essentialis proprietas, imo ispa unio est, aut si mavis ratio sive forma unionis», De Raey 1692, *Unio mentis humanae cum suo corpore*, pp. 670-671.

motion.

As the first order includes interjections, which are not names but just marks (*notae*) of passions, the fifth order includes prepositions, adverbs, conjunction, the marks of the ways in which we pass from one thought to another which are fully meaningful only when joined to a verb or a name[398]. In turn, the sixth order includes all the words already included in the second and the third orders: however, these words are only considered in the sixth order as far as they signify the concepts of the modifications of the soul: that is, such words signify only the concepts of passions, and do not refer to passions themselves[399]. The use of such words to refer to something else than such concepts can be more or less proper, insofar as the names of *affectus* (from the second order) can find a proper signification of intellectual passions[400], whereas in the case of names of external sensations (from the third order), such as "*lumen lucere*", a reference to a mere act of the soul is metaphorical ("*lumen intellectus*"). Besides names and verbs referring to passions, the sixth order includes the terms properly referring to mental acts, as "*cogitatio cogitare*" and "*voluntas velle*", summarizing all the actions of mind.

Finally, the seventh order concerns names and verbs signifying thoughts by which we erroneously refer to some bodily reality, and the eighth order includes the name of things truly existing outside the mind. As to the former, one can find all the terms used in Scholastic metaphysics: this is the case with the verb "*sum*", and the derived terms "*ens*", "*esse*", "*essentia*", "*posse*", "*potentia*"[401]. Such terms signify only the act of affirmation we perform regardingwhat we are talking about. This is a traditional point, which De Raey traces back to Aristotle and Plato[402] and

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[398] De Raey 1692, *Cogitata de interpretatione*, pp. 109-119. Prepositions are mainly *notae relationum*: they signify a relation in respect of the things named by the terms they are applied to. Adverbs, like prepositions, do not have a full meaning alone, and are mere *notae cogitationum*. Some of them, however, seem to have a full meaning as names or verbs have, like those concerning places or times (*ibi*, *sursum*, *heri*, *cras*). These are derived from names or verbs and maintain their signification. The third subclass is that of conjunctions, or the marks of the connections among sentences in the speech.

[399] «Primae cogitationes, quas ita animus invenit apud se atque in communi sermone exprimit, dici possunt illae esse quas natura cum primis passionibus iunxit in animi affectu, naturali appetitu, atque alio sensu interno. Etenim prima aetate fere tantum passiones in anima sunt, primum ab interna, deinde etiam ab externa causa; sicut est sensus internus et externus. Has idcirco passiones primae voces significant. Postea multiplex animi actus et cogitatio accedit, atque, sicut paulatim uti incipit animus libertate quadam, et tam ad ea quae intra se agit et cogitat,quam ad ea quae patitur ac sentit attendere:, primum quidem coniuncta, postea vero etiam separata est cogitatio ista», *ibid.*, p. 120.

[400] *Ibid.* p. 122.

[401] De Raey 1692, *Cogitata de interpretatione*, p. 212.

[402] «Hac solum de causa […] monuimus […] verum esse id quod Aristoteles aperte docet libro de Interpretatione cap. 3 quod in extantibus nihil sit id quod primo et proprie verbum est […]. Prorsus uti Plato hoc ipsum adversus illorum

that is present in Geulincx's logic also[403]. Thus, by "*sum*" we can only mean an act of affirmation about the existence of what we are talking about: if not in external reality, at least in the mind itself, which is entailed by any thoughts, as these concern something real[404]. Moreover, this is the category of all the second notions, κατηγορούμενα, used in scholastic logic and metaphysics: *unum*, *verum*, *bonum*, *necessarium*, *contingens*, *substantia*, *accidens*, *quantitas*, *qualitas*, *causa*, *effectum*, *totum*, *pars*[405], and less general terms signifying relations[406], which do not match anything outside the mind, such as the concepts of divisibility, which is only an expectation that bodies can be divided[407]. Still, these terms can be used in philosophy, along with those terms signifying *res extantes*, which are included in the eight order. In this order, one can count the words meaning motion, figures and magnitudes, that is, the geometrical properties of matter, considered according to the intellect as abstracted from a *concretum* or composite subject[408]. Moreover, De Raey counts in the eighth order also those terms referring to individual substances, such as men, animals, plants

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temporum sophistas monuerat his verbis, non minus notatu dignis, in suo Sophista: i*d quoque nobis patet, quod dictio aliquid circa ens aliquod ubique pronuntiatur, atque impossibile est, ipsum aliquid solum et quasi nudatum ab omnibus his quae sunt, seorsim pronuntiare*», De Raey 1692, *Cogitata de interpretatione*, pp. 200-201. See Aristotle, *De interpretatione*, III, 16b 22-25, Plato, *Sophista*, 237d, 34-35.

[403] A. Geulincx, *Opera philosophica*, ed. by J.P.N. Land, The Hague, M. Nijhoff 1891-1893: vol. I (1891), vol. II (1892), vol. III (1893), see vol. I, *Dictata ad logicam*, p. 463. The philosophy of Geulincx will be the subject of the next chapter.

[404] «Id quod adeo manifestum est de nominis significatione, quam dico non posse de re omnino non existente intelligi, non advertimus communiter, quia ita non distinguimus rei notionem atque omnem in re, quam nomina significant, modum essendi non consideramus, sed eum praecipue quo quid in apparentibus est et secundum ea videtur in rebus extantibus esse, quae corpora sunt. Putare autem omnino non esse quae ista consideratione non sunt, est communi hominum sermone abuti», De Raey 1692, *Cogitata de interpretatione*, p. 164.

[405] «Et quidem de cogitatis tantum affirmatio est in generalibus istis quae de omni rerum genere intelliguntur fere sine distinctione: ens, unum, verum, bonum, necessarium, contingens, substantia, accidens, quantitas, qualitas, causa, effectum, totum, pars, et talia quae metaphysici attributa entis vel etiam medium inter ens et nihil, logici praedicamenta, praedicabilia, affectiones, notiones secundas atque etiam una voce τὰ κατηγορούμενα vocant, quorum numerus infinitus est», *ibid.*, pp. 146-147.

[406] «Sed vero communiter non observant logici et metaphyisici, praeter generalia ista innumera particularia esse, quae quidem secundum cogitationem atque in cogitatione rebus accomodata, hinc vero in rebus ipsis non sunt extra cogitationem, ut divisibile, indivisibile, mortale, dives, pauper, dominus, servus, aequale, inaequale, magnum, parvum, et talia, quatenus rerum inter se habitudines et relationes multiplicemque de iis cogitationem significant, quae etiam infinita sunt. De quibus idcirco omnibus, tam particularibus, quam generalibus istis, in animo et cogitatione quidem, non vero pariter extra cogitationem affirmatio potest vera esse», *ibid.*, p. 157.

[407] «Corpus unum in extantibus non divisum et non motum […] non habet quicquam in se quo dici divisibile et mobile possit in pleno sensu […]. Quandoquidem divisibile et mobile in pleno sensu significat posse dividi cum effectu relate ad causam […]. Et quidem posse, non […] qualitatem rei in extantibus significat extra nos, sed in nobis […] spem de eo quod futurum cogitamus in uno propter aliud», *ibid.*, pp. 196-197.

[408] «Secundum hanc sive abstractionem sive suppositionem omnis istarum rerum definitio, omnisque de iisdem demonstratio intelligitur, primum quidem in cogitatis, deinde etiam in extantibus. Quandoquidem significatio quae supponitur in primis et simplicissumis cogitatis, cum dico, punctum, linea, superficies, corpus, etc. suo modo vera etiam in extantibus est, veritate et significatione magis promota sive transalata ad rem, quae octavi ordinis et postrema in humano sermone est», *ibid.*, p. 188.

(*supposita substantiva separata*)[409].

Through his linguistic study De Raey approaches a crucial problem in Cartesian philosophy: that is, the definition of individual objects within the continuum of extension, deprived of substantial forms[410]. Aristotelian ontology entailed a perfect correspondence between substantive names and individual substances. The collapse of this ontology led to the emergence of a problem, namely, how to find a reference for those terms usually taken as names of substances. If De Raey makes clear the proper – that is, Cartesian – references of the names meaning passions, thoughts and truly existing qualities in bodies, according to a philosophical perspective, he just says that by names of substances we refer to *res extantes* according to common sense. Actually, De Raey solves such a problem by an appeal to their inner form, or the mechanical structure and shape which identifies what we are talking about: bodies are determined by a modification of the unique extended substance. The world is still composed of forms, which have lost the feature of substantial forms and are mechanical constitutions, constituting a *totum physicum* or *essentiale*[411]. However, such constitutions are to be grasped by mind through a process of abstraction. The foundation of mathematical and physical abstraction is provided insofar as the entities we refer to are present in actual bodies as parts in a whole[412], thus, they actually exist, as a whole or *concretum* exists: «abstractum in concreto veritatem habet»[413]. According to De Raey, abstraction is made possible because the mind, as for Aristotle, is the place of forms, τόπος εἰδῶν, this being the «primum fundamentum et praecipua ratio omnis abstractionis»[414]. Even if through a mental act of abstraction, the names of individual substances can truly refer to something existing outside the mind, both in philosophical and in everyday speech. On the other hand, the names of *modi considerandi* counted in the seventh order – such as the notions of cause, effect and divisibility – while not meaning

[409] *Ibid.*, pp. 180-181.

[410] The relevance of this problem in early modern philosophy has been highlighted in H. van Ruler, *The Crisis of Causality, Voetius and Descartes on God, Nature and Change*, Brill, Leiden/New York/Köln 1995. See also N.E. Emerton, *The Scientific Reinterpretation of Form*, Ithaca and London, Cornell University Press 1984.

[411] De Raey 1692, *Cogitata de interpretatione*, pp. 285-288.

[412] «Ita putamus regulam quam tradit Aristoteles II Phys, cap. 2 ubi de hac abstractione mathematica loquitur, […] *abstrahentium non est mendacium*, per omnia veram esse. […] Quia sicut partes, quando eas natura in toto distinguit et separat, sunt in toto quod supponitur ante partes, nec potest totum in partes distingui quae non sunt; similiter non potest simplex per abstractionem significatio intelligi atque distingui, si omnino non sint simplicia quae distinguimus atque ut distincta supponimus in sermone. Et quia pars sequitur conditionem totius, quatenus et qua parte totum in extantibus est, partem in extantibus esse», De Raey 1692, *Cogitata de interpretatione*, pp. 188-189. See Aristotle, *Physica*, II, 2, 193b 25

[413] De Raey 1692, *Cogitata de interpretatione*, p. 213.

[414] *Ibid.*, p. 216. See Aristotle, *De anima*, III, 4, 429a 27-28.

anything but a way to consider bodies, are still necessary in natural philosophy, where one cannot use only words signifying truly existing things, as real modes of substances such as shape and motion[415]. Without *modi considerandi* one could not acquire *scientia* itself, as such *modi* are necessary in order to carry out any demonstration in philosophy and geometry, which relies on comparisons between quantities and on abstract terms[416].

De Raey provides a justification of the use of *modi considerandi* in philosophy, declaring how ordinary language can be used in both everyday practice and philosophy itself. In this way, De Raey can reject the application of a philosophical standard to ordinary language, since this application would deprive of meaning all those terms which do not refer to a physical substance or mode. In this way, such terms would turn to be empty names, as maintained by Hobbes, or their meaning would be changed in order to make them refer to bodily features[417]. By such terms, in fact, one can still refer to concepts, which are of relevant use in philosophy. In this way, the consequences of materialism, resulting from the rejection of Descartes's metaphysics, and the application of philosophy to all disciplines are shown by De Raey from a linguistic point of view.

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[415] «Quanquam cogitata, quatenus non sunt ullius rei extantis cogitata, sola per se intelligere, puta notionem causae sive causalitatis, sine re quae cogitatur esse causa […]; notionem divisibilitatis, sine re quae ut divisibilis spectatur […]; et sic porro ipsam per se notionem substantiae, essentiae, existentiae, […] etc. tam facile non sit quam quidem rem, de qua dicitur quod causa vel effectus sit etc. sine hoc dicto vel cogitato intelligimus», De Raey 1692, *Cogitata de interpretatione*, p. 191. See also p. 209: «hoc ipsum vero nos usus docet aliquando valde incommodum esse, praesertim in philosophia: sicut in vestitu incommodum esset varietate et ornatu carere, quando sunt in usu, atque iis assueti sumus», and pp. 212-213: «*facultas*, *vis*, *actio*, *natura*, *vita*, *anima* […] non sequitur quod aliud non significent aliud non faciant notum, […] sine quo illi ipsi, qui contendunt has voces insignificantes esse, loqui non possunt, et non loquuntur».

[416] «Ista […] veritas non invenitur in significatione omnium nominum quibus mathematici utuntur, neque mathematica abstractio sive demonstratio omnis in extantibus terminatur, verum communiter subsistit in cogitatis, non considerando an prima sint rerum extantium cogitata, an secunda coniuncta huius loci non est», *ibid.*, p. 188. see also p. 215 «tam multas in humano sermone contendunt voces insignificantes esse, ridentque et contemnunt abstracta de quibus loquimur nomina in cogitatis», ibid., p. 215.

[417] «Deinde diminutio, quatenus etiam in una voce restricta sive in arctum coacta significatio est, intra angustum terminum illum τοῦ ὄντως ὄντος (et quidem in corporalibus, de quibus adeo solliciti sunt) etiam multum habet incommodi, quando, ut communiter fit, facta per restrictionem subistitui alienae, atque propria significationis eversio intelligitur, quae propria significatio neque potest eque debet everti, quatenus et quousque communi consuetudine sermonis confirmata est. […] Ac si, quia in corpore quod nos sensu caloris afficit, est motus varius insensibilium particularum, nomen calor non mplius de passione in sensu, non de qualitate obiecti quod ita movet sensum, et, generali saltem sive qualicunque confusa notione, intelligitur causa esse sensus, verum de isto praecise debeat vario motu intelligi, ipsumque hoc novum nomen motus varius substitui, quando loquendum est de calore», *ibid*., p. 210. See also p. 212: «putamusque horum nominum significationem neque ab humano sermone, quo vel in communi vita, vel in disciplinis utimur ad huius vitae usum spectantibus removeri (ac si, ut loquitur Hobbesius, voces insignificantes sint) neque per substitutionem everti debere, ac si non amplius facultas, vis, actio, natura, vita, anima, verum motus, materia primi elementi, globuli coelestes, particulae striatae, dicere, aliisve debeamus novis nominibus uti, propter hoc unum, quod usitata illa non significent, non faciant notum in extantibus id quod in iis philosophus desiderat». See *supra*, nn. 377-378.

3.8 The system of philosophy

De Raey's foundation of philosophy is a survey of the limitations of human faculties. According to him, one can gain clear and distinct knowledge (*scientia*) in metaphysics, mathematics and physics. Metaphysics or logic – that is, first philosophy – works by intuition and has the highest degree of certainty, whereas mathematics works by chains of deductions and is subject to error to a greater extent, and physics concerns complex concepts, which need to be established and clarified by metaphysics itself. De Raey follows the traditional classification of *scientiae*: however, mathematics and physics can be as certain as metaphysics once they are provided with a foundation itself. Yet, in all these disciplines mind works by *modi considerandi*, even in acquiring metaphysical *scientia*.

To such disciplines – first philosophy and physics – De Raey added a further branch of philosophy, whilst not developing it. In his *Dissertatio de sapientia veterum*, the text of which had been read for his appointment as professor of philosophy at the *Athenaeum Illustre* of Amsterdam in 1669, and was later published in his 1677 *Clavis* and in the *Cogitata*, De Raey mentions moral philosophy as one of the three parts of philosophy, along with physics and rational or first philosophy. Such rational ethics is described – with stoic overtones – as relying on the use of intellect alone, and teaching how to avoid the fear of death, the duties of man, and to depreciate pleasure and pain[418]. This ethics is opposed to the common morals of men, as these pursue utility, and is supported by the *ius gentium* and *ius civilis*, based on the use of the senses, on authority and opinions instead of clear and distinct ideas[419]. De Raey does not further, however, his

[418] «Philosophia moralis ars bene beateque vivendi existens secundum verum intellectum, pariter docet nos in vita et moribus bonum a malo, virtutem a vitio secundum veritatem distinguere. Quatenus animus se ipsum cognoscens atque in se virtutis rationem intelligens, primum sui, hinc aliarum rerum potest pretium aestimare. Quo sit ut non amplius totus corpori inserviens, atque in eo sensibus et affectibus suis, etiam non sinat se seduci ab iis: sed rationem velit ac intellectus sequi. Quae prima, si non unica, virtus est, sub se omnes alias complectens. Ita fit, ut quisque apud se scientiam habens cum bona conscientia, inter alios viri boni officium praestare, apud se imprimis voluptatem et dolorem contemnere, hinc mortis metum effugere, et sic porro alia omnia quae cadere in hominem praeter voluntatem possunt», De Raey 1692, *De sapientia veterum*, pp. 378-379. Originally as *Dissertatio philosophica de sapientia veterum, recitata in Illustri Amstelodamensium Athenaeo cum primariam philosophiae professionem auspicaretur*, Amsterdam, apud Joannem Ravensteinium 1669.

[419] «In iure gentium omnes homine, in iure civili populum, aut civitatem, una dici potest ratio movere, quae non tam veritas et verus intellectus, quo iuris originem et veram causam novimus, quam utilitas, opinio, et saepe vis et autoritas est ac potestas imperantis», *ibid.*, p. 381. Moreover, in his *Cogitata* he mentions ethics as part of philosophy, on which politics is based. In this case, he seems rather to refer to the "vulgar" ethics. See De Raey 1692, *Cogitata de interpretatione*, pp. 8-9.

considerations to philosophical ethics[420]. He outlines a plan of philosophy consisting of logic or metaphysics, physics and ethics, independent from the disciplines based on vulgar knowledge: these are the amended natural history, on which medicine has to be based, ethics, which is the basis for politics, and "vulgar" metaphysics, leading to theology[421]. Yet, the practical end of rational ethics seems to be at odds with such a dichotomy of academic disciplines. If De Raey's projected plan of two parallel classes – practical or vulgar, and theoretical or philosophical – of academic disciplines was ultimately unfeasible, he was, however, one of the first philosophers who set a new function of logic and metaphysics: that is, De Raey used his first philosophy in order to provide a justification and a reflection on the proceedings of academic disciplines.

His case, moreover, shows how a foundation of philosophy as a purely intellectual enterprise had to be carried out: that is, as a logical examination of the basic rules of philosophical reasoning, their conceptual presuppositions, and a rational theology aimed at guaranteeing their reliability. No room is left for a consideration of the philosophical role of experience, nor on the use of hypotheses in natural philosophy. These issues, essential to philosophy of science as we conceive it today, found a consistent elaboration in some other foundational theories developed in the Dutch academic context, in the same years as De Raey provided his reflection on the scope of philosophy: namely, those of Arnout Geulincx and Burchard de Volder. Their theories would take into account some of the problems raised by Regius, Clauberg and De Raey: besides the foundation of the use of experience and hypotheses in philosophy, those of the foundation of a rational ethics, the justification of the value of evidence, and the use of *modi considerandi*. All these problems were faced in order to show the means and the conditions of *scientia* both in theoretical and practical knowledge, acquired by different means.

[420] In his *Cogitata* he merely considers the case of the substitution of good according to nature with good according to men as the meaning of "*bonum*", as Hobbes maintained: «in aliquibus […] habet plus periculi et maiorem confusionem parit, quam falsa et inepta Scholasticorum suppositio: ut si in moralibus, *bonum, malum, honestum, turpe, more, atque voluntate hominum*, subsituas, ut certe faciunt his temporibus plurimi, pro eo quod *est natura bonum, malum*; quae non tam substitutio, quam eversio est, quia si non est quicquam per se et natura bonum ante humanam omnem voluntatem, non est ullum bonum», *ibid.*, pp. 210-211.

[421] *Supra*, n. 326.

4. The rational-theological foundation of physics and ethics of Arnold Geulincx

4.1 Introduction

After the official appointment of Johannes de Raey at Leiden University in 1653, the University Curators strengthened the presence of the new philosophy in the Academy with the assignment of a position to the Flemish Professor Arnold Geulincx (1624-1669). However, even if unmistakeably concerned with Cartesian philosophy – especially after his coming to Leiden, as he previously defended Baconian positions[422] – Geulincx had some ideas on the foundation of which were different from those of De Raey, Clauberg and Regius. As I will show in this chapter, Geulincx considered moral philosophy to be the highest branch of philosophy, physics as a subordinate science and natural theology as their foundation. He supplied a theological foundation to physics, no more regarding it as *scientia* but rather as an empirical, hypothetical discipline. On the other hand, according to Geulincx, ethics relies on intellectual ideas more than on experience, and logic does not concern the nature of mental faculties but syllogistic demonstrations.

Born in Antwerp in 1624, Geulincx obtained a degree in philosophy at Louvain University in 1643, and, probably, a degree in theology. In 1646 he became a professor of philosophy in Louvain. In 1652 he was appointed as a *professor primarius* and participated in the final year session of the *Quaestiones quodlibeticae*, whose introductory speech[423] bears witness to Bacon's influence on him. The criticisms of his Aristotelian colleague Vopiscus Plempius (1601-1671) notwithstanding, the speech does not seem to have caused any doctrinal problems to Geulincx. However, six years later he moved to Leiden for having broken the rule of celibacy for professors[424]. There, he obtained a degree in medicine (1658) and started to lecture in philosophy, being officially nominated lecturer

[422] Aalderink 2009, pp. 52-55.

[423] The text of the *Questiones quodlibeticae in utramque partem disputatae* (Antwerp, bij de W[e] Cnobbaert 1653) was published for the second time in 1665, with some variations: *Saturnalia, seu (ut passim vocantur) Quaestiones Quodlibeticae in utramque partem disputatae. Editio secunda ab auctore recognita et aucta*, Leiden, ex officina Henrici Verbiest 1665.

[424] See A. Geulincx, *Ethics: With Samuel Beckett's notes*, ed. by H. van Ruler, A. Uhlmann, M. Wilson, transl. by M. Wilson, Leiden, Brill 2006, pp. XV-XVI, n. 2.

in logic, philosophical exercises and metaphysics in 1662. Later, he started to teach ethics and was appointed as *professor ordinarius* of philosophy in 1665, being allowed to teach moral philosophy only in 1667, two years before his death, which occurred during the Leiden plague.

Several monographs and articles have been devoted to Geulincx in the last two centuries, since the pioneering studies of J.P.N. Land, editor of a three volume *Opera omnia* (1891-1893), whose works are the main biographical sources on him[425]. Among the most recent contributions we find those of Mark Aalderink, Bernard Rousset and Han van Ruler, who have focused on Geulincx's theory of knowledge[426], on his systematic view of philosophy[427], and on his positions in the debates on causality in the Cartesian context[428]. Starting from their conclusions, I will analyse Geulincx's account of the relations between rational theology, physics and ethics, which has not been highlighted in the recent literature. Geulincx's case makes it possible to make some observations on the theory of grounding ethics as a part of philosophy in a Cartesian context. Initiated by Clauberg and De Raey, the project of a philosophical ethics was fully undertaken by Geulincx. For this purpose, besides the relation of body, soul and world, Geulincx considered those relations of man, world and God from which moral duties follow. Accordingly, Geulincx provided his ethics with a foundation in rational theology. In turn, this foundation entails a reflection on the type of knowledge that constitutes physics, and determines its very method. In this chapter, I will show that given the inscrutability of God's reasons in creating the world, Geulincx could claim that

[425] A. Geulincx, *Opera philosophica*, ed. by J.P.N. Land, The Hague, M. Nijhoff 1891-1893: vol. I (1891), vol. II (1892), vol. III (1893); J.P.N. Land, *Arnold Geulincx te Leiden (1658-1669)*, «Verslagen en Mededeelingen der Koninklijke Akademie van Wetenschappen, Afdeeling Letterkunde» 3 (1887), pp. 277-327; id., *Arnold Geulincx und seine Philosophie,* The Hague, M. Nijhoff 1895; id., *Arnold Geulincx and His Works*, «Mind» 16 (1891), pp. 223-242

[426] Aalderink 2009, part III.

[427] B. Rousset, *Geulincx entre Descartes et Spinoza*, Paris, Vrin 1999.

[428] H. van Ruler, *"Something, I know not what". The Concept of Substance in Early Modern Thought*, in L. Nauta and A. Vanderjagt (eds.), *Between Imagination and Demonstration. Essays in the History of Science and Philosophy Presented to John D. North,* Leiden, Brill 1999, pp. 365-393; id., *Minds, Forms, and Spirits: The Nature of Cartesian Disenchantment*, «Journal of the History of Ideas» 61 (2000), pp. 381-395. For a more detailed bibliography, see Aalderink 2009, pp. 405-423; H.J. de Vleeschauwer, *Three centuries of Geulincx research: A bibliographical survey*, Pretoria, Communications of the University of South Africa 1957. other studies on Geulincx's philosophy are R. Buys, *Between Actor and Spectator: Arnout Geulincx and the Stoics*, «British Journal for the History of Philosophy» 18 (2011), pp. 741-761; J.-F. Battail, *Arnold Geulincx*, in Jean-Pierre Schobinger (ed.), *Grundriss der Geschichte der Philosophie*, vol. 2, Basel, Schwabe 1993, pp. 375-397; B. Cooney, *Arnold Geulincx: A Cartesian Idealist*, «Journal of the History of Philosophy» 16 (1978), pp. 167-180; K. Dürr, *Die mathematische Logik des Arnold Geulincx*, «The Journal of Unified Science» 8 (1939-1940), pp. 361-368; S. Nadler, *Knowledge, Volitional Agency and Causation in Malebranche and Geulincx*, «British Journal for the History of Philosophy» 7 (1999), pp. 263-274; G. Nuchelmans, *Geulincx' Containment Theory of Logic,* Amsterdam, Koninklijke nederlandse Akademie van Wetenschappen 1988; T. Verbeek, *Geulincx, Arnold (1624-69)*, in Edward Craig (ed.), *Routledge Encyclopedia of Philosophy*, vol. 4, London, Routledge 1998, pp. 59-61.

physics has to proceed by hypotheses based on experience rather than by a deduction of natural laws from metaphysical principles. In this way, the epistemic consequences of his foundational theory refuelled a reflection on the method of natural philosophy itself.

4.2 Cartesianism and theology

Geulincx's interest in ethics can be seen as the main motive of his original approach to the foundation of physics. The problems he faced have to be found in the Flemish and Dutch philosophical contexts from which he worked. Geulincx's positions on the role of God and on human nature, though primarily of a moral philosophical content, link up with contemporary questions of physics with which they were to be made consistent. Geulincx's physics had an empirical character, developed within a broader ethical perspective: in fact, his physics is to be seen as a systematization of Descartes's, while making clear the importance of hypotheses or *a posteriori* explanations, based on the experience of natural effects. In Geulincx we find the link between human experience on the one hand and the mechanistic reinterpretation of such experience which is typical of a Cartesian view of philosophical knowledge and offers such a reconstruction of experience as the proper object of physics.

In Holland, Geulincx was not supported by his Cartesian colleagues in philosophy but by the theologians: Abraham Heidanus (1597-1678) and Johannes Cocceius (1603-1669), protagonists of Cartesian theology[429]. Geulincx's closest supporter was Heidanus, who shared with him an approach deeply influenced by Jansenism430. Actually, Geulincx was under the influence of Augustinian ideas since his Louvain years, where the ideas of Jansenius's *Augustinus* (1640) were well known. In Leiden, Cartesianism, Augustinianism and the theology of Heidanus can be seen as the keystones of Geulincx's philosophy. Whereas De Raey was educated among the first Dutch Cartesians, mainly interested in the introduction of a new physics in the academy (following Descartes's agenda), Geulincx had a different philosophical agenda. This also meant that he could

[429] See E. Bizer, *Reformed Orthodoxy and Cartesianism*, in R.W. Funk (ed.), *Translating Theology into the Modern Age*, New York, Harper Torchbooks 1965, pp. 20-82; Van Asselt 2001, p. 7; H. van Ruler, *Reason Spurred by Faith: Abraham Heidanus and Dutch Philosophy*, «Geschiedenis van de Wijsbegeerte in Nederland» 12 (2001), pp. 21-28.

[430] See Aalderink 2009, p.12; Van Ruler 2001, pp. 21-28.

develop a more open attitude towards natural philosophy than his colleague in philosophy De Raey , and deal with Cartesian positions in the same manner as reformed theologians such as Heidanus, who was influenced by Cartesianism, but no philosopher himself. The most evident consequence of this is that, contrary to De Raey, Geulincx developed an ethics grounded in rational theology, matching the exigences of philosophy and faith by presenting the *vita christiana* as the final stage of ethics[431]. According to Martial Guéroult, Descartes did not develop an ethics because it would deal with the obscure ideas related to the mind-body union[432]. Indeed, the first thinker who tried to develop a Cartesian ethics was Geulincx. If Descartes was prevented from developing a rational ethics on account of problems related to his metaphysical dualism, Geulincx tried to develop his ethics while giving attention to Augustinian positions that enabled him to go beyond Descartes's difficulties.

The influence of Descartes and of Augustinian philosophy, together with the demands of the Reformed creed in ethics, may thus be seen as the motives for Geulincx's approach. Indeed, by his system he answered the need for a new moral philosophy to accompany the renewal of natural philosophy, a problem left unsolved by Descartes. Moreover, he tried to give the Cartesian theologians – and all believers as well – a rational ethics consistent with Reformed Christianity[433]. Geulincx's emphasis on the passivity of man with respect to God, which leads to an ethics that concerns our internal attitudes (the cardinal virtues of obedience and humility) more than our habits[434], matches the belief in predestination and in the small value of external acts. Moreover, the need for a philosophical guide in morals was felt in Dutch society, as can be argued from the vulgarization of his 1665 *Ethica*[435].

Another possible reason for his philosophical attitude is the spread of Spinoza's ideas around 1660, that is to say, during the years in which the *Tractatus Brevis* and the *Tractatus de intellectus emendatione* were composed[436]. Actually, it is still debated whether Geulincx and Spinoza ever had

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[431] See Geulincx 1893, *Ethica*, p. 110. In 1665 the first treatise was published as *De virtute et primis eius proprietatibus* (Leiden, apud Philippum de Croy), in 1675, a complete version was posthumously edited by Cornelius Bontekoe: *Γνῶθι σεαυτόν, sive Ethica*, Leiden, apud Adrianum Severini 1675.

[432] See M. Guéroult, *Descartes selon l'ordre des raisons*, Paris, Aubier 1953, vol. II, pp. 250-259.

[433] According to Han van Ruler, «Geulincx was the perfect candidate to fulfil a task Heidanus was eager to support: the invention of a Christian philosophy of morals», see Geulincx 2006, pp. XV-XVI, XXI.

[434] See Geulincx 1893, *Ethica*, I, § 3.

[435] A. Geulincx, *Van de Hooft-deuchden: De eerste Tucht-verhandeling*, Leiden, bij Philips de Croy 1667.

[436] See F. Mignini, *Sur la genèse du Court Traité: l'hypothèse d'une dictée originaire est-elle fondée?*, «Cahiers Spinoza», V (Hiver 1984-1985), Éditions Réplique, Paris, 1984, pp. 147-165; *Nuovi contributi per la datazione e*

any direct contact[437]. However, there are several similarities in their approach as well as differences in their solutions. Answering the same demand for a morality based on the new philosophy, both Geulincx and Spinoza were developing a rational ethics. Like Spinoza, moreover, Geulincx had a troubled life: after having been expelled from Louvain University he suffered personal and academic isolation in Leiden, spending his last years in poverty. His ethical system, based on humility as the main virtue and on the acknowledgment of our passivity towards God, can be read as being influenced by his ill fated life. Similarly, Spinoza developed a philosophy to carry the soul away from the turbulence of the passions. Geulincx's ethics can thus in many ways be seen as a twin to Spinoza's: indeed, Geulincx's philosophy was later portrayed as proto-Spinozistic by Ruardus Andala[438]. On the other hand, the differences between Geulincx and Spinoza may also justify the hypothesis that Geulincx was reacting to Spinoza's ideas by developing an ethics more consistent with a Christian morality.

These reasons can make us understand Geulincx's peculiar position. In fact, Geulincx is not concerned with a "logical" epistemology, because, in order to present a Cartesian moral philosophy that would meet Christian standards, he fully focuses his system on the relations between God and man and on human passivity in respect of God. The latter ideas are deduced from Cartesian metaphysics, since Geulincx finds in occasionalism a way to explain the interaction of substances in a world deprived of active forms. De Raey's order of disciplines is thereby rejected: moral philosophy is now at the top of the agenda, provided with the highest degree of certitude and grounded in theology. Physics, on the contrary, though it still has an essential role in the plan of the philosophical disciplines, is a discipline described as the floor of the House of Philosophy[439].

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l'interpretazione del Tractatus de Intellectus Emendatione, in E. Giancotti, *Spinoza nel 350° anniversario della nascita. Atti del congresso internazionale (Urbino 4-8 ottobre 1982)*, Napoli, Bibliopolis 1985, pp. 515-525.

[437] See Rousset 1999, pp. 12-20; H. van Ruler, *Geulincx and Spinoza: Books, Backgrounds and Biographies*, «Studia Spinozana: An International and Interdisciplinary Series» 15 (1999), pp. 89-106.

[438] R. Andala, *Examen Ethicae Clar. Geulingii sive Dissertationum Philosophicarum, in quibus praemissa Introductione sententiae quaedam paradoxae ex Ethica Clar. Geulingii examinantur, Pentas*, Franeker, Wibius Bleck 1716.

[439] *Infra*, n. 457.

4.3 The architectonic of philosophy

For Clauberg, De Raey and other Cartesian logicians, such as Arnauld and Malebranche, logic involves epistemological considerations[440]. This, however, is not the case for Geulincx. He conceives logic as the science of argumentation, following a traditional approach well explained in an oration of 1662: the *Oratio de removendis parergis et nitore conciliando disciplinis*. As the title suggests, this oration was aimed at a removal of all the introductory questions from logic, and to reduce the discipline to a terse body of knowledge that concerned only the forms of demonstration. Logic must avoid proemial questions such as "what is logic?", which occupy the first pages in the Scholastic manuals, e.g. Burgersdijk's *Institutiones logicae*[441], and which involve irrelevant discussions on the whole structure of philosophy[442]. The considerations on the function of logic are described in the *Dictata* to his *Logica restituta* (1662) as belonging to a *scientia scientiarum*, not to logic itself[443]: indeed, it is metaphysics, or a still unnamed discipline that must be the science of sciences, later called *Encyclopaedia*[444]. Hence, Geulincx compares the proper content of logic to the cleanliness of the Dutch towns[445]. In his use of this metaphor, besides appealing to the pureness of

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[440] See Schuurman 2004, pp. 34-50, 63-64.

[441] F. Burgersdijk, *Institutionum logicarum libri duo, editio novissima*, Amsterdam, apud Aeodium Walckenier et Casparum Commelinum 1660 (1st ed. Burgersdijk 1626), pp. 1-6.

[442] Geulincx 1891, *Oratio de removendis parergis*, p. 153. The text was originally included in his *Saturnalia*: Geulincx 1665, pp. 350-384.

[443] «Hic proprie incipit logica; quae praecesserunt enim ea ex scientia de scientiis mutuati sumus. Nam logicae non est dicendum, quid facere debeat logica, sicut militis non est dicere quid miles facere debeat, sed id facere, nec de armis, sed arma tractare. Haec igitur omnia in prooemio Logices dicta sint, atque ibi maneant, neque se unquam in logicam ipsam exferant», Geulincx 1891, *Dictata ad logicam*, p. 459. First edition by Land.

[444] «Spectat ad disciplinas toto coelo diversas […] de scientia illa tractare. Logicus aliquis aut physicus tractatus ad logicam pariter aut pysicam pertinet; sed quae sunt de logica vel physica disputationes, non his scientiis, sed metaphysicae, aut, quod malo, disciplinae cuidam, cui nomen non est, quaeque de ipsis disciplinis agit, debentur», Geulincx 1891, *Oratio de removendis parergis*, p. 154. See also his *Logica restituta*: «sicut enim datur scientia aliqua de virtute (et haec est ethica), item scientia aliqua de argumentatione (et haec est logica), item scientia aliqua de rebus materialibus (et haec est physica), et sic de caeteris, – sic etiam datur scientia aliqua de ipsis scientiis, ubi desinere, unde incipere debeant; quo tenore, quae tractanda in iis sunt, disponi ordinarique debeant. Proinde haec scientia praescribit etiam logicae», Geulincx 1891, *Logica restituta*, p. 455. *Encyclopaedia* will be described as the *scientia scientiarum* only in the *Metaphysica vera*, as the outline of the system of the sciences that Geulincx puts at the beginning of the treatise: see Geulincx 1892, *Metaphysica vera*, p. 139. Originally as *Logica fundamentis suis restituta*, Leiden, apud Henricum Verbiest, 1662, and *Metaphysica vera et ad mentem peripateticam*, Amsterdam, apud Joannem Wolters 1691 (a).

[445] «Mundus quidam est ipsum Belgium, si a munditia, quod volunt, mundus dicitur. […] Sed si nitor […] nonne indignum hoc foret, si domi quidem limpidi, foris nitidi volutaremur autem in schola?», Geulincx 1891, *Oratio de removendis parergis*, pp. 151-152. He was under criticism for the terse structure of his logic: «quis non aegre ferat, exstirpatis succulentis illis et floridis, relinqui tantum arida quaedam et stricta, quae saepe tetricum illud A, B, C mathematicorum affectant? Hae et similes rhapsodorum querelae […] cum se ipsae satis explodant, non est quod a

formal reasoning, we can read a criticism of the problem of the improper mingling of disciplines. The development of a logic focused only on the forms of argumentation in fact helps to keep disciplines separated and prevents the object and method of one discipline from being adopted by another[446]. Actually, the purgation of logic carried out in the *Logica restituta* is aimed against the influences of Aristotelian logic in metaphysics, where logical concepts have been mistaken for existing things, as Geulincx points out in his *Metaphysica falsa sive ad mentem peripateticam* (1691, posthumous edition)[447]. However, this criticism also concerns the positions of some Cartesians, as it has as its direct consequence the disregard of epistemological discussions in logic.

Logic, according to Geulincx, still has an architectonic has a preliminary function[448]: it first functions as an instrumental discipline. This is carefully explained in the manifestos of Geulincx's philosophy: the introductory oration to the *Questiones quodlibeticae* (1652, 1665) and the dedicatory letter of the first edition of the *Ethica* (1665). Logic, indeed, only concerns demonstrations; thus it serves all the other disciplines, first of all mathematics, which adopts demonstrative proceedings[449].

In the introductory oration to the second edition of his *Questiones quodlibeticae* Geulincx outlines an ordered plan of studies beginning with mathematics, which has a pedagogical role, since

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me pluribus refellantur», Geulincx 1891, *Logica restituta*, p. 172.

446 «Anomalia, congeries immensa sordium; Augiae stabulum dixeris, et Herculeus profecto labor est illud expurgare; ita profunde subsidit, et per cuniculos in purissima quaeque surrepit illa colluvio. Anomaliam in scientiis voco cum obiectum uni, et tractandi modus alteri cuidam disciplinae accommodatus est; ut si res logicas physice, aut physicas logice contemplemur. Plerumque, qui in hac sentina volutantur, obiectum ex quavis disciplina nacti, modum tractandi mutuantur ex grammatica et metaphysica», Geulincx 1891, *Oratio de removendis parergis*, pp. 156-157. The very problem of method itself is to be considered, in order to avoid the confusion of disciplines, apart from logic, or by a *scientia scientiarum*, see the *Appendix* to the *Logica restituta*, Geulincx 1891, p. 454.

447 «[…] pronitas humane mentis ad affingendum modos suarum cogitationum rebus cogitatis» Geulincx 1892, *Metaphysica ad mentem peripateticam*, p. 200. The preface of the *Logica restituta* recalls the same point: by the study of logic we cannot deduce anything in metaphysics. For instance, the use of *loci* – as examined by Ramus – is rejected by Geulincx as an improper use of metaphysical concepts in logic for the sake of the solution of all kinds of problems, even those about which scholars do not understand anything: «laudatam illam et arctam semitam nunquam eos ad causas ad effecta, subiecta, similiaque, quae metaphysicae tantum considerationis sunt, ducturam fuisse. Ego igitur conatus sum, quod titulus libelli promittit, eiectis omnibus alienis, quae iam totam fere logicam occupaverant, eam sibi restituere […], e Logica exterminare amplissimos illos Locos […] quibus iuventus instructa erat ad syllogisandum de omni proposito problemate, etiam in materia spectante ad disciplinam aliquam cui nomen suum non dederant, et de qua nihil intelligebant», Geulincx 1891, *Logica restituta*, p. 172. The use of *loci* as the cause of the confusion of logic and metaphysics is also noticed in the main text of the *Logica restituta*, Geulincx 1891, p. 385. This kind of criticism is pursued by De Raey in his *Specimen logicae interpretationis*, cf. the previous chapter.

448 See the dedicatory letter of the *Methodus inveniendi argumenta* (Leiden, apud Isaacum de Waal, 1663): «pergit etiam ad vos libellus hic, via quam alter ei libellus anno iam vertente praeiverat. Logici sunt ambo, palos et rudera convehunt, futuris aedibus fundamentum», Geulincx 1892, p. 3.

449 Geulincx 1891, *Oratio de removendis parergis*, p. 162. See also the *Logica restituta*, Geulincx 1891, p. 382.

it shapes the young minds for the practice of demonstration. Then comes logic, the science of *consequentiae,* which includes mathematics[450]. After these, there is metaphysics, which provides all the other disciplines with their foundation. Metaphysics concerns the properties of body and mind, but not yet those of God[451]. Physics and ethics come next: in fact, in the *Oratio* the focus is more on physics than on ethics. The main topic of the text, indeed, is the eradication – in a Baconian fashion[452] – of the causes of error in physics. This science, for which a «maturior stomachus requiritur», according to the first edition of the text[453], is put at the centre of the system and it is preceded by a preliminary discipline: natural history. Geulincx introduces a modern – Baconian – way of the observation of nature, no more based on the textual discussions plaguing the Aristotelian commentaries, but on the use of «telescopia, […] anatomica theatra, alembici, fornaces, magnetes» and other means revealing the miracles of nature to us[454], which are combined with our demonstrative skills for the sake of the formulation of physical hypotheses[455]. These, at least according to the first edition, have a strongly provisional status[456]. Finally, ethics is at the end of the system: no words, however, are spent on it. Moreover, a concern with rational theology is not yet adopted by Geulincx. However, the empirical and hypothetical method for physics will find a strong basis in Geulincx's mature metaphysics and natural theology, as I am going to show. His empirical physics can not only be seen as a Baconian trace in the Dutch and Flemish context, nor just as the rejection of the bookish Scholastic philosophy, but as a method fully consistent with the metaphysics which he later developed and which was mainly concerned with theology.

A similar agenda is proposed in the dedicatory letter of the 1665 *Ethica*, which sets off with a

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[450] «[…] sine qua apodixes mathematicae non satis feliciter procedunt […]. Quae quidem scientia non ita ex tempore et sparsim (ut hodie fit) velut silva et rhapsodia tradatur, sed ordine ac tenore geometrico», Geulincx 1891, *Oratio prima*, p. 42. Differences with the Louvain edition (1653) are presented in notes by Land.

[451] «Tribus his […] metaphysicam subnectant, sed probe repurgatam, mentis et corporis essentiam ac proprietatis apodictice perhibentem», *ibid*.

[452] See Aalderink 2009, pp. 46-55.

[453] Geulincx 1891, *Oratio prima*, p. 41, n. 13.

[454] *Ibid*., pp. 41-42.

[455] «Intelligentia iam a scientiis culta, ab experientiis firma ac matura, hypothesis physica proponatur, quae sensum cum ratione, experimenta cum scientiis ad amussim conciliet», Geulincx 1891, p. 42. See also Geulincx's commentary to his *Oratio*, added in the Leiden edition: «at hypothesis in disciplinis huc tota refertur, ut declaret et facem praeferat rebus obscuris», *ibid*., p. 64

[456] «In hanc ne iuret discipulus; teneatur quoad phaenomenis omnibus respondeat; ubi in puncto deficit, reiiciatur, et alia tentetur verum», Geulincx 1891, p. 42. In the second edition, however, the accent is more Cartesian as reason is conceived as the faculty which decide upon the role of authority and experience, and corrects what experience suggests us: «quomodo enim ratione potior et antiquior auctoritas, experientia, aut aliud huius generis quodcunque, si cur ita sit, dicenda est ratio? Certe quod ratione aliqua suaderi probarique debet, totum id sub ratione est. Primum igitur, o homo, ratio est», *ibid*., p. 58. See also pp. 50-51, 54-55.

metaphor in which Geulincx compares the *Encyclopaedia* of philosophy to a house. Logic is the foundation, mathematics and metaphysics are the columns, physics is the floor and the decoration of the house and ethics is the roof which makes the structure complete[457]. Physics has here lost the status of the main discipline which it had in De Raey, even if it maintains an essential role as the floor of the House of Philosophy. Moreover, logic, mathematics and metaphysics form the instrumental and epistemological basis of physics and ethics. Even if, in this plan, metaphysics comes after logic and mathematics, it is in fact the first science which provides the other disciplines with their epistemological foundation. Logic, on the other hand, is the instrument for inferences. Metaphysics also establishes some principles which are used by logic itself, such as those of whole and part[458]. Logic and metaphysics, despite all the efforts to keep them apart (in order to avoid the error of a metaphysical use of logical notions that was criticized in the *Metaphysica falsa sive ad mentem peripateticam*), are still presented here as being deeply connected, since Geulincx argues that a use of metaphysical *modi considerandi* is inevitable in every science[459]. Both logic and metaphysics are about mental entities, which makes it difficult for them to remain detached; moreover, metaphysics provides logic with its concepts, thus posing the problem of a circularity in Geulincx's system. In the next sections, I will outline Geulincx's solution to this issue, clarifying how Geulincx defines the proper relations among disciplines.

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[457] «Ea re Libellos vobis in lucem edidi Logicos duos; quorum alter palos et caementa, solidando paviendoque fundo, alter intritam et ferrumen conferret, quibus haec inter se durata vincirentur et coalescerent. […] Iacta sunt Encyclopaediae fundamenta. Interea vero, dum haec fundamenta sibi esse sino, ut, an dehiscant alicubi vel desciscant, an autem perstent et ferendo sint, explorem […] quaedam, quae inter exstruendum usui futura videbantur, parabam, aptabam, dolabam: columnas, tigna. […] Contuli me ad opus amoenum magis: futuri aedificii Coronidem fabricare ingressus sum. […] Coronis ea, De Virtute et primis eius Proprietatibus Commentatio est. […] Igitur in Sapientiae sano laquearium et tectum est Ethica. Ut a Logica fundamentum sit firmum et bene fistucatum; a Mathematica et Metaphysica columnae robustae, parietes bene materiati; a Physica pavimentum et opera intestina cuncta concinne eleganterque elaborata; - tamen sine Ethica nunquam sartum tectum est hoc templum. Imo sine Ethica non templum est sed impluvium; non ad sacra, non ad polluctum valet», Geulincx 1893, *Ethica*, pp. 3-4.

[458] See his *Methodus inveniendi argumenta*: «principia generalia spectant ad metaphysicam. Metaphysica enim sola praecedit logicam inter scientias, quamvis nec sine logica tradi possit», Geulincx 1892, *Methodus inveniendi argumenta*, p. 6. These notions are the basis of the so called logical containment theory, treated in Nuchelmanns 1988.

[459] On the inconceivability of *Ding an sich* without mental categories, see E. Cassirer, *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit*, Berlin, Bruno Cassirer 1906-1920, vol. I, pp. 455-474.

4.4 From logic to theology

The proper foundation of physics and ethics, the two disciplines served by logic and mathematics, is provided in the *Metaphysica vera*[460]. Metaphysics is here described as the whole *corpus* of sciences, or the *prima scientia* from which all the others flow: geometry or the *excursus figurarum*, arithmetic or *excursus numerorum*, logic or *excursus in consequentias*, ethics or *excursus in mores*. Another distinction of disciplines comes through *miscellanea*, or the inclusion of hypotheses which give rise to physics, scriptural theology, law, medicine and all the other arts[461]. Actually, whereas hypotheses concern something we cannot know with certainty, and *miscellanea* characterize provisional knowledge, all the *excursus* of metaphysics share the epistemological status of metaphysics, since all these *excursus* are based on purely intellectual principles, and are *scientia* or evident knowledge. This epistemological difference between *miscellanea* and *excursus* neatly matches the big difference in Geulincx between hypothetical physics and rational ethics. The point can be illustrated by examining the way in which Geulincx builds up his metaphysics.

Some notions in the *Metaphysica* are taken from Descartes's philosophy. Geulincx's argument, for instance, starts from the *cogito*. Thus, his metaphysics or *prima scientia* begins with doubt in order to make our mind empty of all apparent knowledge[462] and to attain the fundamental notions of mind, body and God, referring to the objects of the three branches of metaphysics: *Autologia*, *Somatologia* and *Theologia*. Geulincx, however, includes some logical remarks in the "introspective" intuitions of the *cogito*. According to him, for instance, the first truth we attain is inferential[463]. The supposition that everything is false, indeed, leads to the logical conclusion that it is true that something can be true or false[464]. The beginning of metaphysics confirms the

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[460] Metaphysical considerations or resumes of his later *Metaphysica vera* are provided in his treatises on physics and ethics. They are summarized in the 1665 *Ethica*, where *humilitas* as virtue is deduced from the metaphysical account of the self, *inspectio sui* (see *Ethica*, tract. I, ch. II, sect. II, § 2: Geulincx 1893, pp. 30-37).

[461] Geulincx 1892, *Metaphysica vera*, pp. 139, 266.

[462] In the *Disputationes metaphysicae* Geulincx clarifies how doubt proceeds: that is, through the supposition of the falsehood of all knowledge. It is, in fact, a suspension of judgement: see Geulincx 1892, *Disputationes metaphysicae*, pp. 476-480. These disputations were first published along with his *Annotata maiora in Principia philosophiae Renati des Cartes*, (Dordrecht, ex officina T. Goris 1691 (b)), along with other disputations on logic and physics that he held between 1663 and 1669.

[463] «Suppositio haec, qua sic omnia falsa esse supposuimus, facit etiam ad clarissime demonstrandum primam veritatem», Geulincx 1892, *Metaphysica vera*, p. 142.

[464] «Praeclarius enim demonstrari non potest propositio aliqua quam per dilemma, in quo ex falsitate propositionis demonstrandae infertur per necessariam consequentiam veritas eiusdem. Propositioni enim, quae sic demonstrata

connections between the different parts of Geulincx's system: logic is not used to formalize all the reasoning in metaphysics; however, logical inclusions are present in its arguments and ground the validity of the first truth that follows the initial doubt. Logic, in some manner, teaches the metaphysician how to proceed by training his mind in the procedures of philosophy. On this account, it has a pedagogical, preparatory role within Geulincx's system[465].

The formalistic attitude of Geulincx is mainly reflected, however, in his critique of the reliability of Descartes's criterion for evidence which, according to him, provides only a "psychological" certainty. It is always possible, indeed, to suspect the propositions which seem to be "evident"[466]. Intuitive evidence can deceive us: in some instances we can recognize deception only *a posteriori*, as in the case of the addition of the same number to a odd and an even number, which seem "evidently" to be still single and double after the addition[467]. Evidences are corrected by the intellect, as this is the faculty which judges both the questions it raises itself and the "evidences" of the senses[468]. Therefore, it is our highest faculty. Its reliability seems to be justified only through its primacy. This critique of evidence as the criterion of truth, apparently provided by Geulincx *en passant*, is in fact a cornerstone in the avoidance of a foundation of *scientia* that might make superfluous an appeal to God. This is what Descartes does in the *Fifth Meditation*, grounding

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est, falsum subesse non potest, adeoque necessario vera est; nam sive vera sit, vera est, sive etiam falsa sit, vera est. V. g. si dicam: aliqua propositio vera est, dico adversario: pone hoc esse verum vel falsum, perinde est, nam nihilominus demonstrabo esse verum», *ibid*.

[465] Geulincx assumes Descartes's "argument" of the *cogito* as an example for his considerations on hypothetical syllogism: see the *Methodus inveniendi argumenta*, Geulincx 1892, pp. 88-89, 109-110.

[466] «Suspectare etiam possumus in genere illas propositiones, quae nobis ante hac certissimae videbantur; idque per rationes, ut apparet, convincentes, quamdiu intellectum avertimus ab evidentia istarum propositionum, quas tamen certo et evidenter sciamus», Geulincx 1892, *Metaphysica vera*, p. 142.

[467] «Et videtur ratio aliqua convincens militare pro ista persuasione. Cum enim certo aliquo modo se habeant duplum et simplum, quamdiu utrique idem accedit, videntur in eodem statu permanere; cum enim ea, quae certo modo se habent, mutantur, et modum istum amittunt, signum est, fortius aliquid uni eorum quam alteri accessisse. Sic duo parietes albi eodem modo albi manebunt, quamdiu aeque multum albedinis accedit ad utrumque; et aequalia semper manebunt aequalia, quamdiu idem aut aeque multa iis addentur. Unde videmus, falsitatem istius principii, duplum et simplum, cum idem et aequalia accedunt utriquae semper duplum et simplum manebunt, agnosci tantum a posteriori, applicando mentem ad exempla dupli et simpli. […] Quamdiu autem a priori principium illud intuemur, fortissimum esse videtur, et nihil occurrit, quod veritatem eius suspectam reddere posse videatur», *ibid*., p. 143. This argument is used also in the *Disputationes metaphysicae* as one of the sceptical arguments, see Geulincx 1892, p. 484.

[468] «Secundo intellectus noster corrigit sensum in suis evidentiis. […] Quid scimus autem an, sicut sensus corrigitur in sua evidentia a facultate aliqua altiori, sic etiam intellectus in suis evidentiis non possit corrigi a facultate ipso altiore? Certe enim intellectus non evidentius percipit, duo et tria esse quinque, quam aspectus percipit circulum igneum in casu posito. […] Sed quis dicit, intellectum sensu digniorem esse, nisi ipse intellectus ? Sensus enim hoc non dicit, sed ostendit et repraesentat modo obiecta; num ipse dignior vel indignior sit intellectu, in medio relinquit», Geulincx 1892, *Metaphysica vera*, pp. 143-144. Geulincx notices this also in the introductory oration of his *Quaestiones quodlibeticae*, see *supra*, n. 456.

on God's benevolence only the reliability of the memory of past evidence, whereas the reliability of actual evidence is intuitive and self-grounded[469], and which is reassessed by Clauberg, De Raey and De Volder also. Geulincx, however, reinstates God in the role of a warranter of present evidence as well. This solution, in fact, is an *unicum* in the history of Dutch Cartesianism, with the exception of Regius's positions, which are however developed on the basis of the rejection of pure intellectual evidence. Accordingly, God's veracity is a guarantee to conclude from psychological certainty to logical certainty: it is this premise that turns Geulincx's metaphysics into theology. As will be shown in the next sections, intellectual evidence is grounded in intellectual truths perceived in the very mind of God.

4.4.1 An Aristotelian axiom

The parts of Geulincx's metaphysics are *Autologia*, *Somatologia* and *Theologia*, or the consideration of the self, of the body and of God. *Autologia* is the first and main part, from which the others directly follow. Actually, the propositions or truths of metaphysics are attained by an introspective method (like Descartes's) and not deduced in a strict geometrical way. Even if logic plays some role in metaphysics by being included in its preliminaries, Geulincx still follows a method very different from that of Spinoza[470].

Introspection or *inspectio sui* makes us aware of some truth, as «me esse», «varios habeo cogitandi modos», and «ego sum res una atque simplex»[471]. This is the basis of the whole further development of metaphysics, along with the well-known axiom according to which

> impossibile esse, ut is faciat, qui nescit quomodo fiat[472].

[469] See AT VII, pp. 69-70.
[470] Rousset writes that «car c'est bien ainsi que va procéder Geulincx: alors que tout ce que nous avons vu reste de l'ordre des instruments extrinsèques, la méthode intrinsèquement philosophique, propre à sa Philosophie, à sa Métaphysique avec toutes les conséquences qu'on peut en tirer pour la suite, principalement pour l'*Ethique*, se ramène, comme nous allons le voir, à la simple *Inspectio sui*, sans aucun autre moyen pour constituer la *catena demonstrationum*, qui ne ne trouvera même pas sa forme dans ses raisonnements de nature déductive, comme chez Spinoza», Rousset 1999, p. 43.
[471] Geulincx 1892, *Metaphysica vera*, pp. 147-149.
[472] *Ibid*., p. 150.

This axiom leads to the consequence that we are not the authors of our sensations and movements, since we are not conscious of the way we produce these. Their cause must therefore be found in God. This axiom is a relic of the Aristotelian hierarchy of forms, in which those that are separated from matter and provided with a rational principle (namely, the human and divine intellects) are ontologically superior to those informing brute matter. Actually, Geulincx seems to develop his system upon an Aristotelian principle. Indeed, among souls those which attain true knowledge are superior to the others as they realize their proper end. They are active, whereas the others, which are not aware of what they are doing, do not realize their potentiality by *theoresis*. The hierarchical principle of rational activity is rendered by Geulincx into a hierarchy of substances according to which only those substances which know how they act have a causal role. The scholastic model of action and passion, based on the concepts of matter and form, is thus followed by Geulincx in his consideration of the relative power of bodies and souls. However, because substantial forms as centres of activity are banished from the Cartesian physical world[473] all activity is to be located in God and, to a certain degree, in human souls insofar as they are conscious of their internal acts:

sapientia est, quam nemo videtur habere nisi qui rem illum effecerit; talis est conscientia nostra amoris, odii, affirmationis, negationis, caeterarumque in nobis actionum, eo quod ipsi eas exerceamus et efficiamus[474].

In fact, the communication of movement among bodies cannot be regarded as activity, for they have no consciousness and they are passive[475].

This is the premise of Geulincx's "occasionalism", or the result of the application of Aristotelian ontology of act and potency onto a world deprived of substantial forms[476]. Geulincx

[473] On this topic, see Van Ruler 1995, 1995, pp. 133-166.

[474] Geulincx 1892, *Metaphysica vera*, pp. 192-193. See also the *Logica restituta*, Geulincx 1891, pp. 403-404, 459.

[475] This point is also discussed in the *Metaphysica ad mentem peripateticam*, where Geulincx criticizes the attribution of active faculties to bodies: Geulincx 1892, p. 224.

[476] The part of metaphysics devoted to the properties of body, *Somatologia*, presupposes the arguments concerning occasionalism. In accordance with Geulincx's comprehensive view on the passivity of body, it cannot move itself: it is just extension and does not imply motion in its essence (Geulincx 1892, *Metaphysica vera*, p. 176). Moreover, as it does not think, it is not active: «clarissime deducitur haec assertio ex isto axiomate quod in Autologia […] asserebamus: quod nescit quomodo fiat, id non facit; nescit corpus (utpote res bruta) quomodo fiat motus; non ergo scilicet illum in se; non ergo motum habebit a se» (Geulincx 1892, *Annotata ad Metaphysicam* (originally published in Geulincx 1691a), p. 280). Thus, they come from outside, or from a mind, namely, from God as He is conscious of his operations (Geulincx 1892, *Metaphysica vera*, p. 176). Another argument supporting occasionalism comes from the notion of body. As it is infinitely divisible, that is, as it contains infinite parts to be divided, an infinite force is required for its division: see the *Annotata ad Metaphysicam* and the *Disputationes physicae*, Geulincx 1892, pp.

develops a philosophical system concerning human beings as subject to God's activity in sensorial experience and bodily activity. As we are not aware of the ways by which we receive sensations or make movements, we are not actively involved in them. They come from God, a «sciens aliquis et volens diversus a me»[477]. Indeed, because I am a simple entity, for my nature is deduced from the principle of the *cogito*, thoughts cannot come from myself but from bodies as they are the occasions for sense experience[478]. Moreover, because bodies are not conscious of their operations, and there is no communication between two different kinds of substances[479], thoughts and movements must come from God[480].

Geulincx's occasionalism, as I am going to explain, results in a physics based on experience and hypotheses. Because physical processes are dependent on divine will and action – namely, they are God's very actions – there are no means besides experience to attain them, because no principle can explain them besides divine will. The continued intervention of God in the world and His absolute power are not within the scope of the human faculties. By consequence, it is theology that states what is the highest degree of knowledge we can reach. Before turning to this issue, however, I will spend some words on the problems involved in Geulincx's ontology.

4.4.2 The body

The following parts of the *Metaphysica vera* integrate the conclusions of the *Autologia*, establishing Geulincx's concepts of self, body, and God, and his account of the *conditio humana*[481].

290, 502. Geulincx's *Disputationes physicae* were originally published in Geulincx 1691b.

[477] Geulincx 1892, *Metaphysica vera*, p. 150.

[478] «Iam autem eas excitare debet aut mediante me, aut se ipso, aut tertio aliquo; non excitat eas autem mediante me ipso, quia cogitationes sunt diversae, et ego sum res simplex, a quo diversae cogitationes emanare non possunt. Non se ipso, quia est aeque simplex ac ego; est enim aeque volens et sciens, id est cogitans, ac proinde simplex; simplex enim sui qui idem cogitavi de variis. Restat ergo tertium, cuius interventu hoc faciat, quodque variarum mutationum capax esse debet, ut per hoc varia cogitationum obiecta exsurgant; illudque est extensum, quod potest variari, seu corpus; tertium enim praeter cogitans et extensum nec novi, nec est», *ibid*., pp. 150-151.

[479] «Ego partium omnium expers res sum, ut supra dictum est; et qui incursus fiat in id quod partes nullas habet? Molem aliquam habere debet, et consequenter partes, in quod incursus fiet. Unde ego non proprie versor inter corpora, nullum ibi locum, nullum spatium occupo; quantillum occuparem, extensus essem, et totidem haberem partes secundum molem, quot habet tale spatium (omne autem spatium, quantumcunque exile fingatur, infinitas tamen secundum omnem dimensionem habet partes, ut infra patebit). Ego enim hac ratione inter corpora versor, quod in res agant; agant inquam velut instrumenta, non velut causae», *ibid*., p. 153.

[480] *Ibid*., p. 188.

[481] «Veniamus ad secundam partem metaphysices, in qua multa dilucidabuntur, quae spectant ad primam. Cum enim

Somatologia concerns the properties of body and lends support to physics: however, it is not designed to ground a necessary knowledge of nature, but only to elucidate some concepts useful for the formulation of physical hypotheses. Their actual foundation is developed in the third part, *Theologia*. From it, Geulincx develops an empirical and hypothetical physics consistent with his account of God's causal power: divine providence is taken as warrant of its certainty.

The ontology of body involves two problems for the theory of philosophical knowledge, showing the limits of natural knowledge and leading to a theological resolution of the truths of physics. The first problem is raised by the dualism between the realms of being and of becoming in the physical world. The way Geulincx deals with it, is meant to help us understand the problem of necessary knowledge in physics. Secondly, the *Somatologia* involves the question of the individuation of bodies or, as Geulincx interprets it, of their "abstraction" from continuous extension. Such abstraction from singular bodies and their features is the main cognitive process in natural philosophy.

The first problem is to be evaluated in the light of the ontology of physics developed in the *Metaphysica vera*, as well as in his *Disputationes physicae*, in whose introductory or metaphysical section[482] Geulincx defines the properties of body necessary for the formulation of physical hypotheses. These notions, in fact, concern essences and properties whose actual existence in the physical world is to be discovered by the senses: its acknowledgment thus has a hypothetical status. At the beginning of the *Somatologia*, the first section of his *Metaphysica vera*, Geulincx introduces the idea of body, or the purely intellectual notion of extension[483]. Geulincx deduces some properties from it, such as that it is infinite, that its dimensions are related to each other[484], that it is a simple entity and that no void can be admitted in it[485]. On the basis of these considerations on body, in fact, Geulincx introduces a second form of dualism. Besides the distinction between soul and body, he outlines a difference between the immutable and the mutable body, or between body-as-such

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corpus pertineat ad humanam condicionem, quam nostram condicionem sine corporis, eiusque affectionum notitia non satis feliciter consequi possumus», *ibid*., p. 155.

482 Geulincx 1892, *Disputationes physicae*, pp. 489-510.

483 Geulincx 1892, *Metaphysica vera*, p. 158.

484 «Fieri non potest, ut intra sit sine extra, non magis quam […] supra sit sine infra, pater sine filio, et generatim relatum sine correlato: nam quod intra est, intra aliquod fit necesse est, utique intra illud quod extra est», Geulincx 1892, *Metaphysica vera*, p. 162.

485 *Ibid*., p. 163.

(*extensio simpliciter dicta* or *corpus)* and the mutable body in motion, *mundus*[486]. Body-as-such cannot be divided because no void can be admitted in it[487]. Singular bodies, on the contrary, are the result of a division which does not involve the existence of a void. At the same time, such a division is not a mere mode of considering body-as-such in the mind, namely, as a concept without any real reference. The singular bodies can be truly abstracted by the mind:

itaque cum corpus non sit divisibile, particularia tamen omnia corpora divisibilia sunt; tantum difficultas est, quo pacto corpora particularia habeantur […]. Particularia corpora habentur per determinationem mentis seu abstractionem et praecisionem, sicut et linea et superficies et puncta tali aliqua abstractione proveniunt […] nam verissimum est illud, quod Scholae ex Aristotele hauserunt […]: abstrahentium non est mendacium, seu, qui abstrahunt, non fingunt, non mentiuntur; res enim quam abstrahunt, revera est, etiamsi non sub illo abstractionis statu sit[488].

The existence of particular bodies, however, abstracted from the continuum of extension, is the result of the division of the body in motion, or *mundus*. They are not parts of the body-as-such but of the world in motion, the realm of becoming. Indeed, Geulincx defines motion as the combination of closeness and distance of parts of *mundus*: «vicinitas atque distantia duarum earundam partium inter se»[489], and rest as the permanence of distance[490]. Division is thus motion itself. From motion and rest all sorts of figures and singular bodies flow, because figure is produced by the rest among parts of matter and by the movement of one part with respect to other parts[491]. From this point of view, figures and particular bodies seem to be the same thing.

In Geulincx's *Disputationes physicae*, however, motion is further defined as "*forma corporis*" or "*forma mundi*"[492]. Besides the "particular" body in itself (or the "becoming" extension), only motion is real as its mode; by motion, parts of extension are united or separated. Their figures are determined by the motion of their closest bodies. Therefore, motion is the *modus realis* of the "particular body", whereas figure is its *modus rationis*, as it results from a mental activity over parts

[486] *Ibid*., p. 188.
[487] *Ibid*., p. 167.
[488] *Ibid*., pp. 168-169.
[489] *Ibid*., p. 175.
[490] *Ibid*., pp. 179-180.
[491] «Includit ergo figura et quietem eorum inter se, quae iunctim figura circumscribi dicuntur, et motum separationemque eorundem a quibusdam aliis», *Ibid*., p. 181.
[492] See Geulincx 1892, *Disputationes physicae*, pp. 490, 496. In addition to this, Geulincx follows the Aristotelian tradition of the *quantitates interminatae* as the essence of matter by defining extension as *forma corporis* in his *Disputationes physicae*: see *ibid*., p. 506. On the *quantitates interminatae*, see S. Donati, *La dottrina delle dimensioni indeterminate in Egidio Romano*, «Medioevo», 14 (1988), pp. 149-233.

of body in motion among each other[493].

The problem involved in these statements is the relation between body-as-such and the existing world of bodies in motion. According to Geulincx's *Metaphysica vera*, single bodies are not parts, but modes of the body-as-such, as lines, surfaces and points are modes of particular bodies:

> non sunt figmenta, non entia rationis, non chimaerae […] sed corpora particularia sicut sunt aliquid ipsius corporis simpliciter dicti, sic et revera superficies, lineae atque puncta sunt aliquid extra nos in corpore particulariter sumpto; cum vero non sint partes […] restat, ut modos esse dicamus[494].

However, they are parts of the "particular body" subjected to motion, because motion is between *parts* of matter. As motion is what transforms the simple *corpus* into *mundus*, or body in motion, it affects the body-as-such as a mode. However, motion as division of parts can characterize only *mundus*, as body-as-such has no parts[495]. The problem is, thus, how to find a relation between these two kinds of reality: one is put into succession and time (as time is the measure of movement[496], following Aristotle's definition). The other is an immutable, extra-temporal entity. Outlining a difference between the consideration of body *sub specie aeternitatis* (from the perspective of God) and as it is in time (or as seen by men) is a traditional solution that cannot resolve these problems. According to this differentiation, we could say that man can truly recognize actual bodies as they are shaped by motion in the temporal realm. God, on the other side, contemplates the world as it is outside time, or a monistic extension. Actually, it is the same body under different viewpoints. What is lacking in Geulincx's analysis, however, is a theory of knowledge integrating these two perspectives: Spinoza will in fact solve this problem by showing how man can attain the same knowledge of God. Geulincx does not deal with an actual *adequatio humanae mentis et Dei*, even if he admits that single minds belong to God's mind as its *modi*[497]. This difference of perspectives, or

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[493] «Figuram esse modum-rationis ipsius motus; nam nec figura sine motu, nec motus sine figura esse cogitarive potest. At motus est modus-realis corporis, qui et abesse potest a corpore, et necessario aliquando etiam abfuit; nam corpus ab initio moveri non poterat», Geulincx 1892, *Disputationes physicae*, p. 517.

[494] Geulincx 1892, *Metaphysica vera*, p. 173.

[495] «Corpus est divisibile. Hoc intelligendum est de corpore particulari, nam de corpore generaliter sumpto intelligi nequaquam potest. […] Si enim corpus, ut sic, divideretur, non nisi interiecto vacuo divideretur; atqui vacuum est impossibile, ergo et corporis generatim sumpti divisio», *ibid*., p. 167.

[496] *Ibid*., pp. 176-177.

[497] *Infra*, n. 527.

the dualism between being and becoming, leads to a consideration of physics as a science of the apparent structure of the world, reflected by the contingency of natural laws or the impossibility of deducing them *a priori*.

The other problem raised by Geulincx's ontology for physics concerns the abstraction of single bodies as *modi rationis* and *aliquid corporis* at once. It involves the problem of individuation of bodies: «quid ergo de lineis, punctis et superficiebus censemus? […] Per abstractionem seu praecisionem ea deradimus ex corporibus particularibus, sicut ipsa corpora particularia praescindimus ex corpore simpliciter dicto»[498]. Single bodies are not just in our thought, because they result from a consideration of body, not from a mere *cogitatio*. The difference between *cogitatio* and *consideratio* is grounded in our self-consciousness:

> dico in considerationem, non autem in cogitationem. […] Si vero petas, in quo cogitatio atque consideratio differant? Respondeo, id dici non debere; sunt enim actus operationesque mentis nostrae, quorum nobis per conscientiam intimam cognitio ac sensus est[499].

The only foundation which can thus be provided for the distinction of particular bodies is an appeal to our inner consciousness and intuition[500]. This problem results from the eradication of substantial forms from nature: within a mechanical worldview the problem of individuals is hard to solve. Figures are bodies themselves, as a body is abstracted according to the motion it has with respect to others. However, Geulincx does not mention the problem of the identity of a body through its geometrical modifications. In fact, the problem of individuation remains unsolved.

Geulincx's view is thus focused on a sort of inconceivability of body-as-such, which, in turn, characterizes the *conditio humana* as being dependent on the way in which God has provided a way for us to understand nature. This *conditio* consists in the actions and passions that the soul has in itself or together with its own body (such as movements and sensations), no matter what the actual

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[498] Geulincx 1892, *Metaphysica vera*, p. 171. See also p. 169

[499] *Ibid*., p. 172.

[500] The foundation of abstraction on self-consciousness is provided also in his *Physica vera*, where Geulincx discusses the definition of dimensions: see Geulincx 1892, p. 377. The *Physica vera* was originally published by Cornelis Bontekoe: C. Bontekoe, *Metaphysica, et liber singularis De motu, nec non eiusdem Oeconomia animalis, opera posthuma: quibus accedit Arnoldi Geulincx* […] *Physica vera, opus posthumum*, Leiden, apud Johannem de Vivie, et Fredericum Haaring 1688.

cause of their communications is[501]. These are recognizable in the coincidence of the motions in soul and body[502], whose union is based only on God's will. As man does not know anything without the intervention of God, as far as experience is concerned, he is passive: this passivity leads to scepticism in philosophical knowledge. His theology is actually designed to solve this problem.

4.5 The freedom of God

Theologia is the culmination of Geulincx's metaphysics. Its problems are mainly discussed in an ethical perspective, for the definition of divine properties throws light on our position in the world and on our duties. Indeed, such definitions are not deduced from the idea of God but from the consideration of the human condition, or *a posteriori*[503]. However, they are relevant for epistemology as well, as they concern the status of essences or the objects of necessary knowledge. Indeed, Geulincx states, in a Platonic manner, that ideas and essences are the divine archetypal models[504]. He thus supports the view that *scientia* comes only from the ideas of pure understanding. Following a traditional position, he admits in *Logica restituta* that the knowledge of ideas, essences and definitions is necessary[505]. These are defined in *Metaphysica peripatetica* as leading to necessary consequences, whereas the products of God's will – namely, the created world – cannot

[501] «Id enim est hominem esse, a corpore aliquo pati, et vicissim in corpus illud agere […]. Constituunt quidem plurimi rationem hominis in unione mentis cum corpore, imo omnes fere in ea unione humanitatem versari arbitrantur. Sed meminerint, unionem non esse primam notionem, sed secundam […]. Iam autem ad humanam naturam videtur perinde esse, sive mens stabiliter a corpore patiatur, atque in illud agat, sive hoc ad momentum tantum fiat», Geulincx 1892, *Metaphysica vera*, pp. 154-155.

[502] «Est igitur hoc quam clarissimum, me solutione humanae condicionis meae interire non debere; nam quid hoc faciat ad interitum meum, si horologium corporis quoad motus suos non amplius consentiat cum voluntate mea, aut perceptiones meae non amplius pendeant a motibus corporis?», *ibid*., p. 157.

[503] «Non exsequemur hunc tractatumm procedendo ex definitione, et ex idea Dei ad eius proprietates descendendo (sicut id praecedenti tract., qui de corpore est, praestitimus), sed potius a posteriori; eo quod iuvet hanc scientiam connectere cum ea quae traditur parte prima, et gradatim a cognitione nostram descendere ad cognitionem Dei», *ibid*., p. 186.

[504] «Apud Platonicos et veros philosophos essentia passim vocatur idea; et qui quidem hoc nomine usi sunt, arctius se ipsos ad contemplationem verae essentiae restrinxerunt, quam qui nomine illo scholastico, egregiam licet admonitionem continente, usi fuerunt. Sic idea corporis consistit in extensione, idea mentis (spiritus, dicunt Scholae) consistit in cogitatione, idea globi consistit in certa figura, etc. Porro ex ideis illis proprietates et demonstrationes deducunt, v. g. quod corpus infinite extensum, infinite secundum partes suas divisibile sit», Geulincx 1892, *Metaphysica ad mentem peripateticam*, p. 263.

[505] Geulincx 1891, pp. 193 (*Metaphysica vera*), 236-237 (*Metaphysica ad mentem peripateticam*). On these points, see Aalderink 2009, pp. 157-204.

be objects of *scientia*[506]. Indeed, the world is the object of sense experience. In *Annotata ad Metaphysicam*, moreover, we find a comparison between sensory ideas in physics and passions in ethics[507]. Geulincx emphasizes the pivotal role of innate ideas in the development of philosophy. Metaphysical *scientiae* thus concern essences or the concepts in God's mind, no matter whether or not they match created entities in the world. Geulincx admits, for instance, that the idea of motion does not depend on the existence of motion itself[508]. According to him, however, God is free in the creation of the world according to these ideas, for He is not constrained by any rule. The principle of goodness does not force God as it comes after His will[509]. Therefore, the created world is subject to contingency. However, God also follows the principles of justice and mercy, as Revelation states. These principles have no clear status, because they seem to come after divine will but at the same time they influence the act of creation[510]. In any case, truths concerning the created, physical world are contingent: things could be different from the way they are as their existence depends on divine will.

In the light of this, Geulincx can state that some truths depend on God's will, whereas others

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[506] «Essentia est praedicatum necessarium et primum. Primum est cuius non datur ratio per aliud pertinens ad idem subiectum; necessarium vero est quod affirmari quidem de subiecto suo potest, negari minime. Non sufficit igitur ad essentiam ut attributum primum fuerit; nam huc omnia contingentia pertinent, quorum nec ratio, nec demonstratio, nec scientia ulla est […] sed solum Dei arbitrium his causa est; veluti quod mundus sit, sol, terra, caeteraeque ejus partes, nosque homines, nulla horum ratio, nulla demonstratio, nulla scientia; totum hoc est, quia Deo sic placuit», Geulincx 1892, *Metaphysica ad mentem peripateticam*, p. 261.

[507] «Tum mens aut libera penitus aut saltem liberior, dici non potest quam facile ad veritatem intendat, quam sublimiter philosophari incipiat, solis iam suis ideis et innatis notionibus addicta et auscultans tota. In rebus ethicis simile quid contingit circa passiones», Geulincx 1892, *Annotata ad metaphysicam*, p. 277. In the *Ethica* he makes the same point, see Geulincx 1893, *Ethica*, p. 105. Moreover, pure ideas are distinguished from mere *phantasmata* and *schemata*, or sensory species and *modi considerandi* in *Metaphysica ad mentem peripateticam*, where Geulincx criticizes the use of Aristotelian metaphysical notions («loco idearum et notionum nostrarum, schemata et phasmata nostrorum sensuum surrogemus», Geulincx 1892, *Metaphysica ad mentem peripateticam*, p. 210), and in his *Oratio de abarcendo contemptu* (1665), aimed at criticizing the neglect of the first principles and concepts in philosophy. In this oration Geulincx speaks against a way of reasoning according to which the notions of God and mind are known through the senses, as they must be derived from pure intellect. In fact, he is considering innate ideas such as those of immaterial things, not of bodies, as they cannot come from the senses nor can they be created by the mind itself (Geulincx 1892, pp. 132-133). The *Oratio de abarcendo contemptu* was originally edited in Geulincx 1691b.

[508] Geulincx 1892, *Annotata ad metaphysicam*, p. 270.

[509] «Sed dices: bonitas Dei necessitatem hic fecit, atque erat necessum ut mundum crearet, et homines conderet, qui tam bonus erat, Resp. Esto haec necessitas (si qua sit); non impedit contingentiam, non officit libertati […]. Bonitas enim seu inclinatio faciendi hoc quod praestat, idque semper agendi, quod optimum est, non eripit libertatem, quia voluntate posterior est haec bonitas adeoque cum libertate bene compatibilis, et nulli de libertate decedit, si melior fuerit, atque ad id quod expedire judicaverit propensior», Geulincx 1892, *Metaphysica vera*, p. 194.

[510] «Creavit homines; sed inde non sequitur quod eos non creaverit libere. Ita, cum humanum genus peccasset, Deus redemit illud; potuisset id utique non facere, sed obstabat eius misericordia. Angelos lapsos non redemit; quod utique tam bene potuisset facere quam homines redemit, sed obstabat iustitia eius; omnia autem ille nihilominus fecit libere. Quid enim, quaeso, officit libertati, quod agens determinatus sit nonnihil magis in unam quam in aliam partem? Eo magis libere certe id aget», Geulincx 1892, *Annotata ad metaphysicam*, p. 296.

are necessary, like those of mathematics[511]. The point is clarified by a comparison with the case of man. Given the concept of a triangle, it is necessary that its internal angles are equal to two right ones. But given the existence of man, it is not necessary that, if wounded, he suffers some pain:

naturale […] id est, quod pendet ab intellectu divino, antecedenter ad eius voluntatem, seu in quo tantum intellectus regula eluceat et nullum voluntatis decretum. Sic naturale est, triangulum habere angulos suos aequales duobus rectis […]. Perverse autem Scholae et populus haec ad quam plurima diffundit, ut cum dicunt naturalia esse, ut corpore laeso doleamus, […] in quo vehementissime errant. Nam nulla necessitate ex antecedentibus illis haec consequentia deducuntur; sed tamen ex instituto divino libero atque arbitrario[512].

Geulincx is comparing two different ontological levels: that of necessary mathematical ideas, antecedent to creation, and that of the created, contingent existence of man. Because man is composed of two substances which cannot interact, his properties – such as having pain – are in any case contingent, as they are fully dependent on the miracles of occasionalism. They cannot be deduced from any essence. Whereas the essence of extension leads to some necessary properties, and thus only its existence is contingent, man as the union of two substances has no essence before God's will. Moreover, even the world as a whole has no essence by which we can deduce all its properties and modes. Indeed, the world is made by motion, but bodies cannot move anything as motion is not included in their essence, nor they can be active, according to Geulincx's axiom. Therefore, the world's properties and modes do not depend on anything but on God's will. Even the quantity of motion is subject to His will, as well as its laws[513]. An essence for the whole world and thus a rational deduction of its laws would require an independent activity of bodies: this, anyway, will contradict occasionalism. It is admitted by Spinoza, who accepts the identification of the world with God and an absolute necessity in all its modifications, and by Leibniz, who introduces in matter substantial forms involving a necessary connection among themselves. Also De Raey, who

[511] «Deus igitur liber est in condendo homine, in creando mundo; nihil ipsum ad haec adegit, nulla hic necessitas est voluntate eius prior. Duo et tria ut quinque sunt, circulus ut aream habeat, mons ut vallem, necesse est. Deus hoc etiam vult, sed haec necessitas voluntate eius quasi prior est, et ex natura et intellectu eius dimanat. Sed nihil simile apparet in motu, nil simile in devolutione, qua Deus nos per motum de aliis cogitationibus in alias tam ineffabiliter devolvit. […] Motus enim est de genere contingentium, cum et possit non esse, et aliquando non fuerit, imo et necessum sit ipsum aliquando non fuisse, ubi habetur tota definitio contingentis et plus quam ad illam requiratur. […] Ex quo vides notabile discrimen inter ea quae necessaria sunt (tale enim primum a natura seu intellectu divino dependet, etiamsi voluntas Dei accedat et assentiatur) et inter ea quae contingentia sunt (id est, primum a voluntate divina Dei dependent, ex natura seu intellectu praecedente necessitate)», Geulincx 1892, *Metaphysica vera*, pp. 193-194.

[512] Geulincx 1892, *Annotata ad metaphysicam*, p. 294.

[513] Geulincx 1892, *Disputationes physicae*, p. 510.

denies that we can refer the concepts of act and potency to bodies, still admits that they can produce effects, avoiding any occasionalist conclusion[514]. Geulincx, on the contrary, emphasizes the passivity of the world and its being subject to God's action, which cannot be the object of evident knowledge (*scientia*). As motion depends on God's will, there can be different worlds and thus different ideas of it, as stated in *Annotata ad Metaphysicam*:

ideam […] mundi, partiumque eius habere possemus, imo […] ideam huius mundi (plures enim esse possunt mundi, auctore naturae aliter atque aliter itemque remissius vel intentius, diffusius vel contractius movente materiam, haec enim omnia pendent ab eius arbitratu)[515].

However, these ideas do not seem to imply necessary consequences for the quantity and the laws of motion. God can change them, because He is not forced to adopt the idea of one world instead of another. These ideas, in fact, do not involve a general essence of the world as they concern something which is arbitrary.

In the light of this, we can acknowledge to what extent the problem of divine freedom involves that of the necessary existence of things, and thus that of philosophical knowledge as it concerns essences or contingent entities. Indeed, as Spinoza and Leibniz's positions on the essence of the world are different from those of Geulincx, they give different accounts of divine freedom also. Leibniz admits a *potentia Dei ordinata* based on a divine freedom granted by the co-existence in God's intellect of infinite essences or ideas of world[516]. Spinoza, on the contrary, recognizes the existence of one world, the actually existing one; every truth, according to him, is like those of geometry and can be deduced from its essence. In both cases, however, the world is provided with its own activity and does not depend on God's intervention to develop its states, independently inscribed in its essence. Because in Geulincx's opinion the existence of motion, its laws and degrees are contingent, we can acknowledge them only through the senses. Therefore, his physics is

[514] See his *De mundi systemate et elementis* (published in De Raey 1677, pp. 574-634): «quanquam enim nihil in se actuosum sit praeter naturam intellectualem, cuius substantia actus est: quamquam haec sola primum in se et hinc etiam in alia potestatem habeat, non impulsa ab alio, verum ex se et sponte sua. Hinc tamen non sequitur, quod natura corporea, quae tali modo actuosa non est, nullum proprius effectum habeat», De Raey 1677, p. 591.

[515] Geulincx 1892, *Annotata ad metaphysicam*, p. 288.

[516] A freedom warranted by the infinite number of possible worlds in God's intellect, and ordered by the principle of the richest production of phenomena according to the simplest laws. See his *Principes de la nature et de la grâce fondés en raison* (1714), § 10, in G. W. Leibniz, *Die philosophische Schriften*, ed. by C. I. Gerhardt, Berlin-New York, Georg Olms Verlag 1978, vol. VI, pp. 598-606.

contingent from an ontological and epistemological point of view, because it concerns contingent objects and is based on experience. It is a hypothetical science, relying on some concept or idea matching essences and necessary properties (its "metaphysical" part), and on some others known by experience, those concerning matters of fact[517]. According to Geulincx the senses are the only means to acknowledge the existence of corporeal things, because by pure intellect we can acknowledge only the essence of a limited range of things:

cum motus sit contingens, et pendeat ab arbitrio moventis, hactenus etiam incertus est, quod ab essentia et a priori, id est ex ratione proprie dicta procedentibus, lateat. Non mirum igitur, si quidam hac sola lucerna gressum dirigentes, in Naturae meridie, in Mundi foro, Mundum, id est Motum, non invenerint. […] A posteriori vero procedentibus explorata satis et certa est existentia motus; cum et successionem in nostris cogitationibus, et perceptiones nostras, inter caeteras, tales aliquas observemus, quas conscii sumus a nobis solis non pendere[518].

The ontological contingence of the world finds its counterpart in the epistemic contingence of the hypothesis[519]. As a result, Geulincx's positions on the freedom of God integrate a view of physics according to which it has a provisional status and whose method consists of deductions based on experiences of motions, as first pointed out in his 1652 *Oratio*[520].

4.6 The foundation of experience and intellectual evidence

The epistemic problem these positions involve concerns the reliability of the senses. It is solved by Geulincx by an appeal to divine providence. This is well explained in the *Annotata ad Metaphysicam*, where he admits that without the senses we can truly conceive the world as it is in itself, but only insofar as it is a possible world[521]. In other words, we cannot be sure that it is the

[517] Geulincx 1892, *Physica vera*, p. 422-423.
[518] Geulincx 1892, *Disputationes physicae*, pp. 511-512.
[519] «Hypothesium prima condicio est ut sint contingentes; si nempe essent necessariae, ex illis, cum metaphysicae theorematis necessariis pariter, nunquam sequerentur apparentiae, quae contingentes sunt», Geulincx 1892, *Physica vera*, p. 422.
[520] «Sufficere autem illum ad omnes illas perceptiones, quas de mundo eiusque partibus habemus, absolvendum, tum intelligenti satis demonstratum est, tum qui non satis intellexerit habet quod Physicam adeat; in qua continua deductione per varios motus, varia atque adeo omnia naturae phaenomena abunde explicantur», Geulincx 1892, *Metaphysica vera*, p. 189.
[521] «Sensibus etiam destituti, ideam tamen mundi partiumque eius habere possemus, imo etiam ideam huius mundi […]. Nam habentes ideam mundi seu corporis in motu, possemus ad varias eius species descendere tandemque etiam ad

actual world. In fact, there are two worlds: a world in itself, whose idea cannot be known through the senses, and a sensible world. This second one bears the marks of divine providence or of God's «wisdom and goodness», as it is through it that we can attain the first and acknowledge it as really existing[522]. This is, actually, the only way by which Geulincx can ground the reliability of the unavoidable use of the senses in physical explanations.

The importance of the senses is stated in the *Autologia* as well, in which he states that the succession of thoughts relies on the succession of bodily motions. Indeed, God cannot produce ideas in us without bodies as instrumental causes[523]. This point reveals a Platonic influence, because the body is conceived as the *organon* of the soul. Geulincx's appeal is indeed to Augustine and Paul, and it contains a critique of the immateriality of angels affirmed in the fourth Lateran Council (1215):

non puto Deum posse successionem cogitationum in mentibus efficere nisi illas alliget ad corpora. Unde etiam Augustinus, ut salvaret successionem cogitationum in mentibus angelicis, dixit eos habere tenuia corpuscula, forte aeria et similia. Et forte sic est; neque enim contrarium est in Scriptura revelatum; imo saepe de apparitionibus angelorum sub specie corporea in illa legimus. Certum est (quicquid hac de re sit), ecclesiam non posse temere hoc reiicere; Augustinus enim post Paulum optimus doctor Ecclesiae fuit et omnia eius ex intimis verae Philosophiae penetralibus hausta videntur, tam mirabiliter consentiunt nobiscum. Scio tamen Pontificios id reicisse[524].

The relevance of bodily motions for the production and succession of ideas matches Geulincx's emphasis on the passivity of the soul, which depends on God (as the cause of ideas) and on bodies

speciem huius mundi appellere; quo casu tamen hunc mundum non ut existentem, sed ut possibilem. Nec enim idea aliud de re obiecta […] indicat», Geulincx 1892, p. 288. «Haec idea repraesentaret nobis hunc mundum eiusque partes ut sunt in se», Geulincx 1892, *Annotata ad metaphysicam*, p. 288.

[522] «Deus itaque duos quodammodo mundos fecit, alterum in se (et non est aliud quam corpus diversissime, ordinatissimeque motum); huius ideam habemus in nobis independenter a corpore, […], alterum mundum fecit Deus in nobis sensibusque nostris miris elegantissimisque spectris et phantasmatibus praeditum; et hic venustior est longe et magis artificiosus, plus sapientiae et bonitatis in illo spirat quam in alio isto mundo. Huius vero mundi nullam haberemus cognitionem, nisi sensibus et corpore instructi essemus; atque id est, quod hic dicitur, nos de hoc mundo partibusque eius nisi per sensum nihil rescire posse; hoc, inquam, de posteriori mundo intelligendum. Priorem autem mundum Deum voluit esse occasionem posterioris: voluit enim priorem illum mundum motu suo imprimere nobis diversas illas apparentias, imagines, phaenomena, phasmata (et quibuscunque tandem id libet nominibus exprimere), in quibus essentia posterioris illius mundi consummatur», *ibid*., pp. 288-289.

[523] «Sed Deus potest successionem causare in nostris cogitationibus sine motu corporum; tempus ergo potest esse sine motu. Resp. Merito praesumimus Deum id non posse; ipse enim unus idemque, eodemque modo se habet; necessum ergo est, ut instrumento diversimode affecto utatur, si diversos in nobis cogitandi modos suscitare certum habeat […]; atqui nullum est aliud instrumentum quod diversimode se habere potest, quam corpus», Geulincx 1892, *Metaphysica vera*, p. 177; «ineffabili illa operatione, quae per corpus et motum ([…] inepta et bruta instrumenta) cogitationes in nobis diversissimas excitat», *ibid*., p. 188.

[524] Geulincx 1892, *Annotata ad metaphysicam*, p. 282. See H. Denzinger, Adolf Schönmetzer, *Enchiridion symbolorum definitionum et declarationum de rebus fidei et morum*, Freiburg-Basel-Rome-Vienna, Herder 1991 (37th ed.), § 800.

(as their occasions). Bodies in motion and the senses seem to be the only instruments by which God can cause thoughts in the human mind.

These statements seem to contradict the possibility of attaining purely intellectual ideas, according to a Cartesian theory of knowledge. However, another point justifies their acknowledgment. Some sort of Platonism can be also found, indeed, in Geulincx's assimilation of human minds to God, as souls are modes of the unique divine mind. This assimilation leads to an illuminationistic theory of knowledge. In this way, the appeal to God also guarantees the reliability of intellectual evidence, which is not an autonomous criterion of truth, as noted at the beginning of the *Metaphysica*. This appeal is the only means to grant the reliability of our faculties: even of intellect, whose faithfulness could otherwise be granted only through its primacy over the other faculties, as it decides about the truth of sense data[525]. In fact, all thoughts come only from God: men cannot cause any idea, for they are not conscious of the ways they could do so. Therefore, besides innate ideas in the human mind Geulincx writes about the contemplation of pure ideas and eternal truths in the divine intellect:

Ideae omnes et veritates aeternae, ut e.g. duo et tria sunt quinque, etc., sunt in mente divina, non in nostra; cum itaque nos consideramus ideas istas, consideramus eas in Deo[526].

In this case, Geulincx follows the traditional, Averroistic strategy to guarantee the universality of knowledge by recognizing its objects in the Divine intellect. As a consequence, he considers single minds as belonging to God, just as particular bodies are *modi* of extension[527]. For there are no means to understand how we perceive innate ideas, as they do not come from bodies, so it is necessary to explain their perception through God himself. Actually, Geulincx's solution is similar to that of Leibniz, according to which it is experience that awakens our innate ideas, or bodily movements are just the first step in our knowledge of them, and this is consistent with the illuminationistic theory of perception of ideas.

This position, moreover, reflects a Cartesian principle of economy regarding substances: as

[525] *Supra*, n. 468.
[526] Geulincx 1892, *Annotata ad metaphysicam*, p. 287. See also pp. 280-281.
[527] «Sumus enim modi mentis, ut corpora particularia sunt modi corporis […]; si auferas modum, remanet ipse Deus», *ibid*., p. 273. See also pp. 237-240, 269, 293.

Descartes reduces individual substances to one unique matter, Geulincx reduces souls to God. He does not consider, anyway, the theological consequences of this point, nor the principle of individuation of souls, as Spinoza does. In fact, Geulincx does not consider our presence in the divine mind in a wider perspective, as Spinoza will do in the light of the *adequatio humanae mentis et Dei*.

4.7 The hierarchy of knowledge

In the light of these remarks, can we regard physics as *scientia*? According to Geulincx's axiom, indeed, if we are not aware of the ways by which we attain knowledge we do not know anything. It seems, therefore, that even through the pure ideas guaranteed by God we cannot get any knowledge, as we do not "cause" them. This problem arises from Geulincx's statements on the impossibility of knowing something without "clothing" it with mental categories, on our being limited by a knowledge which does not go beyond the senses and modes of consideration. These statements are to be found in his outline of four degrees of knowledge:

sapientia […] est profunda aliqua penentransque cognitio rei coniuncta cum summa animi delectatione. Hanc sapientiam nemo habet in summo gradu circa rem aliquam, nisi qui rem illam effecerit, et in efficiendo intime possiderit. […] Nota, varias esse perceptiones quae sapientiam non pertineant, ut imprimis est perceptio sensuum, quae minime rem ipsam attingit, sed tantum illa nobis, in quantum homines sumus, quid commodi vel incommodi afferre possit, demonstrat. Secundo cognitio certa etiam, sed rem non penetrans, seu sine evidentia, seu sine claritate (ut cognitio qua videmus Deum nos homines fecisse; etiamsi enim certa sit, cum tamen modum ignoremus et utique ignorare cogamur, obscura est, inevidens, et rem non penetrans). Tertio etiam scientia seu cognitio cum evidentia, sed quae haeret in cortice et rem non penetrat […] v.g scientia qua cognoscimus et scimus res, prout substant operationibus intellectui nostri, seu modi illis ac externis denominationibus, quas ab intellectu nostro eiusque operationibus mutuantur […]. Tandem est scientia illa, quae rem nude et abstractam ab omnibus modi cogitationum nostrarum denominationibusque proponit; haec vero sapientia, quam nemo videntur habere nisi qui rem illum effecerit[528].

The lowest kind of knowledge is sense perception, which is neither certain nor evident. Then there is a knowledge provided with certainty, but not with evidence: it characterizes some truths of metaphysics, such as that we have been created by God. We know this with certainty, but we cannot understand how we have been created. The third knowledge is *scientia*, or the evident knowledge

[528] Geulincx 1892, *Metaphysica vera*, pp. 192-193. The fourfold distinction of knowledges, like the consideration of the last two as true, is analogous to Spinoza's theory of science as developed in the *Tractatus brevis*, and then turned into a threefold distinction in the *Ethica*. See Mignini 1984.

coming, however, through *modi considerandi*. The fourth knowledge is *sapientia*, or the knowledge proper to God and everyone who causes what he knows.

In his *Annotata* Geulincx clarifies these points, writing that the first two kinds of knowledge are neither *doctrina* nor *sapientia*, which are, respectively, only the third and the fourth ones[529]. What the latter have in common is their concern with ideas, and thus the real essences of things[530]. In fact, they are *scientiae*. *Sapientia* is the immediate knowledge of ideas without any *modum considerandi*. *Doctrina*, on the contrary, still concerns ideas but as they are "clothed" by *modi*. Anyway, the acquaintance with things through these modes seems to involve some ignorance:

non debemus res considerare prout sunt sensibiles […] neque ut sunt intellegibiles […]. Sed ut sunt in se, non possumus eas considerare; unde videmus magnam nostram imperfectionem. Hoc unum igitur restat nobis faciendum […], ut iudicio mentis, quotiescunque rem aliquam sub modo aliquo cogitationis nostrae apprehendimus[531].

Plainly, only God has *sapientia* as He does not know things by abstraction, i.e., by *modi considerandi*, but immediately[532]. Man is concerned with abstraction and consideration, which are the same process, as I have pointed out[533]. They involve the meta-concepts of whole and part, which are necessary for the individuation of bodies or their apprehension *simul et semel*[534]. This mental process characterizes the senses but also the intellect[535] and reveals the problems of individuation raised by the abolition of substantial forms as the basic individuals.

It is in the light of this that we should consider what is the epistemological status of physics

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[529] Geulincx 1892, *Annotata ad metaphysicam*, p. 291.

[530] «Doctrina vero et sapientia ad ideas referuntur. Proprie tamen sapientia huc tantum spectat, nam doctrina versatur adhuc in considerationibus nostris. Unde sapientiam recte definies: cognitionem per ideam, seu cognitionem qua aliquid cognoscitur in idea sua», *ibid*., pp. 291-292.

[531] *Ibid*., pp. 300-301.

[532] «Cum id quod ad praecisionem, abstractionem limitationemque pertinet, a nobis removerimus, clarissime Deum ipsum in nobis agnoscimus», Geulincx 1892, *Metaphysica ad mentem peripateticam*, p. 239.

[533] *Supra*, nn. 499-500.

[534] Geulincx 1892, *Metaphysica ad mentem peripateticam*, p. 227.

[535] «Cum enim ratio totius duo involvat ad intellectum spectantia, nempe simul-sumptionem plurium aliquorum, et exclusionem aliorum ab eorum numero quae simul sumpta sunt (quae simul-sumptio et exclusio sunt modi cogitandi ad intellectum nostrum pertinentes), sensus quidem, qui aliter afficitur a mensa v. g. quam ab aëre ac pavimento adiacente, et speciem illam objecto adscribit, exemplo suo quodammodo praebet intellectui, ut simul-sumptionem illam asserum atque palorum ex quibus mensam constare dicimus, simulque exclusionem aeris et pavimenti circumstantium, adscribat ipsi mensae. Mensam enim putamus ut tale totum extra nos exsistere in rerum natura; quod minime sic est, cum res quidem atque res sint extra nos, sed simul sumptae abstractaeque ab aliis seu aliorum numero (sub qua ratione tantum totum esse possunt) in rerum natura non sunt, sed hoc habent a modo cogitandi nostro», *ibid*., p. 211.

and ethics. Actually, the highest, most certain knowledge seems to be found in metaphysics as it concerns the simplest ideas or essences. In his introduction to the *Metaphysica falsa sive ad mentem peripateticam* Geulincx is more open to a possible attainment of a *sapientia* or a knowledge which does not come through "clothes". In fact, the *Metaphysica falsa* is devoted to the individuation and criticism of the *modi considerandi* upon which the Scholastics have built their system by considering them to be ideas of really existing things[536]. It is the case of substances, accidents, relations, subjects, predicates, wholes, parts[537], that can lead us to regard them as existing things, whereas they are only mental categories. This mainly comes from the confusion of logic and metaphysics, criticized in the introductory *Oratio* to the *Quaestiones quodlibeticae*. True metaphysics, on the contrary, recognizes *modi considerandi* as mere instruments of thought and considers only the first notions concerning body and mind. Thus it is a *sapientia*, whereas Aristotelian knowledge is a *doctrina*[538]. Man can attain *sapientia* if he considers in a careful way the simplest ideas of the intellect and distinguishes them from their "clothes". Besides the limits imposed by Geulincx's axiom (which, strictly speaking, reduces human *sapientia* to the self-consciousness of internal acts[539]), he seems however to admit a perfect knowledge of some metaphysical idea. Whereas for De Raey the human mind cannot think except with *modi considerandi*, Geulincx, who provides a justification of *scientia* by claiming that the highest truths are contemplated in the divine intellect, addresses the possibility for man of reaching a knowledge cleansed from the use of any *modum considerandi*, like God himself. In the *Ethica* metaphysical, introspective truths obtained through an *inspectio sui* are considered to be even more certain than mathematical ones: «quae ex […] mei ipsius inspectione didici […] ita perspicue didici, ut ad eam quam apud me […] certitudinem et evidentiam habent, mathematicorum apodixes aspirare non valeant»[540]. Ethics is a rational discipline as it is based on the discovery of the self, resulting in the *depectio sui*[541]. Geulincx's interest in ethics, the proper end of the system, leads him to find a

[536] *Ibid*., pp. 199-200.
[537] *Ibid*., p. 204.
[538] «Vera sapientia considerat res ut sunt in se, abstractae a modis nostrarum cogitationum, quibus circa illas versari solemus. […] Res quidem sensibus subiectas vera sapientia abstrahit a speciebus et imaginibus, quae per sensum iis affingi et adscribi solent; easque sic abstractas contemplatur in physica. Res vero quae sub sensum non subiiciuntur, abstrahit vera sapientia atque praecidit a modis cogitandi nostrae intelligentiae, a phasmatibus et speciebus intellectualibus; […] et res sic […] considerat vera sapientia in metaphysica […]. Doctrina autem Peripatetica (quae ideo non sapientia est) considerat res quatenus inficiuntur modis nostrarum cogitationum», *ibid*., p. 199.
[539] *Supra*, n. 528.
[540] Geulincx 1893, *Ethica*, p. 36.
[541] The *obligationes*, the rules for conducting life according to this view of man and God, result from the establishment

ground for a Cartesian moral philosophy in truths provided with the maximum degree of certitude. Ethics, in fact, is the highest science. Physics also has a metaphysical, absolutely certain part concerning the basic ideas explained in the *Somatologia.* However, as it relies also on experience it has only a moral certitude, given by God's benevolence or by a principle coming after divine will: therefore, it is not *scientia*. Intellectual truths, on the other hand, are granted by their being present and acknowledged in the divine intellect, as evidence is not an autonomous criterion of truth. In fact, whereas sense experience is grounded only in divine will – and thus it is a matter of faith, as no reasons can explain His decrees – the knowledge of ideas is given by the divine intellect also. They can be truly grasped as they precede the indeterminacy of voluntary principles: plainly, intellectual truths have the strongest foundation.

In conclusion, these points reveal the tension, hidden in Geulincx's system, between the Cartesian demand for a rational ethics and the Christian perspective on human limits. In the light of this we can fully understand the distance from De Raey's positions, developed to avoid the improper mixing of philosophy and theology of Meijer and Spinoza. In fact, Geulincx's philosophy is equally distant from De Raey's as from Spinozistic ideas. Geulincx is not concerned with a "logical" epistemology, because, for the sake of a Christian moral philosophy, he builds his system on the relation between God and man and on his complete dependence on God's inscrutable actions. This approach has its premise in Cartesianism, as Geulincx adopts occasionalism to solve the problem of the interaction of substances in a world deprived of active forms. Moreover, it respects the commitments of Christianity, as it leads to an ethics based on the main virtue of humility. Despite his rationalization of morality and religion, therefore, Geulincx's positions contradict those of Spinoza on the strengthening of *conatus* as the keystone of ethics. More than the intuitive knowledge of essences it is the second level of knowledge – that concerning the inscrutability of God's actions – that gives us the greatest delight[542]. Geulincx's ethics finds its end in a *docta ignorantia* more than in an intellectualistic way to freedom. This is reflected by an approach according to which metaphysics as the highest science implies the knowledge of God's role as the unique warranty of the truth of human knowledge. This perspective is embodied by a theological

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of the first *scientiae* reached through the *inspectio sui:* «procedens igitur iuxta illud propositum, tam evidenter ex mei ipsius inspectione deductum, tam probum, tam legitime fundatum», *ibid*., p. 37.

[542] «Nulla potest esse maior delectatio quam cum de Deo nostro aliquid incipimus intelligere […]. Tunc enim ipsum Deum intuemur aliquo modo, et per aenigma vel in speculo, ut loquitur Apostolus. Unde concludere possumus, quanta futura sit illa delectatio, cum post hanc vitam Deum visuri sumus ut est» Geulincx 1892, *Annotata ad metaphysicam*, p. 292.

metaphysics and by a foundation of philosophical knowledge stating that man is not independent in the recognition of the world's features but relies on divine actions and ideas.

4.8 Physics without metaphysics?

Providing a foundation for philosophy as a reflection and justification of its assumptions and method is the first step in Geulincx's construction of a philosophical system, as it was in the case of De Raey. Even if Geulincx admitted the crucial role of experience in physics before his adherence to Cartesianism, his development of a philosophical ethics through rational theology led him, during the Leiden years, to systematize his views on the method for physics. In accordance with his tenet of the arbitrariness of physical principles, Geulincx can claim that in physics explanatory principles are to be formulated only through a rational reinterpretation of experience. Accordingly, besides showing how a rational ethics can be provided with a foundation and besides showing what are the relations of such a foundation to the method used in physics, the case of Geulincx reveals two issues underlying early modern Dutch philosophy. First, it testifies to a "de-metaphysicalization" of physics that will be finalized by Burchard de Volder and Willem J. 's Gravesande. If metaphysics provides only the basic ontology to physics and explanatory models are formulated by a rational interpretation of experience, physical models cannot be drawn from metaphysical truths. In fact, such de-metaphysicalization had already been explored by Regius: however, in the case of Geulincx it results from a comprehensive foundational theory, whereas for Regius it was a consequence of the rejection of metaphysics and rational theology as such. Secondly, Geulincx puts at stake the problem of the reliability of evidence, either empirical or intellectual. Given the misleading "evidence" of some inference and the recourse to sensory experience in natural philosophy, evidence is questioned as characterized by a psychological certainty. Geulincx's theological solution, according to which God's actions guide our perceptions of phenomena, and the reliability of metaphysical truths is guaranteed by their presence in divine mind, will be rejected by De Volder and partially accepted by 's Gravesande. Yet, the problem of evidence would be at the top of their philosophical agenda.

5. The metaphysical foundation of empirical physics of Burchard de Volder

5.1 Introduction

The approaches to physics of Henricus Regius and Arnold Geulincx are samples of the role that experience played in the development of the natural philosophical theories of Dutch Cartesians, and that physical theories based on Descartes's principles could still be developed by empirical means. No radical discontinuities, in fact, can be recognized in the evolution of Cartesian physics with respect to the role of experience[543]. Still, Burchard de Volder (1643-1709) can be considered as having introduced a more empirically oriented form of Cartesianism, paving the way for the upcoming Newtonianism of Willem Jacob 's Gravesande and Pieter van Musschenbroek[544].

Born in Amsterdam in 1643, De Volder studied philosophy from 1657 at the *Athenaeum illustre*. Subsequently, he matriculated at the University of Utrecht, graduating in 1660 as *magister artium* and *doctor philosophiae*, and then in Leiden, where he graduated in medicine on his dissertation *De natura* (1664)[545], dedicated to Franciscus de le Boë Sylvius, by whom he had been initiated to iatrochemistry and to Cartesianism. After some years spent in Amsterdam as "physician of the poor", De Volder came back to Leiden University as professor of philosophy in 1670. There, he was actively involved in the defence of Cartesian philosophy when the Aristotelian philosopher

[543] On the topic, see Ruestow 1973, pp. 89-112; C. de Pater, *Experimental Physics*, in Lunsingh Scheurleer - Postumus Meyjes 1975, pp. 308-327; G. Wiesenfeldt, *Leerer Raum in Minervas Haus. Experimentelle Naturlehre an der Universität Leiden, 1675-1715*, Amsterdam, Koninklijke Nederlandse Akademie van Wetenschappen 2002; Krop 2003; W. van Bunge, *Dutch Cartesian Empiricism and the Advent of Newtonianism*, in Dobre-Nyden 2013, pp. 89-104; id., *The Waning of the Radical Enlightenment and the Rise of Newtonianism in the Eighteenth-Century Dutch Republic*, in S. Ducheyne (ed.), *Radical Enlightenment. Critical Studies*, forthcoming.

[544] W. Klever, *Burchardus de Volder (1643-1709): A Crypto-Spinozist on a Leiden Cathedra*, «Lias» 15 (1988), pp. 191-241; P. Lodge, *Burchard de Volder: Crypto-Spinozist or Disenchanted Cartesian?*, in T.M. Schmaltz (ed.), *Receptions of Descartes - Cartesianism and anti-Cartesianism in early modern Europe*, London and New York, Routledge 2005, pp. 128-145; T. Nyden, *De Volder's Cartesian Physics and Experimental Pedagogy*, in Dobre-Nyden 2013, pp. 227-249; id., *Living Force at Leiden: De Volder, 's Gravesande and the Reception of Newtonianism*, in E. Schliesser, Z. Biener (eds.), *Newton and Newtonianism*, Oxford Press, forthcoming. Biographical information are mainly provided in J. Le Clerc, *Bibliothèque choisie*, vol. XVIII, Amsterdam, chez Henri Schelte 1709, art. XI, pp. 346-354; J. Gronovius, *Burcheri de Volder laudatio*, Leiden, apud Cornelium Boutestein 1709.

[545] B. de Volder, *Disputatio medica inauguralis de natura*, Leiden, S. Matthiae 1664.

Gerard de Vries had to leave the University in 1674[546]. His main defence of Cartesian metaphysics, however, can be found in his later *Disputationes philosophicae omnes contra atheos* (1685) and his *Exercitationes academicae quibus Renati Cartesii philosophia defenditur adversus Petri Danielis Huetii censuram philosophiae Cartesianae* (1695)[547], expounding a metaphysical justification of his natural philosophy. Moreover, De Volder was influenced by Robert Boyle and by other fellows of the Royal Society, whom he met during his journey in England in 1674. Impressed by their experimental practices, De Volder asked and obtained from the Curators of Leiden University the funding to establish an experimental cabinet[548]: his *Theatrum physicum* was the first official experimental cabinet in European universities[549]. Mainly concerning pneumatics, the contents of his lectures are collected in his *Quaestiones academicae de aëris gravitate* (1681)[550]. After having been appointed professor of mathematics in 1681, when De Volder gave his *Oratio de coniugendis philosophicis et mathematicis disciplinis* (1682)[551], he became more interested in the application of mathematics to physics, as he carefully studied Newton's *Principia* and made Christiaan Huygens acquainted with their contents[552]. In a late stage of his life, moreover, De Volder started a correspondence with Leibniz (between 1698 and 1706), although not accepting his views in metaphysics[553], and with Newton, even if not embracing his physics[554].

Following Le Clerc's judgement, who reported De Volder as having been progressively

[546] De Volder contributed with Christoph Wittich and Abraham Heidanus to the writing of the *Consideratien over eenige saecken onlanghs voorgevallen in de Universiteyt binnen Leyden*, Leiden, bij Aernout Doude, 1676. See Le Clerc 1709, pp. 355, 368-373; Molhuysen 1918, pp. 291-294.

[547] B. de Volder, *Disputationes philosophicae omnes contra atheos,* Middelburg, apud Joannem Lateranum 1685; id., *Exercitationes academicae quibus Ren. Cartesii philosophia defenditur adversus Petri Danielis Huetii Episcopi Suessionensis Censuram philosophiae cartesianae*, Amsterdam, apud Arnoldum van Ravestein 1695.

[548] See Le Clerc 1709, pp. 362-364; Molhuysen 1918, pp. 301-302.

[549] De Pater 1975, pp. 309-327, De Clercq 1989, pp. 9-14. See also P. de Clercq, *At the sign of the Oriental Lamp. The Musschenbroek workshop in Leiden, 1660-1750*, Rotterdam, Erasmus Publishing 1997.

[550] B. de Volder, *Quaestiones academicae de aëris gravitate*, Middelburg, typis viduae Remigii Schreverii 1681 (a).

[551] B. de Volder, *Oratio de coniugendis philosophicis et mathematicis disciplinis, cum philosophicae professioni adiunctam mathematicam rite auspicaretur*, Leiden, apud Jacobum Voorn 1682.

[552] Le Clerc 1709, pp. 379-380. De Volder corresponded with Huygens: see C. Huygens, *Oeuvres complètes*, vol. IX, ed. by J. Bosscha jr., Den Haag, M. Nijhoff 1901, letters 2537, 2547; vol. X, 1905, letters 2798, 2799, 2800, 2802, 2803, 2861, 2862, 2701. Also, De Volder was the editor of the posthumous edition of Huygens's *Kosmotheoros* (The Hague, apud Adrianum Moetjens 1698) and of the *Opuscula posthuma* (Leiden, apud Cornelium Boutesteyn 1703), along with Bernhard Fullenius.

[553] See P. Lodge, *The Failure of Leibniz's Correspondence with De Volder*, «Leibniz Society Review», 8 (1998), pp. 47-67; id., *The Debate over Extended Substance in Leibniz's Correspondence with De Volder*, «International Studies in the Philosophy of Science» 15 (2001), pp. 155-166; id. (ed.), *The Leibniz-De Volder Correspondence: With Selections from the Correspondence Between Leibniz and Johann Bernoulli*, New Haven, Yale University Press 2013.

[554] See A.R. Hall, *Further Newton Correspondence*, «Notes and Records of the Royal Society of London», 37/1 (1982), pp. 7-34.

discontented by Cartesian philosophy, some scholars have argued that he rejected Cartesian physics and metaphysics[555], as his *Oratio de rationis viribus et usu in scientiis* (1698)[556] is supposed to testify. This view has been corrected in recent years by other scholars arguing for a continuity in De Volder's thought, as he had always been open to the role of experience in physics[557]. On the other hand, one can recognize some original points in De Volder's Cartesianism: such as in the adoption of teaching experimental practices, in his overall project to integrate experience and mathematics in physics, and in his very foundation of natural philosophy. The first theme has been thoroughly addressed by Tammy Nyden, who has highlighted the main didactic function of De Volder's experimental practices. Elaborating on this point, in this chapter I will provide an assessment of De Volder's methodology and an analysis of his metaphysical, foundational arguments, which have not been taken into account in the secondary literature.

The case of De Volder shows how an empirically oriented form of Cartesian physics – that is, one based on Descartes's main ontological assumptions – could be provided with a foundation. However, his case also shows the limits of Cartesian metaphysics in providing such a foundation, as Descartes gave no arguments to support the reliability of experience as a source of philosophical knowledge in physics. Through his metaphysics, De Volder can only justify the explanatory value of the ontological assumptions of physics, that is, of the clear and distinct ideas of the intellect. If Geulincx provided a foundation for the use of experience by a rational-theological argument, De Volder – more loyal to Descartes's metaphysics – provides only a justification for the main concepts of physics. Moreover, this justification cannot demonstrate the truth of such principles: as we have no other means but the ideas of mind, body and God to grasp any kind of reality, we cannot demonstrate that the world has been created according to mechanical principles. While maintaining a metaphysical foundation of science, De Volder deprived physics of the metaphysical or absolute certainty De Raey aimed at bestowing on it.

Yet, De Volder's case shows how Cartesian foundationalism met the methodological standards of the fellows of the Royal Society, who purported what we can label, for the first time, as

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[555] Le Clerc, sympathetic to Newtonian ideas, emphasized the empirical attitude of De Volder. According to him, De Volder was disenchanted by Newton about Descartes's vortex theory, and was annoyed at having to teach Descartes's *Meditationes* and Rohault's *Traité de physique*: see Le Clerc 1709, pp. 382, 398-399. This interpretation had been followed in Ruestow 1973, pp. 89-112.

[556] B. de Volder, *Oratio de rationis viribus, et usu in scientiis, dicta publice cum rectoris Academiae Lugd. Bat. munere abiret*, Leiden, apud Fredericum Haringium 1698.

[557] See Krop 2003.

"science" in the modern sense of the word. As experience gained a primary role in the formulation of hypotheses, the use of metaphysics in physics was more and more limited to the foundation of its basic concepts, that is, physics was "de-metaphysicized". Through his case, therefore, one can recognize the foundation of science as the attempt to explain natural phenomena by means of experience and mathematics, rather than of philosophy and its branches. In fact, the apparent failure of such a foundation on a Cartesian basis would not prevent 's Gravesande from using the three Cartesian foundational strategies – that is, logical, metaphysical and theological – to provide Newtonian science with a philosophical foundation, developing a fully-fledged philosophy of science.

5.2 The role of empiricism

The scientific methodology of De Volder is mainly found in four of his works: his *pro gradu* disputation *De natura*, his *Quaestiones de aëris gravitate* (1681), the *Oratio de coniugendis philosophicis et mathematicis disciplinis* (1682) and his *Oratio de rationis viribus*. Also, the application of his method can be observed in his *Disputatio philosophica de universi systemate* (1694)[558].

De Volder's *De natura* is a defence of the principles of iatrochemistry; it is dedicated to Franciscus de le Boë Sylvius. In this text, De Volder addresses both the so called *empirici*, or those physicians who do not consider the proper causes of diseases, as they are just concerned with experience, and the *dogmatici*, looking for such causes in an obscure *natura* or *monstruum* ruling the human body[559]. Therefore, De Volder assumes the notion of *effervescentia* as the general principle capable to explain the effects ascribed to the nature of the body by physicians[560]. Indeed, *effervescentia* is the cause of the circulation of the blood as this had been mechanically explained by

[558] B. de Volder (*praes*.), G.H. Casembroot (*resp*.), *Disputatio philosophica quae est de mundi systemate*, Leiden, apud Abrahamum Elzevier 1694.

[559] De Volder 1664, pp. 1-2. These two categories roughly include practitioners and Galenic medicine.

[560] General *effecta* require a general explanatory principle: «naturam non in omnibus […] mutationibus, sed in primaria, et maxime generali sitam esse. Cum enim generalia sint, quae a natura fieri dicuntur, effecta, et primario ad corporis nostri conservationem faciant, ipsam etiam causam talem esse necesse est», *ibid*., p. 4. The criteria in formulating hypotheses on particular phenomena are not addressed by De Volder. Such general principle is required to assess what 1) preserves and feeds our body, 2) causes its functions, 3) heals it, 4) excites fevers in order to recover it, 5) makes every medicaments active, 6) accustom itself to medicaments: *ibid*., p. 3.

Descartes or Hoogelande, who however did not distinguish it from the similar process of fermentation, as Sylvius did[561]. Its position at the core of blood circulation – and thus of all the effects to be explained regarding the human body – is to be assessed through experience[562]. This early disputation thus reveals some continuities in De Volder's thought, as a high value is attached to experience as the means for the discovery of the causes of bodily functions, and the processes described by De Volder are consistent with a mechanistic account of bodily processes. Descartes, even if corrected through Sylvius's authority, is favourably quoted by De Volder. In his later work, actually, De Volder emphasizes much more the *rationes mechanicae* in spite of his early iatrochemical approach[563]. Still, his 1664 *De natura* shows his first concern with a Cartesian theory of philosophical knowledge, which would be maintained until the end of his career.

In fact, De Volder's openness to the role of experience is fully revealed by his *Quaestiones de aëris gravitate*, offering consistent evidence of the contents of his experimental lectures in Leiden. Even if it is reported that he carried out experiments on all the topics of natural philosophy, and the equipment of the *Theatrum physicum* not only consisted of pneumatical devices (such as the well known air pump built for him by Samuel van Musschenbroek)[564], De Volder mainly focused on hydraulic experiments. But such experiments had no heuristic function: they were primarily meant to criticize the Aristotelian prejudice of the *levitas* of the air by offering experimental evidence of the existence of air pressure or *gravitas*[565] – thus confirming the Cartesian worldview, where air and water follow the same laws as they are two kinds of fluids[566]. Hence, such experiments had a didactic function in the mechanical worldview[567], and served to increase the prestige of Leiden University. In his lectures De Volder repeats and comments on some experiments carried out by Torricelli with his barometer and by Otto Von Guericke with his sphere, as well as those of Robert

[561] *Ibid*., pp. 5-6
[562] «Constans est omnium anatomicorum, et experientiae consentiens sentientiae», *ibid*., p. 7.
[563] «Etenim fermentum generale admodum nomen est, aut nihil causae explanans; aut nihil aliud, quam ope externi cuiuspiam, quod corporibus admiscetur, partes, vel a se invicem secerni, vel laxius commisceri. Quod si omnem hanc coporum mutationem fermentum appellent, sciant, se nobis effectum obtrudere, non causam: sin veri aliquid particulare per vocem fermenti denotent, hoc quid sit, qua ratione agat, ut definiant opus erit, si cavere velint, ne ad occultam fermenti qualitatem confugere videantur», De Volder 1698, pp. 22-23.
[564] See the *series lectionum* reported in Molhuysen 1913-1924, vol. IV (1920), p. 45*. On Leiden equipments, see *ibid*., pp. 104*-106*; De Clercq 1989, p. 10. See the private collection of De Volder: *Bibliotheca Volderina: seu catalogus selectissimorum librorum Burcheri de Volder*, Leiden, van der Linden et Voorn 1709.
[565] De Volder 1681a, p. 7. "*Gravitas*" and "*pressio*" are used as synonyms by De Volder, who also uses the term "*pondus*": *ibid*., p. 50.
[566] *Ibid*., p. 18.
[567] Johannes de Raey used Torricelli's barometer for the same purpose: see De Raey 1654, pp. 193-198.

Boyle[568]. Actually, De Volder does not aim to provide new experiments but only those already known by the scientific community, as he has only teaching purposes[569]. These experiments are explained in the light of a Cartesian and mechanistic worldview, but this is never explicitly ascribed to a particular philosopher. In the first pages of his *Quaestiones*, indeed, De Volder exhibits his admiration for Galileo, Torricelli, Roberval, Pascal, Guericke, Boyle and Huygens, adding that with their experiments they proved that air has a weight *mathematica claritate*[570]. According to him, indeed, philosophy should be based on reason and on carefully performed experiments[571]. He can be considered as embracing a mechanistic worldview; he is however not uniquely concerned with Descartes's theories, as one can see from his criticism of the principle of authority in philosophy:

plurimis amicus Plato, amicus Aristoteles, amicus Epicurus, amicus Democritus, amicus Paracelsus, amicus Helmontius, amicus Carthesius et paucissimis amica veritas[572].

Moreover, even if De Volder's worldview is roughly Cartesian[573], he declares an openness to the theories of scientists with different approaches to the sources of philosophical-scientific knowledge and to the method of discovery.

Some further light on De Volder's theory of science is given by his *Oratio de coniugendis philosophicis et mathematicis disciplinis* (1682), which mainly aims to criticize the Aristotelian detachment of physics and mathematics[574]. Whereas De Volder's *Quaestiones de aëris gravitate*

[568] De Volder 1681a, pp. 6, 8-9, 32-33. See the notes of Carolus Vinson, in Sloane 1292, ms., British Library, ff. 78-141, *Burcherus de Volder, of Leyden: Experimenta philosophica naturalia: 1676, 1677*, testifying that De Volder lectured on Boyle's *New experiments physico-mechanicall, touching the spring of the air and its effects*, Oxford, printed by H. Hall 1660. See Nyden 2013, p. 236, and Nyden forthcoming. According to Le Clerc, De Volder would later teach Jacques Rohault's *Traité de physique* (Paris, de l'imprimerie de Denys Thierry 1671): see Le Clerc 1709, p. 398.

[569] De Volder 1681a, pp. 9-10.

[570] «Neque vero res dubia habita fuit, nisi postquam experimentis Galilaei, Torricellii, Robervallii, Pascalii, Guericke, Boylaei; Hugenii, aliorumque excellentium […] virorum, gravitas ipsius aeris adeo manifeste demonstrata fuit, eiusque effectus adeo notabiles animadversi, ut qui eam nihilominus negare velit […] tantae demonstrationum mathematicarum claritati tenebras offundat», *ibid*., pp. 1-2.

[571] «Excelsa quaedam et pulchra res est philosophia, in ratione et experimentis caute captis fundata», *ibid*., *Lectori philosopho*, p. I (unnumbered).

[572] *Ibid*., *Lectori philosopho*, pp. I-II, (unnumbered).

[573] This can be seen in his definition of the nature of fluids (*ibid*., pp. 13-14), the circularity of motion (*ibid*., p. 25), the rejection of the void, filled with subtle matter (*ibid*., p. 22), and of the existence of any *suctio*, *attractio* or *fuga* and *vacui metus* in extension, in accordance with its definition (*ibid*., pp. 37-50).

[574] «Nulla profecto naturalium rerum cognitioni perniciosior […] unquam invaluit opinio, quam quae apud peripateticos inveteravit, alia longe ratione tractanda res physicas, alia mathematicas, nec harum artium rebus physicis applicanda

offer a highlight of his actual experimental practices and of their methodological implications, his 1682 *Oratio* is a programmatic text, expounding his views on science. Focusing on the relation between experience and mathematics in physics, De Volder declares that just as all *res* are connected, so all disciplines are connected: thus, he emphasizes the connection between physics and mathematics[575] and mathematics and practical arts, as every discipline can be helped by mathematics through its direct application or its exercising function[576].

First of all, physics and mathematics are about the same objects: extension, motion, size and shape, all capable of a mathematical consideration. Therefore, physical phenomena are explainable through mathematics, since they flow from motion, which can be mechanically defined[577], as Galileo and Huygens did[578]. So De Volder seems to be open to a formulation of physical laws on the basis of a generalization of experience. In turn, such laws have an explanatory function as these are the real causes of phenomena[579]. Still, the overall theoretical model he assumed is that of Descartes, since De Volder adopts the Cartesian vortex theory as explanation for the overall structure of the universe. This can be seen in his *Disputatio philosophica de universi systemate* (1694), where the Copernican system is defended against the Ptolemaic and Tychonic models, and is explained by means of Descartes's cosmology[580]. In fact, the Ptolemaic system contradicts

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principia. Quasi vero totum esse maius sua parte in mathesi verum, in physicis falsum foret», De Volder 1682, pp. XIV-XV (unnumbered).

575 *Ibid*., pp. 1-3.

576 *Ibid*., pp. 7-9.

577 «Quae quidem omnia, ut generalem mathematicarum artium usum comprobant, ita proprie non pertinent ad eam quam primario mihi illustrandam proposueram rerum physicarum cum mathematicis affinitatem. Quid autem ego affinitatem dico? Cum revera una eademque sit scientia, et mathesis aut ipsa physica sit, aut certe physices pars maxime princeps. Considerat enum utraque corpus, eius figuram, magnitudinem, motum. […] Nulla certe un physicis causa aut universalior, aut foecundior ipso motu, a quo nulla non exoriuntur phaenomena, omnes corporum fluunt varietates. […] Proprietates vero motus, aut omnes aut praecipuas absque geometria cognosci posse […] pernego», *ibid*., pp. 14-16.

578 «Nunquam magnus ille florentinus Galilaeus de Galilaeo admirabilem illam detexisset in motus acceleratione proportionem, nisi in geometricis demonstrationibus fuisset versatissimus. […] Haec autem ea motus proprietas est, quae in rebus ad usum vitae pertinentibus spectatur plurimum. Nemo enim absque hac cognita motus indole, aquarum ex fontibus […] erumpentium quantitatem, nemo proiectorum vim […] definiet accurate. Hinc elegantissima pendulorum doctrina, et ex hisce accuratissima temporum observatio, sine qua in astronomicis […] nihil exacti fiet unquam. Hinc accuratiora nuper inventa horologia, quae absque vibrationum in pendulis cognita proportione, absque cycloidis lineae contemplatione vere intelligentur neutiquam. Quod inventum ut illustri Hugenio debet orbis litteratus, ita illi debuisset nunquam, nisi caeteris cum scientiis […] coniunxisse mathematicarum artium notitiam», *ibid*., pp. 16-17.

579 «Quae tamen illae leges sunt, quae corporum occursibus moderantes, omnium corporearum mutationum, atque adeo omnium physicorum effectuum verae sunt causae», *ibid*., p. 17

580 «Haec sententia de terra mobili a Copernico invecta multos illustres sectatores habuit, inter quos maxime Cartesius omnium temporum philosophorum princeps, Cartesius, qui primus recta posuit philosophandi elementa, systema copernicanum illustravit et explicuit», De Volder 1694, p. 2.

Galileo's observation of the phases of Venus and his measurements of the variations of distances between planets[581]. Moreover, the Tychonic model does not justify why earth should be at the centre of the universe[582]. On the other hand, the Copernican system allows the explanation of the solar spots observed by Galileo, as well as of his other discoveries[583]. Its validity can be justified by means of arguments based on pure reason[584], namely, through Descartes's vortex theory. According to it, since celestial matter is fluid and rotating, it moves celestial bodies like ships in a river: thus, it is implausible that any body would be at rest, like the earth or sun[585]. The cosmological theory of Descartes, apparently deduced by the Frenchman from the mere ideas of extension and motion, is assumed by De Volder as the overall model of the universe. So it seems that De Volder was admitting the derivation of a cosmological model from purely intellectual ideas: namely, from the ideas of extension and its modes, and from some metaphysical principles. Some other laws of motion, such as those of the acceleration of falling bodies or of pendulum vibration, on the other hand result from a quantification of phenomena.

Finally, De Volder's openness to the role of experience in science is stated in his programmatic *Oratio de rationis viribus*. Whereas in his *Oratio de coniugendis philosophicis et mathematicis disciplinis* he assumed astronomy as the model for a natural philosophy combining experience and mathematics, in his 1698 *Oratio* he takes into account medicine and anatomy, both heavily relying on the use of experience. Like De Raey, De Volder criticizes those aiming to deduce the whole *corporis humani fabrica* from the first principles of physics, distinguishing themselves from the *empirici*. Since this attempt still deserves some respect, these philosophers nevertheless

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[581] «Ptolomaicum certe systema nullo modo admitti potest, quoniam non minus calculis, quam experientiae maxime adversatur; primo calculis, quia Venus sexies a terra remotior est, uno, quam alio tempore, et Mars adeo suas varias distantias […] ut testatur nob. Galilaeus in suo de Mundi systemate libro. […] Secundo experientiae repugnat, nimirum phasibus Veneris, et Mercurii ex quibus constat planetas illos non semper citra solem», *ibid*., p. 3. See G. Galilei, *Systema cosmicum*, London, apud Thomam Dicas 1663.

[582] «Praeter haec autem mundi systemata aliud a celeberrimo Tichone Braheo est effictum, inter quod et Copernici systema, non magna differentia est, omnibus enim phaenomenis tam Tychonica quam Copernicana hypothesis satisfacit […]. Quamvis Tychonica hypothesis Ptolomaica multo probabilior esse videatur, non tamen omni plane defectu caret. Nam primo in eo laborat, quod falsa nitatur hypothesi, supponendo terram esse centrum universi», De Volder 1694, pp. 3-4

[583] «Praeterea illustris Galileus non terrena modo, sed et excelsa contemplanda natus observavit, solares maculas non perpendiculariter erecta, sed inclinatas ad planum eclipticae moveri», *ibid*., p. 7.

[584] «Electo igitur Copernicano systemate, restat, ut illud argumentis, non a praeiudiciis sensuum, sed a solo rationis lumine petitis stabiliamus, ac defendamus», *ibid*., p. 4

[585] *Ibid*., pp. 5-6. Other arguments appeal to an economical principle: for instance, according to De Volder it is more probable that only the earth moves, instead of the fixed stars. Also, the motion of the heavens will imply a contrariety between the motion of planets and stars, as well as an improbable rapidity of these and their variation in speed: the motion of the earth, actually, preserves the harmony of the cosmos: *ibid*., pp. 6-7.

pretended to deduce the complex structure of the body from a few notions, as if one could deduce Archimedes's discoveries from Euclid's principles[586]. This is the case with Theodor Craanen's explanations as expounded in his *Oeconomia animalis* (1685)[587], based on subtle matter, pores and fermentation as the basic notions in the explanation of bodily functions. In fact, the shape of particles – which have to fit into pores – cannot be discovered by geometry or by experience and has no observable effects, as Pitcairne argued. Moreover, fermentation, or the main principle of iatrochemistry advocated in his 1664 *De natura* – is only an effect to be further explained[588]. Hence, De Volder advocates a method of discovery more attentive to the use of experience in explaining bodily functions. This method, actually, consists of the a careful application of geometrical principles to observed phenomena, as Giovanni Alfonso Borelli and Lorenzo Bellini practised[589]. This application is to be intended as a careful procedure of arguing for conclusions, and as the explanation of observed bodily functions through mechanical principles[590]. Huygens, Newton and Leibniz are praised by De Volder as having extended such a method to the discovery of the laws of motion[591], whereas in anatomy explanations are to be provided through careful observation of the circulation or motion of fluids (as Borel or Harvey did[592]), which can be mathematically described[593]. In order to develop these mathematical explanations a new anatomy is thus required, based on vivisection and the observation of fluids in motion. In this way, one can collect those data allowing the formulation of explanatory hypotheses on bodily functions, from which phenomena

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[586] «Quapropter ad alterum propero cogitationum genus, quod in rebus est corporeis, in quarum, prout existunt, cognitione rationi soli ascribenda tantum fortasse peccatur, quantum in metaphysicis eidem abnegandis. […] Quae ut nequaquam inficior, ita vereor non parum, ne qui ita ratiocinantur, nimium magnifice de nostra scientia sentiant […]. Quoscunque enim physica recentiorum maxime industria hoc tempore fecerit progressus, tam parum ea provecta est hactenus, ut ex illius inventis ad corporis nostri effecta perpetuam argumentationem deducere qui tentant, multis partibus et absurdius et arrogantius facere nec iniuria videantur, ac faceret ille, qui perlectis omnibus Euclidis notionibus hoc solo instrumentum se putaret abunde, ad Archimedes inde perficienda conclusiones», De Volder 1698, pp. 17-18. See also p. 30.

[587] Craanen 1685, see 2nd ed., Amsterdam, apud Joannem Wolters 1703, pp. 2-3, 304-305. See also Luyendijk-Elshout 1975; Krop 2003.

[588] De Volder 1698, pp. 22-24. See A. Pitcairne, *Oratio, qua ostenditur, medicinam ab omni philosophorum secta esse liberam*, Leiden, apud Abrahamum Elzevier 1692.

[589] See G.A. Borelli, *De motu animalium*, Rome, ex typographia Angeli Bernabò 1680; L. Bellini, *Opuscula aliquot ad Archibaldum Pitcarnium*, Pistoia, ex nova officina Stephani Gatti 1695.

[590] De Volder 1698, pp. 25-26.

[591] «Ostenderunt magna huius seculi nostri lumina Hugenius, Newtonus, Leibnitzius, ne simplicium quidem corporum motus, viresque investigandas unquam, non dicam absque notitia matheseos, sed addam absque recondita harum artium scientia. Qua qui instructus non est, in physicis hospes ut sit, necessum est. Tanta igitur cum inter has disciplinas sit affinitas, eo meliori iure inquiremus, num eadem methodo tractari queant», *ibid*., p. 26. Such laws, actually, are the very causes of phenomena, *supra*, n. 579.

[592] *ibid*., pp. 29-30.

[593] *ibid*., p. 28.

can flow[594]. Scientific hypotheses have to fulfil some conditions: not to contradict other assumed hypotheses, be open to correction by new experiments and reasoning, be consistent with experience, and allow explanations for newly observed bodily operations[595].

De Volder's 1698 *Oratio de rationis viribus* thus shows some similarity with his 1682 *Oratio de coniungendis philosophici est mathematicis disciplinis*, testifying, in spite of Le Clerc's judgement, to the continuity in De Volder's thought, as he emphasizes the role of mathematics in physics and appeals to a mass of scientists concerned with mechanicism, even if not sharing the same theoretical model. If any evolution is to be found in De Volder's philosophy, this is to be seen in the replacement of iatrochemistry by an approach more open to Newtonianism. So it seems that at least in medicine the method of scientific discovery prescribes not going beyond empirical evidence about the functioning of the body. In more general theories, actually, one can hypothesize the existence of insensible features of matter in order to explain the constitution of the universe. This is the case, indeed, with his *De mundi systemate*. However, De Volder is not clear on the actual source of our knowledge of the first laws of motion: namely, whether the method of medicine has to become the paradigm for the overall physics, or if a purely rational physics can still be realized as a *physica generalis* as a product, in fact, of his acceptance both of Descartes's cosmology and of a scientific methodology roughly inspired by Galileo, Huygens and Newton. The coexistence of different methodologies in De Volder's thought, actually, results in a standpoint according to which only few explanatory principles are provided with a foundation on a Cartesian metaphysics: this, in fact, concerns only the basic notions of natural philosophy.

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[594] «Ea ergo experimenta anatomica et summo quidem cum iudicio facienda sunt, ex quibus patefiant corporis nostri non mortui membra, sed vivi actiones, qui fiant, qua partium operatione, quo fluidorum motu perficiantur. Quibus si ultimo accedat historia corporis affecti, quae morbos, quibus obnoxiis sumus, eorumque singula symptomata, variasque periodos singulatim describat, in numerato habebimus, ut cum geometricis loquar, data, ex quibus de causis porro rationicemur. Huic denique aedificio ut fastigium imponatur, non secus ac astronomi hypotheses effinxerunt, quibus iam cognitos astrorum explicarent motus, rudes in principio, quas dein novis ex observationibuis sensim emendando tandem perficerent; ita et nobis necesse erit hypothesin excogitare, quae structurae partium, motui liquorum, efficaciae spirituum sensili conveniens causas in se contineant mechanicas, ex quibus, quae fieri per experientiam novimus, sequantur», *ibid*., pp. 30-31

[595] «Non secus ac astronomi hypotheses effinxerunt, quibus iam cognitos astrorum explicarent motus […] ita et nobis necesse erit hypothesin excogitare, quae structurae partium, motum liquorum […] conveniens causas in se contineant mechanicas, ex quibus, quae fieri per experientiam novimus, sequantur. Quod cum in fabrica totius corporis nimiam habiturum sit difficultatem, praestabit seorsum in singulis eius operationibus tentare, modo caveamus, ne quid in una hypothesi assumatur, quod alteri repugnet. Nec expectandum erit, eam, quae ita primo nobis in mentem venit, rei satisfacturam; sed, ut in omnibus fieri solet, ea novis experimentis et rationibus limanda et perpolienda erit. Inquirendum scilicet porro, num, quae ex ea sequuntur, experientiae congruant, et num eadem paucis hinc inde pro re nata additis, demtisve, omnibus id genus in corpore operationibus adaptari queat. Quod si minus succedat, immutanda erit, donec tandem inveneriums hypothesin, quae in omnibus cum iis, quae fiunt, consentiat», *ibid*., pp. 31-32.

5.3 The principles of nature

Before addressing the foundational arguments set forth by De Volder, an analysis of his criteria in choosing physical explanatory principles is required. In his *De natura* De Volder stresses the importance of a *quaestio de principiis* as the crucial means for the development of sciences, instead of a mere analysis of deductions and conclusions of each particular theory. Clearly referring to Descartes's revolution in philosophy, De Volder underlines that as doubt started to be systematically applied to philosophy, allowing the discovery of more reliable physical principles, natural philosophy underwent considerable progress[596]. Such a *quaestio de principiis*, eventually, is elaborated in his *Cogitationes de rerum naturalium principiis* (1681)[597], in which the criteria for the choice of the first concepts of physics are set out in the light of Descartes's theory of clarity and distinction as marks of philosophical knowledge. Borrowed from mathematics as the paradigm of *scientia*, indeed, clarity and distinction is the first criterion in De Volder's *quaestio de principiis*, prescribing the use only of clear and distinct principles in physical explanations[598] as the very first causes of phenomena[599]. This condition, nevertheless, is not taken as a guarantee of the truth of scientific principles by De Volder. Clear and distinct perception, actually, can be compared to the mere grasping of the meaning of a sentence: hence, it is necessary but not sufficient to assess the truth of scientific principles. Ultimately, it implies that the conclusions drawn from these would be indubitable, but not that such principles have a real explanatory value[600]. Hence, the second criterion prescribes that a scientific principle must not be the effect of some other natural or

[596] De Volder 1664, p. 1. This differentiation between metaphysical doubt and the endless analysis of every argument will recur in De Volder's other works, see *infra*, n. 645.

[597] B. de Volder, *Disputationes philosophicae sive cogitationes rationales de rerum naturalium principiis*, Middelburg, typis Remigii Schreverii 1681 (b).

[598] «Quarum prima sit ut clare distincteque percipiantur», p. 12. As in his *Oratio de coniugendis philosophicis et mathematicis disciplinis*, the failed application of mathematics to physics is regarded as one of the main causes of the underdevelopment of the latter, due to the Aristotelian prejudice of the difference of physics and mathematics (*ibid*., pp. 10-11).

[599] «Ut enim phaenomenum quodpiam explanem, nonne requiritur, ut eius causas ostendam? Quae aut primae erunt, et a nulla alia corporea causa dependentes, aut erunt aliarum causarum effecta. Priori in casu quid est manifestius, quam me ipsa demonstrasse principia? Sin vero aliarum causarum effecta sint, quis non videt […] unquam huius phenomeni claram distinctamque […] notionem acquiri posse, nisi huius causae iterum cognoscam causas, idque doenc ad primas causas, sive ad ipsa rerum principia devenerim», *ibid*., p. 2.

[600] «Hactenus non requiro, ut demonstrentur, non ut certo vera esse ostendantur, sed illud tantum exigo, ut percipiantur, ut quae et qualia sint cognoscatur. Quae sane duo non parum differunt. Aliud quippe est percipere huius illiusve effati sensum, aliud eius veritatem cognoscere, de qua nisi prius illud percipiatur, constare nemini potest», *ibid*., p. 12, see also pp. 13-14.

corporeal cause[601], while the third dictates that physical principles must not involve the notion of mind[602]. The fourth criterion concerns the explanatory scope of scientific principles. According to it, every kind of natural phenomena has to be explicable through them, moreover, one has to demonstrate that the human mind cannot attain any other explanatory principle[603]. Finally, the fifth condition prescribes that these principles have to be true, that is, that they are the real causes of experienced phenomena. De Volder does not regard this last criterion as necessary. In accordance with the traditional distinction between physical (or moral) and metaphysical degrees of certitude, De Volder states that the first four conditions are adequate to choose explanatory principles for physics, as these can serve to "deduce" every kind of phenomenon, and have indubitable consequences. According to De Volder himself, this would surprise those looking for the same degree of certainty in physics as in metaphysics, plainly, the orthodox Cartesians: in fact, whereas metaphysics concerns mere concepts, in physics one has to rely on the senses and provide true hypotheses[604]. Nevertheless, this hypothetical status of physics is not only justified by our relying on experience, or on the apparent existence of the world: even in the case that the world exists, it is still doubtful whether it obeys the clear and distinct principles of mechanicism. Phenomena, indeed, can have more than one possible cause: hence, one cannot ascertain their actual cause by reason alone, since different kinds of explanatory principles are conceivable. On the other hand, experience is not a means in the discovery of the first scientific principles or causes, since phenomena are the very *explanandum*. Two identical phenomena, for instance, can only lead to the same hypothesis on their cause, even if they actually have different causes, but no differences can be inferred from their

[601] «Altera conditio est, ut prima principia non sint alterius causa naturalis, sive corporea effecta», *ibid*., p. 14.

[602] «Tertia sit, ut principiis hisce nulla ascribatur proprietas cogitationis aut mentis. Agitur enim hic non de natura earum rerum, quae cogitant sentiuntve, se de natura phaenomenum a corpore dependentium», *ibid.*, pp. 14-15.

[603] «Quarta conditio sit, ut ex iis, quae pro principiis sumuntur, omnia mundi huius phaenomena queant deduci. […] Neque tamen exigi putem, ut omnia revera deducantur, sed ut ostendantur deduci posse. […] Sed hoc tamen fieri potest, ut iis utar principiis, ex quibus ostendam sequi certo et evidenter, primo omne qualecunque genus phaenomenum. Deinde in unoquoque genere infinitam phaenomenum varietatem, atque adeo maiorem, quam quae unquam hominum sensibus possit lustrari; postremo: ut demonstrem humanum intellectum ultra ea principia nihil capere aut percipere, atque adeo me hisce principiis efficere, quidquid ab humano intellectu praestari potest», *ibid*., pp. 17-18.

[604] «Quinta denique conditio est, ut principia certo demonstrentur esse vera. De qua tamen, an requiratur necessario, admodum dubitem. Me enim quod attinet, facilem concedam unicuique, ut assumat principia, quaecunque visa fuerint sine ulla ratione, ulla demonstratione, modo ea propribus conditionibus non repugnent. Quod forte mirum videbitur iis, qui putant omnia certo demonstranda esse, nullibi untendum hypothesi. Quod ut in metaphysicis, ubi omnia per ipsam rerum naturam determinata definitaque sunt, verissimum est, ita in physicis, ubi omnia ad sensus referuntur, paris sit evidentia, non immerito forte quid ambigat», *ibid*., pp. 18-19.

observation[605]. Therefore, the fifth criterion is not required in the formulation of explanatory principles, since reason cannot ascertain that some principles are true according to metaphysical certainty: that is, by showing that others are contradictory. Accordingly, clarity and distinction – that is, evidence – are not sufficient to establish the truth of scientific models.

The major part of De Volder's *Cogitationes de rerum naturalium principiis* is devoted to a refutation of some philosophical hypotheses on the constitution of the world, and to the assessment of Cartesian principles as the best explanatory means. These hypotheses, actually, are traced back to four main philosophical schools classified by Francis Bacon in his posthumous *De principiis atque originibus secundum fabulas Cupidinis et Coeli: sive Parmenidis et Telesii et praecipue Democriti philosophia* (1653)[606]. Through a history of philosophical sects De Volder addresses some contemporary alternatives in philosophy. Thus, the first sect is portrayed by Parmenides, Melissus, Heraclitus, Anaximenes and Thales of Miletus, and in modern times by Jean Baptiste van Helmont, basing his explanations on water[607]. The second school is that of the corpuscular philosophy: starting with Democritus, it inspired Gassendi, but also Bacon, Descartes and Boyle[608]. The third one is that of those who adopted multiple – but still determined – principles: the Aristotelians and the Alchemists. The fourth category is that of those adopting infinite explanatory principles, such as Anaxagoras, embodying another form of corpuscolarism[609]. All these schools are regarded as

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[605] «Humana […] industria si inter varios quibus tunc mundum fieri potuisse supponimus modos, discrimen facere et verum eligere modum posset, profecto id benefici vel rationi deberet, vel experientiae. […] Rationi autem hoc in negotio nullae reliquuntur partes, quippe quae suam explevit potestatem, si doceat tam hanc quam illam causam mundo efficiendo parem esse; neque vero plus potest. Nam quid evidentius si ex iisdem datis, animadvertamus problema variis modis posse dissolvi, rationem eousque ad summum sese extendere, ut varios hosce modos enumeret, verum neutiquam ut demonstret hoc, non illo modo solutum esse mundum. Quod si faceret illud evidenter sequeretur, eo modo productum esse, nec alio posse, quod est contra hypothesin. Neque etiam huic difficultati enodandae auxilio est experientia, utpote quae tam ex hoc quam ex illo modo una sequitur eademque. […] Nonne evidentissimum est, illum ad summum nihil aliud posse, quam ut ostendat, aut hoc aut illo modo ortam esse glaciem, non vero quidque etiam moliatur, cum idem sit phaenomenum atque adeo eadem ratione, ex quibus ratiocinetur suppeditet data, ut determinet hoc modo hanc, illo vero alteram lagenam concretam esse. […] Eodem modo si homini huius artificii vel peritissimo duo proponantur horologia diversis ex rotulis confecta, eadem tamen externa facie […] atque adeo eadem exhibeant phenomena, in vanum profecto ab ipso expectabimus, ut certo concludat hoc modo unum, illo vero alterum horologium confectum esse, nisi forte, quo nihil est absurdius, existimemus ex iisdem datis diversas conclusiones posse elici», *ibid*., pp. 20-22.

[606] *Ibid*., pp. 24-25. See F. Bacon, *De principiis atque originibus secundum fabulas Cupidinis et Coeli: sive Parmenidis et T. et praecipue Democriti philosophia,* in *Scripta in naturali et universali philosophia*, Amsterdam, apud Ludovicum Elzevirum 1653, pp. 208-284.

[607] De Volder 1681b, pp. 25-26.

[608] «Ad secundam sectam pertinet Democritus, […] quae principia dudum reiecta nostro demum saeculo in lucem revocarunt Gassendus, Verulamius, Cartesius, Boylaeus, et quantum est ingeniosorum hominum, qui corpusculari, ut angli vocant, addicti sunt philosophiae», *ibid*., p. 26.

[609] *Ibid*., pp. 27-28.

providing principles not complying with the aforementioned criteria: the only principles to be admitted, eventually, are those of mechanical philosophy[610]. Such philosophy, however, is not expressly ascribed to Descartes. As in De Volder's *Quaestiones de aëris gravitate*, Descartes is placed among those philosophers traditionally appealed to as authoritative sources, but is no more considered the prince of philosophers.

The principles matching the first four criteria are the notions of matter and motion[611]. Such concepts fit the first criterion: physical body is one with mathematical body, and the notion of motion can be mathematically described in terms of variation of distance between bodies[612]. Also the second condition is respected, since matter has in God its only cause, motion nor rest are caused by matter itself, but by God only[613]. The metaphysical demonstration of the detachment of mind and matter, moreover, fulfils the third criterion[614]. Finally, every kind of phenomenon can be deduced from such principles, in accordance with the fourth criterion[615]. Indeed, phenomena are *communia* or *propria* to each sense. Being *communia* the size, shape and motion of bodies, these have to be explained through mechanical principles, grasped by intellect alone or by common sense[616]. On the other hand, sense data can be proper to each sense, such as colours and sounds. However, the metaphysical demonstration of the distinction between soul and body proves that no qualities such as pain or delight, nor colours and sounds can be found in the body, but only matter, figure and

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[610] *Ibid*., pp. 29-144. However, De Volder distinguishes between the Scholastics, who provided unintelligible principles (*ibid*., p. 38 *et seq*.), and the corpuscular philosophers, who adopted the principles of mechanicism even if admitting some unintelligible notion as void or *gravitas* as a property of body (*ibid*., pp. 102-121).

[611] *Ibid*., pp. 144-145. Also, De Volder mentions rest, «de quo non laboramus», or what preserves bodies in their current status. He seems to be cautious in considering this notion as being grounded *a parte rei*. This problem, on the other hand will be addressed in his metaphysical considerations: *infra*, n. 616.

[612] «Quid enim clarius, quod distinctius cognoscitur ipsa materia? […] Per ipsam enim nihil aliud intelligimus quam id, de quo agunt mathematici. Quod corpus mathematicum a physico distinguendo, immane quanto noxae, obscuritatis confusionisque scientiis scholastici attulerunt philosophi. […] Non absimili ratione obscurum esse nequit, quid sit motus. […] Quis enim profecto vel stupidissimus mortalium est, qui ignorat, quid sit corpus alteri vicinum ea ex vicinia recedere, et distantiam ab illo corpore continenter immutare?», *ibid*., pp. 145-147.

[613] *Ibid*., pp. 148-149.

[614] *Ibid*., pp. 149-150.

[615] *Ibid*., pp. 150-151.

[616] «Phaenomena autem quae observantur vel plurium sensuum sunt communia vel singulorum propria. Quae pluribus sensibus conveniunt, vel in motu, vel in magnitudine, vel in figura, situ similibusque consistunt. Quae vero propria sunt manifeste spectant colorem […] similesque […] qualitates. Praeter quae nulla in rerum natura aut dantur aut dari queant phenomena. […] Qua in re id occurrit primum, quaecunque mutationes vel in motu vel in figura vel in magnitudine occurrunt sensibus, eas qualescunque demum sint hisce principiis deberi. […] Ex quibus itaque sequitur nullam in corpore aut motus aut magnitudinis aut figurae varietatem dari, quin ea ex iis, quae diximus, principiis sequatur», *ibid*., pp. 152-154. De Volder enriches the catalogue of actual properties of body listing *magnitudo*, *motus*, *figura*, *situs*. See also the following quotation. Actually, he does not clearly define which are the properties and modes existing *a parte rei*.

motion[617]. To that extent every kind of phenomenon can be mechanically accounted for[618].

In sum, the principles of mechanical philosophy, that is, the notion of body and modes as these can be mathematically described, fulfil the four conditions stipulated by De Volder. Moreover, according to him the human mind cannot conceive anything beyond such principles, since it can grasp nothing but extension, size, shape and motion in the physical realm. So according to De Volder it is not required for such principles to be true, according to the fifth condition. First of all, no one can deny that extension or motion exist. Moreover, such a demonstration would belong more to metaphysics than to physics[619]. Therefore, his *Cogitationes de rerum naturalium principiis* can be considered as expounding a philosophy of science, whilst not providing a metaphysical foundation. However, as De Volder will provide scientific principles with a foundation in his metaphysical works, he will show a similar unconcern about their being absolutely true.

5.4 The foundation of the principles of nature

The metaphysical foundation of physics is provided by De Volder in his *Disputationes contra atheos* (1685), *Disputatio philosophica de certitudine clarae et distinctae perceptionis* (1689)[620] and *Exercitationes adversus Censuram* (1695). Designed to defend Cartesian philosophy against the

[617] «Inter obiecta, quae ad singulos senus spectant, et ea quae plurium communia sunt, licet vulgo confundi soleant, permagnam esse differentiam negabit, ut opinor, nemo, modo attenderit, quam clare intelligat, quid sit in rebus extra se positis, motus, figura, magnitudo, situs et . Et quam obscurum ipsi sit, quid sit iisdem in rebus, color, odor, sapor, et c. […] Ex hac autem distinctione sensuum et qualitatum, quae in corporibus sensum excitantibus revera sunt, id licebit animadvertere, qualiscunque ea corporea dispositio sit, eam ab ipso sensu omnino diversam esse. […] Verum ne hoc generali ratiocinio, quamquam id vel solum puto rem conficere, sollumodo niti videar; accedamus ad speciales sensus, eorumque peculiaria phaenomena. Cui rei non parum conducet annotasse, ex motu locali […] nihil posse produci, quam varietatem in figura, magnitudine, celeritate, determinationeve ipsius motus. Hinc enim sequetur, si ostendam sensiles qualitates suam originem debere motui, eas vel in figurae, vel magnitudinis, vel motus diversitate consistere, atque adeo nostris principiis deberi», *ibid*., pp. 154-158, see also pp. 158-166.

[618] «Ex quibus ita constitutis non arduum est elicere, si singula phaenomenum genera nostris principiis debeantur», *ibid*., p. 166.

[619] «Deinque, in quinta conditione hisce principiis applicanda multus ut sim necesse non est, cum nemo diffiteatur, haec in rerum natura locum obtinere, qualiacunque etiam principia sequatur. Quis enim est, qui aut extensionem non admittat, aut qui motum neget? Unde nec puto quenquam fore, qui accuratam huius demonstrationem severe exigat, quam conficere hic supersedeo, tum quia res planissima est, tum quia eius demonstratio metaphysici potius quam physici est fori», *ibid*., p. 168.

[620] B. de Volder (*praes*.), G. vander Tak (*resp*.), *Disputatio philosophica de certitudine clarae et distinctae perceptionis*, Leiden, apud Abrahamum Elzevier 1689.

accusations of atheism and scepticism[621], De Volder's *Disputationes contra atheos* expound his demonstrations of the existence of God: recalling, in traditional terms, that every truth can be deduced from the idea of God[622], the keystone of such demonstration is the notion of idea as representative being. As the mind can deal only with ideas – that is, essences or natures can be grasped only as represented objects – these are our only means to justify the existence of something different from the mind itself. De Volder refuses to provide a demonstration on the basis of the *consensus omnium*, or through a cosmological argument based on the sensory appearance of the world[623]. He relies on the indubitable existence of thought, which is confirmed by appealing to Augustine's *Soliloquia* – thus not directly referring to Descartes[624]. Thereby, two Cartesian proofs are set forth. The first is based on two assumptions: 1) what necessarily follows from the nature of some thing is an attribute of such a thing, and 2) what necessarily follows from the idea of something necessarily follows from the nature of such a thing. The second assumption is grounded in the very nature of ideas as these are objective beings. Since ideas are represented natures, one can find the same connection between the nature of things and their attributes, and between ideas and what ideas entail[625]. Hence, as the idea of existence is entailed by the idea of God, existence necessarily belongs to the nature of God[626]. The second proof consists in the application to ideas of

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621 De Volder 1685, pp. 5-6.

622 «Etenim ut Divinum Numen unice causa est omnium, quae in rerum universitate aut sunt, aut esse possunt, sic eius cognitio, ea est, ex qua reliquarum omnium rerum scientia, evidentiaque tanquam perenni quadam e scaturigine fluunt, deducunturque» De Volder 1685, p. 3.

623 «Neque etiam ex fabrica ipsius mundi, aut ulla rerum sensilium existentia Dei argumentabimur, non quod existimemus ea ipsa Dei existentiam non evinceret, si nobis res sit cum iis qui res sensiles affirmant, sed ne nosmet ipsos scepticis deridendos praebeamus, ea nostri ratiocinii assumentes fundamenta, quae ab ipsis pro falsis aut sane pro incertis haberi, obscuro non est», De Volder 1685, p. 8, see pp. 8-9.

624 «Verum omnis difficultas in eo est, taliane principia inveniri possint. Qui enim omnia negantibus, aliquid extorqueri potest quod non negent? […] Quantumcunque enim dubitationi indulgeat, non tamen hoc efficiet, ut se cogitare nesciat. Quod ipsum es quod Augustinum impulit, ut, in inquisitione, quam instituit de Deo et mente, cogitationem pro fundamento poneret. Soliloq. I. 2», pp. 9-10. See Augustine, *Soliloquiorum libri duo,* in *Opera omnia*, vol. III/1, Roma, Città Nuova Editrice 1970, II, I, 1.

625 «Quae itaque paucis ut ob oculo ponatur, assumo, ea omnia quae per necessariam, et certissimam consequentiam ex rei cuiuscunque natura deducuntur, ea esse rei istius attributa, rei isti certo competere, nec absque iis rem illam aut existere aut concipi posse. […] Assumo deinde, ea omnia, quae in idea rei alicuius continentur, sive quae ex idea istius rei necessario sequuntur, necessario quoque sequi ex ipsa natura. Nam quid aliud sunt quam naturae ipsarum rerum repraesentationes? Ex quibus quidquid sequitur, sequitur ex natura rerum quas repraesentat. Quis enim non videt, inter naturam rei, quatenus ab idea offertur menti, et attributa, quae ex eadem necessario fluere mens percivit, eandem omnino connexionem esse, quae est inter rei naturam extra nos existentem, et attributa quae producit? Ita quidem ut sicut omnino nequeo habere ideam rei sine illo attributo quod ex idea sequitur, sic res illa omnino nequeat existere absque eodem illo attributo. Nullam enim aliam ob causam ex idea id sequitur, quam quod cum ipsa rei natura necessario copulatur. […] Manifesto siquidem eadem analogia et connexio est inter ideam rei et ea quae in idea continentur, quae est inter naturam rei, et ea quae ex illa fluunt», De Volder 1685, pp. 23-25.

626 «Profecto si quis ea quae […] de connexione inter ideas, et rerum quae repraesentent naturas diximus, attente applicet ideae divinitatis videbit evidenter, istius naturae existentiam necessarium esse attributum, ideoque de ea non

the principle of causality[627]. Whereas such application can be allowed by the common persuasion that every idea has a cause provided with those features it represents, like those perceived through the senses, De Volder does not want to rely on a commonsensical foundation of his proof[628]. Hence, he first considers the axiom according to which everything is *a se* or *ab alio*[629]. Given its evidence, he focuses on the nature of ideas: since these are, *ut obiectum*, "natures", they differ from each other according to their representative being. In the case that the things ideas represent exist, therefore, the differences among things would correspond to those among ideas, insofar as these represent natures. As a consequence, the very connection between the natures of cause and effect can be found between the ideas of cause and effect[630].We can grasp therefore the connection of cause and effect by means of ideas. In addition, one needs to admit that the difference between causes matches that between effects[631]: otherwise, the conclusions drawn from two identical data would be different, or the same conclusion would be drawn from different data[632]. The validity of the

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posse non affirmari», *ibid*., p. 26, see pp. 25-27.

627 «Post eam existentiae divini numinis demonstrationem, quae suam efficaciam debet ispi naturae Dei […] proximum est, ut videamus quidnam sequatur ex eadem illa idea, eam si consideremus, non in sua natura, sed tanquam causae alicuius effectum. Cui rei non inutile erit praemittere quaedam generalia ipsam naturam causae et effecti», *ibid*., p. 32. Cause is defined as «qua posita effectum ponitur et qua sublata tollitur». The necessary connection of cause and effect, however, is subjected to the actual agency of the cause: see *ibid*., pp. 33-34.

628 «Cur enim quaeso dicimus terram, coelum, sidera, idem autem est de quibuslibet rebus existere? Nonne quia ea videmus aut aliis quibusdam sensibus percipimus? Visio autem haec nobis ne quidem persuadere, multo minus nos certos reddere posset, de rei alicuius existentia, nisi mentem afficeret. Quid enim evidentius, quam si corpus afficeretur, mens non afficeretur, nunquam nos visuros, nec ex ea corporis affectione si eius conscii non fiamus, nos nobis unquam persuasuris dari aliquid extra nos. Sola igitur idea est, quae persuadet […]. Qua autem, quaeso, ratione hoc potest idea, nisi persuasissimi essemus ea causa requirere extra nos existentem, et talem quidem, quae illius repraesentatis perfectionibus respondeat? Quae non eo adduco, quasi ex hac persuasione argumentum petere velim, sed solummodo ut ostendam eos qui, ubi de idea Dei agitur existentia, hanc de causis idearum veritatem in dubium trahunt, eandem illam, ubi de rerum sensilium existentia agitur, extra omnem dubitationis aleam ponere, sive sibimet ipsis pugnantia loqui», *ibid*., pp. 49-50.

629 «Manifestum plane attendenti axioma est, omne id quodcunque rei alicui adest, adesse vel ab ipsa rei natura, vel a causa externa. […] Cui equidem effato consectarium est, omne id quod existit, aut existere a se, a sua natura, aut existentiam suam mutuari ab alio», *ibid*., pp. 50-51.

630 «Quod si idearum nostrarum naturam vel obiter contemplemur, facile liquebit inter eas respectu rerum quas repraesentant eandem omnino diversitatem esse, quae foret inter ipsas res quarum sunt ideas, si eae forte existerent […] Ex quibus nec difficile erit advertere eundem hunc nexum, qui est inter naturam operationemque causae, et effectum quod producit, esse quoque eadem omnino necessitate, inter causae, eiusque operationis ideam, et ideam effecti», *ibid*., pp. 36-37.

631 «Quibus omnibus consentaneum est, quantum inter diversas causas varietatis est tantundem necessario diversitatis inter earum effecta fore, et viceversa, quantum est inter effecta variarum causarum discriminis, tantundem quoque inter ipsas causas reperiri differentiae», *ibid*., p. 37.

632 «Ut enim in ratiocinio, ieri nequit, ut ex iisdem plane datis diversis concludantur eadem, sic nec fieri poterit, ut ex communibus iisdemque in utraque causa proprietatibus, operationes diversae sequantur, neque ut ex diversis proprietatibus, operationes diversae sequantur, neque ut ex diversis proprietatibus sequantur eaedem. Hoc etenim si fieret, sequeretur diversam plane esse inter causam et effecta connexionem ab ea quae est inter ideam causae, eiusque effecti; quod aburdum esse […] evicimus. Merito igitur licebit concludere, eandem omnino causarum, quae effectuum, et viceversa varietatem poni», *ibid*., pp. 39-40.

principle of causality, therefore, is grounded in the nature of ideas as objective beings and our proceeding in thoughts: then, it is applied to ideas as these are effects of something else. This is the case with the idea of God, which differs from other ideas as God differs from things. Since the idea of God does not exist *a se*, and it is the idea of an infinite thing, it requires an infinite cause[633]. Still, this proof is based on the assumptions that everything is *a se* or *ab alio*, and that ideas represent things that can exist, namely, that we can conceive things as they are, in the case they exist[634]. Eventually, De Volder stresses that in the case we are not convinced that ideas require a cause external to them that matches its contents, we could not assess the existence of anything. Actually, we have no means besides mere ideas to grasp reality[635].

The problem of the role of ideas in grasping external reality is re-examined by De Volder in his *Disputatio de certitudine clarae et distinctae perceptionis* (1689), aiming to provide a definition of clarity and distinction, i.e. the evidence of ideas. Thus, besides appealing to the immediate awareness we have of evidence[636], De Volder defines such a property in terms of the compulsion to the assent. Plainly, this compulsion concerns only the perception of the nexus of several ideas, that is, propositions, as in the case of mathematical and metaphysical principles like «totus esse maius sua parte» and «factum infectum reddi non potest», entailing the absence of any obscurity in perceiving each idea and their connection[637]. Eventually, the evidence of simple ideas is defined in

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633 «Quae quidem omina non difficulter evincent Dei existentiam, cum iam constet, ideam, quam habeo divinitatis, tantopere differre ab ideis aliarum rerum, quantopere ipse Deus sic existere ab illis quoque rebus existentibus diversus foret. Habeo ego ideam Dei, illa certe causam requirit. Nihil enim aut dari aut concipi potest quod existentiae suae essentiaeve causam non habebit, sive a semet ipso, sive ab alio. A qua igitur causa illa est? Vel certe ab ea quae est infinita et omnino perfecta, vel a finita: illud si quis dixerit, eo ipso fatebitur rem infinitam, hoc est Deum dari», *ibid*., p. 40, see pp. 40-41.

634 «A quo argumento antequam discedam, non inutile forte erit ex iisdem fundamentis […] demonstrare conclusionem. […] Quod ut fiat, illud primum considerari velim, omne id quod sub perceptionem nostram cadit, si forte non existat, existere tamen ex sua natura posse», *ibid*., pp. 41-42.

635 «Verum, inquiet forte quispiam, ex cogitationibus nostris, quae multa comprehendunt, quae in rerum natura non reperiuntur, non licet concludere rerum existentiam. Imo vero existentiam concludere nisi ex cogitationibus nullo modo licet», *ibid*., p. 30. See also p. 36: «nam si omnes meae, quas habeo, ideae tales sint, ut nullam extra me causam agnoscant, de nullius quoque rei a me diversae existentiae certus fieri potero».

636 «Quamvis ea sit mentis nostrae natura, ut suas operationes prae caeteris rebus clare et intime cognoscat, cum omnis cogitatio conscientiam sui involvat; attamen verba idonea satis ad aliis indicandum, quae et qualesnam sint, vix excogitare potest», De Volder 1689, p. 1.

637 «Ut ipsas voces aliquo modo determinemus, claram et distinctam perceptionem habere dicimur, ubi aut unam eandemque ideam tam evidenter percipimus, ut nullam ignorantiam cum illa commixtam cognoscamus; aut idearum nexum et relationem ad se invicem, absque ulla confusione cum aliis ideis, tanta cum claritate et evidentia, mentis acie intuemur, aut non possimus, quin assentiamur cum plena voluntatis nostrae lubentia; prout ex gr. (quia non de unius ideae, sed de idearum evidentia, impreaesens agemus) intelligimus, totum esse maius sua parte, factum infectum reddi non posse, et eiusmodi sexcenta; unicuique enim attendenti fit manifestum, se a talium veritati, assensu iudicium suum abstinere non posse; ex quo sequitur cum nullo modo errare; quod hocce exercitio serio et

the light of being part of propositional notions. Thus, evidence as *norma veritatis* is grounded in our absence of freedom to assent to such propositions: in fact, we cannot doubt that an external force is not deceiving us, as we cannot frankly work this hypothesis out[638]. This foundation of evidence as the norm of the truth – or of the highest *scientia*, to be found in metaphysics and mathematics – is strengthened through an appeal to the existence of God, which is assumed in De Volder's argumentation. First of all, since *scientia* is something real and it is a perfection, it requires a cause. As God is the cause of positive beings, He is the cause of such knowledge. Moreover, since we are forced to assent to evident propositions, God would be the cause of error if He compelled us to assent to false principles. Finally, since truth is an attribute of God, we conceive evident principles in the same manner as God: otherwise, God will reveal something of Himself not matching His nature[639]. Actually, De Volder proves that what we evidently conceive can truly exist by an appeal to the existence of God: whose existence, however, is proved in his *Disputationes contra atheos* by means of the same assumption. Apparently aware of this circle, De Volder underlines that the reliability of evidence as *norma veritatis* does not truly need a demonstration, like «duo et tria facere quinque». In fact, the evidence is so compelling that even past evidence cannot be put to doubt[640]. The argument based on the existence of God, therefore, merely confirms what has already been indubitably perceived. As stated above, we simply cannot doubt some principles: therefore, in the case that something external to the mind exists, we cannot deny that it must obey to such principles.

A metaphysical foundation of scientific knowledge is finally developed by De Volder in his *Exercitationes adversus Censuram* (1695). Whereas Jean Le Clerc wrote in his *Bibliothèque choisie* that the *Exercitationes* – also printed in separate booklets[641] – were published without De Volder's permission[642], it is beyond any doubt that De Volder actually embraced their contents. Encouraged

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modeste paucis defendere aggredimur», *ibid*.

638 «Hanc itaque veritatem edocemur primo ipsa experientia; ubi enim clara distincta alicuius rei perceptio adest, tam plene de veritate rei perceptae convincimur, ut certi simus, nos errare ne per ullam quidem potentiam posse; quod si fieri posset, iam semper aliquis nobis remaneret scrupulus, an non falleremur; quotquot vero sumus, experimur, nos de talibus veritatibus praesenti illa clara et distincta perceptione, quicquid etiam moliamur, dubitare non posse: ut cum cogito totum esse maius sua parte , et c.», *ibid*., p. 2.

639 *Ibid*., pp. 2-3, see theses III-V.

640 «Quia quis aliquando, absente illa clara perceptione, dubius herere posset, […] ideo hoc argumentum, adducitur […] illud omne, quod aut unquam evidenter percipimus, aut in posterum sic percepturi, sumus, certum et inconcussum est», *ibid*., p. 3

641 B. de Volder, *Exercitationum philosophicarum prima-vicesima octava*, Leiden, apud Abrahamum Elzevier 1691-1693; P.-D. Huet, *Censura philosophiae cartesianae*, Paris, apud Danielem Horthemels 1689.

642 Le Clerc 1709, p. 383. Le Clerc was however right, as De Volder states, in writing that De Volder was driven by his

by his students to write a defence of Descartes's philosophy against Huet's *Censura*[643], De Volder was willing, rather than to enter in a dispute about what Descartes had truly said, or a dispute about persons, to lay the foundation of philosophy[644]. Roughly following the series of chapters of Huet's *Censura*, De Volder's *Exercitationes adversus Censuram* start with his *Exercitatio de dubitatione universali*, concerning doubt as the grounding step of philosophy[645]. As a truth *per se nota* is required, that is, not relying on any other knowledge, doubt proves to be the only means to acquire it[646]. As doubt does not provide the annihilation of all knowledge, but only a strict examination of mental contents[647], it is to be first applied to axioms as «totum maius esse sua parte»: thereby, it makes us aware that we cannot refuse to assent to this kind of propositions[648]. This is also the case with respect to the proposition «cogito ergo sum», the certainty of which cannot be refuted through Descartes's arguments concerning the unreliability of sense perception, of the difference between sleeping and waking, and the hypothesis of a deceiving genius[649]. Whatever opinion we have of the

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students to answer Huet and that he was not supporting Cartesian philosophy as a whole, but only some of its general principles: see *ibid*., pp. 381-382.

643 De Volder 1695, vol. I, pp. 1-4.

644 «Quae disputationis ratio, ut ad personarum, ubi de iis agitur, defensionem multum potest, ita ad veritatis perquisitionem nihil confert. Sive hoc enim senserit Cartesius, sive illud, quid attinet inquirere? An verum sit quod senserit, ubi de sensu constat, hoc demum scientiarum et veritatis interest. […] Accedebat et illud, quod hac occasione sperabam me eam philosophandi rationem, quam licet nequaquam in omnibus, in generalibus tamen sequendam existimo, ab innumeris liberaturum cavillationibus, et praecauturum hac via, ne tyronum, quibus haec solummodo destinantur, animi per illas avocentur a rei veritate exacte inquirenda et agnoscenda», *ibid*., pp. 2-3.

645 De Volder distinguishes two methods in the foundation of science: namely, the Cartesian way, based on doubt and a careful analysis of every opinion (*ibid*., pp. 7-8). This second way turns out to be an endless analysis of preconceived opinions: a foundation *ex novo*, actually, is the only suitable way to ground the new science (*ibid*., pp. 7-9).

646 «Adeoque primam et praecipuam eius, qui nunc demum incipit philosophari, hoc est, certam scientiam quaerere, curam esse debere de fundamentis, quibis secure postmodum philosophiae suae superstruat aedificium. […] Prima certe scientiarum fundamenta; si quae sint, per se nota sint, necesse est, adeoque ad sui agnitionem nulla alia re indigent; non priori, siquidem sint prima; non posteriori siquidem omnium illorum cognitio a fundamentis pendet. Aut igitur omnis de fundamentis scientiarum ponendis exuenda sollicitudo est, quod nemo dixerit; aut si quae restat, id certe agendum, ut dum in fundamentis elaboramus, ita progrediamur, ac si nihil nobis cognitum foret, nullasque in mente haberemus opiniones: quarum dein, si ordine progredi velimus, nulla assumenda erit, nisi quam fundamentis positis consentire, et ex illis necessario fluere certo animadvertimus. […] Atqui hoc unice est, quod sibi vult haec tantopere a multis exagitata universalis dubitatio», *ibid*., pp. 11-12, see also p. 16.

647 *Ibid*., pp. 12-15.

648 «Progrediatur igitur noster hac methodo, ut primo generatim accuratius diipicienda sibi proponat omnia, ipsa etiam axiomata. Haec enim dum fundamenta futura sunt omnis ulterioris ratiocinii, cavendum summopere, ne in illis ulla fallaciae superesse queat suspicio. Quod dum agit, dum ad ipsa axiomata attendit, dum sibi horum aliquod ob oculos ponit, totum ex gr. maius esse sua parte, experitur statim hoc inter ea esse, de quibus, quantumcunque etiam dubitationi indulgere studeat, dubitare vel minimum non est in ipsius potestate», *ibid*., pp. 18-19, see also p. 17. Mathematics is therefore taken by De Volder as the paradigm of science, as mathematicians consider all the axioms and deductions carried out, until they find they cannot doubt of them.

649 «Atqui tu nescis, an non fallaris in evidentibus: verum est; sed etsi hoc generatim nesciam, an hoc fieri nequeat, scio tamen hoc in casu me non falli, et experior illam generalem rationem me non posse abducere, quin his effatis, cogito, ergo sum; totum est maius sua parte, et c. absque ulla haesitatione assentiar. […] Sed concedat tamen nobis,

power of God, consciousness convinces that propositions like «cogito ergo sum» or «duo et tria facere quinque» are indubitably true[650]. As there are no other means to ground the truth of our knowledge but our consciousness, our lack of freedom in assenting to certain propositions becomes the mark of the truth of such propositions. Plainly, this canon of truth must not be applied to Revelation or to disciplines based on authority or experience, such as medicine: it merely concerns metaphysics and mathematics, which are both based on pure reason[651]. However, since De Volder considers both physics and mathematics as having the geometrical body as the common object, he provides physics with a metaphysical foundation with regard to its basic notions: extension, size, shape and motion. Since we have no means to doubt their being capable of representing bodily features, no more foundational arguments are required to prove their reliability. The truth of evident perception can be stated *sola conscientia*. Thus, a foundation of scientific knowledge can be provided without the demonstration of the existence of God. It is through an appeal to mere consciousness, moreover, that in the *Exercitatio de Deo* De Volder objects to Huet that no simple ideas can be created by the mind: these are innate or to be gained by the senses[652]. The problem of the impossibility for mind to create any idea by itself is addressed by De Volder both by appealing to inner consciousness and by hypothesizing the existence of a third nature beside body and thought: this is inconceivable. No new objective realities can be created by the mind alone, as these

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obsecro, si talis quis inter homines reperiatur […] ut ex ea, quam in nobis experimur mentis nostrae constitutione argumentemur, et ea pro certis habeamus quae nobis certa sunt, et de quibus, quidquid sit de fide sensuum, de discrimine inter somnum et vigiliam, de genio deceptore, et si quid porro est, quod ad scientiam nostram labefactandam potest adferri, conscius ego mihi sum, me ita certum esse, ut quidquid agam, quidquid moliar, ut dubitem, dubitare tamen non possim», *ibid*., pp. 24-25.

650 «Cum cogito duo et tria facere quinque conscius mihi sum, huius evidentiae, quae in mente est, hunc esse effectum, ut plane hac de rei veritate certus fiam, ut sciam, quidquid sit de illa potentia Dei, utut illa me forte in evidentissimis aliquando possit decipere, illam tamen hoc in casu me decipere nequam», *ibid*., pp. 26-27.

651 *Ibid*., pp. 30-31

652 «Non […] quaeri, an possimus ideas, quas a rebus externis accepimus variis inter se modis operatione mentis nostrae componere, verum an possimus plane novam effingere, sic Cartesius facillime huic allato exemplo oggeret, non quaeri, an nos qui habemus idea extensionis et motus […] possimus illas variis inter se modis disponere pro arbitrio intellectus nostri, et si nihil extra nos sit, quod illi compositioni simile sit; sed id agi, an illas ideas extensionis et motus habere possimus, si nihil foret, quod extensioni et motui respondeat. Quae duo admodum a se differre, vel hoc ipsum Chimerae, et c. exemplum evincit. Chimaeram enim, et Pegasum ut non possem effingere, nisi animalia, ex quorum compositione illa effingo, sensibus percepissent, ita nec possem mundum illum alterum effingere, nisi haberem ideam extensionis et motus, ex quorum in se actione omnia haec mea figmenta oriuntur. Ex eo itaque quod possim ideas, quas habeo extensionis et motus pro arbitrio meo varie inter se componere, et ex hac compositione alterum quendam mundum effingere ab hoc nostro modorum respectu diversum, concludere velle, me posse pro meo quoque arbitrio, illas ipsas extensionis et motus idea efformare […] ac si qui concludere vellet, ex eo quod colores, quos visu […] percepit, varie inter se miscere possit pro arbitrio suo, se quoque, utut ab ineunte aetate caecus fuisset, adeoque eos visu nunquam percepisset, efformare tamen in se pro arbitrio suo has ipsas colorum ideas posse», *ibid*., pp. 13-14.

have a consistent ontological status, that is, are something positive[653]. What justifies the deductions between natures as these are represented by ideas, indeed, is the objective being of the ideas themselves: these are not simply formal entities – which are all identical – but have different objective beings, over which we have no actual power[654]. We cannot deceive ourselves in creating new ideas, nor do we have other means beside the ideas of God, mind and body in grasping the different kinds of reality. De Volder stresses our being forced to deal only with ideas, whose contents do not depend on our will. If we doubted that there are ideas able to represent natures, and that the consequences between ideas match those in natures or *res*, we would have no means to know nature[655].

Still, God plays some roles in the foundation of De Volder's notion of *scientia*, as this is developed in his *Exercitatio de clara et distincta perceptione criterio veri*, which, in part, restates the contents of his *Disputatio de clara et distincta perceptione*. Besides remarking that we deal only with ideas, and that we rely on their properties – like evidence – to assess their truth[656], De Volder deepens the point by analysing the very notion of truth. This is defined as *veritas rei*, or the very being of things what they actually are[657]. Secondly, it regards ideas that do not involve any affirmation or negation, that is, non-propositional ideas. These can be true or false insofar as they represent something different from themselves, namely, an *obiectum*. Ideas of this kind are always true – since they represent something – but can be different according to their clarity and

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653 «Nos mentem habemus, quae duo rerum percipit genera, cogitantium et extensarum; tertium genus non percipimus. Neque tamen ullus est, opinor, qui ex eo concludere valeat, tertium genus rerum non posse dari. Ponamus itaque tertium aliquod rerum genus, et praeterea dari substantiam cogitantem finitam, quae praeter illa duo rerum genera, quae et nos percipimus, etiam percipiant hocce tertium. Haec tertii generis rerum idea in illa substantia cogitante, erit mera modificatio, et tamen mens nostra, quae est substantia, et cogitans substantia non habet in potestate sua, ut illam alterius ideae realitatem obiectivam […] in se producat, cum tamen illa, qualiscunque etiam sit cogitatio videatur a re cogitante eodem modo procedere, ac eae quae sunt in nobis videntur procederea mente nostra» *ibid*., pp. 18-19.

654 «Poterone haerere vel minimum quin illud ad illam rem pertineat? Idea huius attributi necessario pertinet ad ideam illius rei, quam cogito, hunc necessarium nexum in mente mea adverto, poterone dubitare an idem sit nexus inter harum idearum obiecto? Non certe. Proculdubio enim ideae respondent obiectis, sive rebus repraesentatis; cumque hic nexus, sequatur non ex communi hoc, quod ideae sint, sed ex repraesentamine idearum, sive ex naturis repreaesentatis», *ibid*., pp. 21-22.

655 «Nisi enim ex ideis de rebus iudicare possum, nullum mihi aliud iudicium adest. […] Fierine potest, ut hic nexus in ideis sit, in re ipsa non sit? […] Sin vero possit, iam idea mea non respondet triangulo, quod manifestissime falsum est; iam aut falso, aut saltem incerto assuerunt mathematici, triangulo habere angulos aequales duobus rectis; conceptus trianguli hoc quidem involvit, sed si ex conceptu ad rem ipsam argumentari non licet, dubitari potest, an idem hoc, quod ex conceptu trianguli sequitur, sequatur ex trianguli natura. Quod si dubium esse queat, iam profecit nulla datur via, per quam in rerum cognitonem deveniam», *ibid*., p. 22.

656 *Ibid*., pp. 47-49, 52-55.

657 *Ibid*., p. 57. This is the traditional correspondence of truth and being.

distinction[658]. Non-propositional ideas, therefore, are false whenever they do not represent anything at all, or whenever they represent just an affection of the mind, whereas they are believed to represent something else, or *vice versa*. This is the case of obscure and confused ideas[659]. The ideas we grasp in a clear and distinct way, on the other hand, do not represent mere affections of the mind: like the nature of a triangle, which is not a mode of the mind but can exist as something different from an idea, as its notion does not include that of mind. Moreover, even if no triangle existed outside the mind, its idea would still be true, thanks to the existence of God. Insofar as God exists, He can create whatever we evidently conceive as possible[660]. Thus, the power of God is the ground of the truth of ideas as these represent natures with evidence. The demonstration of His existence, on the other hand, is proved in the next *Exercitatio de idea Dei* and *Exercitatio de Deo*, where De Volder restates the proofs already given in his *Disputationes contra atheos*[661]. These are based, in any case, on the assumption that ideas can match something different from themselves. This, actually, is the ultimate ground of the reliability of ideas, whereas the demonstration of the existence of God merely assures us that finite things may exist.

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[658] «Conceptus autem quod spectat, in illis omnibus verum est, ita me affici, me hoc cogitare, me hos illosve conceptus inter se coniungere, disiungereve, haec enim omnia aeque vera ac certa sunt, ac certum est me cogitare […]. Manifestum equidem est […] cogitationes […] plures reperiri alias […] quae praeter illam mentis meae affectionem, aliquis mihi repraesentant, quod ab ipsa mentis meae affectione, ipsa cogitatione mea plane concipitur distinctum. […] Hoc quod ita mihi repraesentatur, obiectum huius mei conceptus dico, hoc rem reive modum voco, ipsam vero cogitationem huius ipsius, quod repraesentatur sive rei, sive modi, ideam voco […]. In hisce autem rerum ideis hanc manifeste invenio discrepantiam, quod quaedam harum maximam et perspicuitatem et evidentiam sibi habent coniunctam, quas claras distinctasque vocat Cartesius, quaedam vero […] confusas vel obscuras dicit. […] In hisce autem conceptibus, utpote qui nullam affirmationem aut negationem continent, cum sola repraesentatio locum habeat, et semper verum sit mihi hoc illudve repraesentari, huius enim conscius sum, non video, quid in illis falsum dici queat», *ibid*., pp. 58-59.

[659] «Si tamen has veras, illas falsas, ut in vulgari usu est, dicere velimus, non video quaenam falsae dici queant, nisi vel quae videntur aliquid menti repraesentare, cum nihil offerant, vel etiam quae affectionem mentis repraesentant tanquam quid ab illa affectione diversum, et viceversa. Qua ratione si ideas in veras falsasque distinxero, clarae nihilominus et distinctae perceptiones omnes certissime erunt verae», *ibid*., p. 60. In his *Disputationes contra atheos* De Volder considers the case in which the contents of ideas would not represent a nature: plainly, it would not be the idea of such nature: De Volder 1685, pp. 36-37.

[660] «Erit fortasse triangulum sola mentis meae affectio? Nihil minus. Quod enim mihi repraesentatur nihil habet cum cogitatione commune. Sed forte nullum dabitur extra me triangulum, nec hoc affirmo, non dico dari, dico concipi. Quid ergo? […] Siquidem ego, qui iam novi Deum esse, et illum omnipotentem et omniscium esse, facile etiam novi omnia illa, quae hoc modo a me perciipiuntur a Deo etiam percipi, illum omnia ea posse, quae possum concipere», De Volder 1695, vol. I, pp. 60-61.

[661] De Volder 1695, vol. II, pp. 1-7, 30.

5.5 Foundation and philosophy of science go separate ways

In the light of this analysis, one can draw some conclusions with respect to De Volder's philosophy. According to him, physics is a hypothetical discipline. First of all, because it concerns the sensible world, whose existence can be proved only through the application of the causality principle to adventitious ideas. Moreover, the laws governing phenomena can be assumed only hypothetically, as their formulation also relies on experience. Finally, even the basic notions of physics are hypothetical insofar as the world could have been created according to different principles. Still, we have no other means to grasp the constitution of the world besides the notion of extension and its modes. Whereas Le Clerc voiced his unconcern about metaphysical problems as such, De Volder is to be considered an interpreter of Descartes's metaphysics, clarifying some of its implications. The hypothetical certainty of mechanical explanatory principles, indeed, results from Cartesian metaphysics as this does not allow us to demonstrate that the world actually follows certain physical principles. Moreover, one can find a limited recourse to the notion of God both in defining the first principles of nature and in ensuring the reliability of our physical explanations. De Volder, in fact, limited the scope of his foundational theory to metaphysics, leaving no place for a recourse to natural theology as the basis of science. He finds in indubitability and consciousness the criteria for developing physical theories following clarity and distinction as the marks of truth. His main concern with the practice and didactics of experiments rather than with their use for the sake of discovery results in a rejection of the role of the idea of God in providing us with the first principles of nature, that is, in a foundation of science limited to the acknowledgement of clarity and distinction as the sole and autonomous criterion in assessing the truth of scientific principles. De Volder thus provided a foundation of some basic notions while avoiding a more comprehensive systematization of the principles of philosophy. In fact, he showed no interest in logic, namely, in an exposition of the methodology of natural philosophy, roughly set forth only in his two inaugural speeches. He does devote some words to logic in his *Oratio de coniugendis philosophicis et mathematicis disciplinis*, but states that even if scholastic logic concerns the working of the mind, it does not ask how we can recognize the truth. This can be taught and put into practice by mathematics alone, which turns out to be the only *organon* of philosophy[662]. Also, his difficulties in

[662] «Verumenimvero obstrepente huic meo sermoni videre mihi videor, ingentem dialecticorum turbam, qui, quod

dealing with the methodological consequences of his openness to the use of experience are confirmed by his unconcern with a justification of the reliability of sense perception, which is briefly grounded in the application of the causality principle to sense data[663]. This problem, in fact, will be consistently addressed by Dutch Newtonians, whose shift in epistemic paradigm will lead to a more attentive foundation of experience as a source of scientific knowledge, as well as to a more comprehensive theory of method.

From a broader perspective, De Volder's case shows the "dead corner" to which Cartesian physics came at the end of seventeenth century. The emergence of an experimental-mathematical science scarcely concerned with metaphysical issues, and whose foremost success was the discovery of the correct laws of impact by Huygens, Wren and Wallis announced in 1668 and 1669[664], probably made De Volder adopt a broader attitude towards experiments, and to carry on a "de-metaphysicalization" of physics. However, his adherence to Cartesian physics and metaphysics prevented him from going further than merely announcing a new experimental science and a didactical use of experiments, aimed at demonstrating those truths consistent with Descartes's principles. Moreover, De Volder's case shows the incapability of Cartesian metaphysics to support this new science, as it offered no arguments to provide experience with a foundation, nor even –

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artibus adscribo mathematicis, soli dialecticae vendicent, hance eam esse praedicent, quae vera doceat a falsis distinguere, quae ratiocinii laqueos enodet, quid ex quolibet sequatur explanet, omnes denique ostendat et veri ratiocinii modos, et falsi technas. […] Noscet enim accurate quisquis hanc excoluerit, quid sit demonstratio, quae sint conditiones ad veram demonstrationem requisitae, quales oporteat esse praemissas, qualem conclusionem, et quae huius farinae in dialecticis traduntur plurima. Itane vero? Quid sit demonstratio, quid rite sequatur, quid minus, id ego accuratius cognoscam ex illorum hominum tricis, qui nulla saepenumero demonstrationes percepere unquam, quam ex frequenti demonstrandi et clare sequelas percipiendi exercitio? Illa sc. ars docebit me certo ratiocinari, firmas formare conclusiones, quae ipsa vix ullas demonstrationes habet, […] omnibus suis ratiocinandi regulis res nequidem suas demonstrare valet. […] Quae quidem ita accipi nolim, ac si despectui plane haberem ea, quae a dialecticis tractantur, sed quod existimem, ad iudicii nostri comparandam firmitatem, hanc cum artibus mathematicis ne conferendam quidem esse. Neque enim dubito, si ex una parte habeamus eum, qui dialecticorum instructus sit dogmatis, ex altera, qui horum omnium ignarissimus solas artes didicerit mathematicas, quin in pari etiam intelligendi facultate, hic illo ad perceptionem certae veritatis multis partibus futurus sit habilior», De Volder 1682, pp. 9-10.

663 *Supra*, n. 628. See also De Volder 1695, vol. I, pp. 124-126: «verum cum ex lege coniunctionis mentis cum corpore id fiat, ut nonnullos ex motibus corporeis certae comitentur perceptiones, has perceptiones non dubitat, quin debeatur menti, has, sensus proprie [Cartesius] vocat. [...] [Cartesius] inquirere voluit, an ex ideis suis alterius rei praeterquam sui existentia deduci queat, cumque non facile esset omnes ideas simul considerare, eas sibi primum examinandas censuit, de quibus probabilis esset coniectura, eas alterius rei existentiam comprobaturas». Actually, De Volder also avoids to refer to moral certainty with regard to sense experience: see Nyden 2013, p. 243.

664 «The papers by Wallis and Wren (1668) and Huygens (1669) settled on a widely shared and recognized mathematical treatment of the rules of collision that were claimed to have high empirical confirmation and predicted surprising empirical results; this post-Galilean analysis of motion became an autonomous practice relatively insulated from metaphysical and theological concerns», Schliesser 2011, p. 109. See also D. Jalobeanu, *The Cartesians of the Royal Society. The Debate Over Collisions and the Nature of Body (1668-1670)*, in Anstey-Jalobeanu 2011, pp. 103-129.

according to De Volder – a demonstration of the truth of the principles of physics. Indeed, De Volder's exposition of such principles in his *Cogitationes de rerum naturalium principiis* (1681) cannot be regarded as a foundation of their truth: rather, the foundation and philosophy of science seem to become separated. Therefore, the encounter of English science with the Continental Cartesian tradition apparently led to a reflection on the principles of science independently of their metaphysical foundation. Yet, mainly attracted by Huet's accusation of scepticism – the fundamental reason to provide Cartesian philosophy with a foundation –, in his *Exercitationes* (1691-1693 and 1695) De Volder attempts to justify the truth of clear and distinct knowledge. For the same reason, the introduction of Newtonian science in the Dutch academies would be characterized by a foundation of its epistemic premise, which would assume both the nature of the reflection and of the justification of the reliability of science. In fact, the methodological novelty embodied by Newtonianism would revive interest in a foundation, required in order to guarantee the acceptance of Newtonian physics as part of a broader corpus of academic disciplines.

6. The aftermath: metaphysics, logic and theology in ‘s Gravesande’s foundation of Newtonian physics

6.1 Introduction

The foundation of Newtonian science was required in order to validate its conceptual premises and methodology, and to enable its introduction into the University as a certain and secure knowledge. As during the introduction of Cartesian philosophy in the 1640s-1650s, the establishment of Newtonian physics at the beginning of the eighteenth century was characterized by a justification of its epistemic assumptions, given its groundbreaking impact on the Cartesian and Aristotelian framework of academic culture. In the Low Countries, the philosophical defence of Newton’s physics was undertaken by Willem Jacob ‘s Gravesande (1688-1742), who provided Newtonian physics with an introduction and foundation in his *Introductio ad philosophiam, metaphysicam et logicam continens* (1736), a comprehensive metaphysical and logical treatise in which the use of experience in physics is justified as provided with a moral, but indubitable evidence. An analysis of his foundation of Newtonian science – that is, of the status of *scientia* of Newtonian physics – is crucial in order to show that the need for a foundation, as laid by Cartesian scholars and later undertaken by Newtonian philosophers, came to characterize the whole development of early modern philosophy, being a means of introduction in the universities and marking its novelty with respect to medieval and Renaissance traditions. Accordingly, the analysis of ‘s Gravesande’s foundation allows us to develop an understanding of early modern philosophy that overcomes historiographical categories such as “Newtonianism” and “Cartesianism”, as well as “empiricism” and “rationalism”, as ‘s Gravesande’s foundationalism reveals a continuity in problems and solutions with regard to the different developments of early modern philosophy.

Whereas most Cartesian natural philosophers had a medical background, which often reflected their philosophical standpoint, ‘s Gravesande[665] had a juridical formation, as he studied

[665] On ‘s Gravesande’s life, see the *Histoire de la vie et des ouvrages du Mr. ‘s Gravesande* of Jean Allamand, in the *Ouvres philosophiques et mathématiques de Mr. G.J. ‘s Gravesande*, à Amsterdam, chez Marc Michel Rey 1774, vol. I, and the entry “‘s Gravesande” of the *Dictionnaire historique* of Prosper Marchand (La Haye, chez Pierre de Hondt 1758-1759). See also G. Gori, *La fondazione dell’esperienza in ‘s Gravesande*, Firenze, La Nuova Italia

law at the University of Leiden, where he graduated in 1707, and subsequently started his practice as a lawyer in The Hague. However, 's Gravesande was first and foremost interested in mathematics, as he used his mathematical skills as a cryptographer in the last phase of the War of the Spanish Succession and helped the government in solving some economical questions. In fact, he started to be known in 1710, when he entered into a debate raised by John Arbuthnot in an article published in the *Philosophical Transactions* on the role of divine providence in maintaining the ratio of male and female newborns[666]. In 1711, moreover, he published his first scientific treatise, *Essai de perspective*[667], which made him renowned in Dutch and English mathematical and philosophical circles. Finally, in 1713 's Gravesande along with Justus van Effen and some other friends founded the *Journal litéraire*, hosting articles on literature and politics, but also on law, ethics, philosophy, mathematics and physics[668]. Given the vicinity to the English intellectual context shown by 's Gravesande and Van Effen in their journal[669], they both participated in a diplomatic mission of the Baron Wassenaer to London in 1715, where they became members of the Royal Society. Given the esteem for 's Gravesande in Dutch and English intellectual circles, and under the recommendation of the Baron of Wassenaer, 's Gravesande finally assumed the chair of mathematics and astronomy at Leiden University in May, 1717, giving an inaugural speech *De matheseos*[670]. As a teacher, he provided lectures in geometry and on Newton's physics. Eventually, his teachings resulted in the publication of his most important work, *Physices elementa mathematica, experimentis confirmata. Sive introductio ad philosophiam newtonianam* (1st ed. 1720-1721), which had a huge diffusion in continental Europe and in England also, as attested by their many editions, reprints and translations, which definitely determined the acceptance and dissemination of Newton's theories in Europe[671]. This work also had an abridged version for

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1972, pp. 64-159.

666 J. Arbuthnot, *An argument for Divine Providence, taken from the constant regularity observed in the births of both sexes*, «Philosophical transactions» 27 (1710), pp. 186-190. 's Gravesande defended the effectiveness of providence by means of particular laws in his correspondence with Bernoulli – who admitted a probabilistic explanation of such a phenomenon – and in his *Démonstration mathématique du soin que Dieu prend de diriger ce qui se passe dans ce monde, tirée du nombre des garçons et des filles qui naissent journellement*, which circulated as manuscript before being published in 's Gravesande 1774, vol. II, pp. 221-236.

667 W.J. 's Gravesande, *Essai de perspective*, The Hague, veuve A. Troyel 1711.

668 See, for instance, 's Gravesande's *Examen des Raisons de Mr. Bernard contre le Mensonge officieux*, «Journal literaire» XI (1721), pp. 344-366, and his *Remarques sur la construction des machines pneumatiques & sur les dimensions qu'il faut leur donner*, «Journal Literaire» IV (1714), pp. 182-208.

669 See Gori 1972, pp. 76-77.

670 W.J. 's Gravesande, *Oratio inauguralis de matheseos in omnibus scientiis, praecipue in physicis, usu, nec non de astronomiae perfectione ex physica haurienda*, Leiden, apud Samuelem Luchtmans 1717.

671 W.J. 's Gravesande, *Physices elementa mathematica, experimentis confirmata. Sive introductio ad philosophiam*

students, namely, the *Philosophiae newtonianae institutiones* (1723)[672]. After having published a new edition and a commentary on Newton's arithmetic (1727)[673], 's Gravesande became professor *totius philosophiae* in 1734, delivering an inaugural speech *De vera et nunquam vituperata philosophia* (1734)[674]. In 1736 he published his *Introductio ad philosophiam*[675]. He kept his position at Leiden University until his death, in 1742, after having refused a chair at the Royal Academy of Berlin founded by Frederick the Great.

Being not the first, nor the only Dutch scientist to embrace Newton's physics, partially accepted by Bernard Nieuwentijt and Hermann Boerhaave, and fully embraced by Petrus van Musschenbroek (1692-1761)[676], 's Gravesande is to be considered the most important teacher of the new physics in the Netherlands and in Europe, as he adapted the contents of Newton's physical works to the academic audience in his *Physices elementa mathematica*, aimed at teaching the new physics by means of experiments rather than by mathematical demonstrations. His case is to be examined both to reconsider the evolution of foundational theories in the Dutch philosophical context, and to ascertain their interconnectedness with the academic need to justify the assumption of new views in : above all, of the use of experience in discovering natural laws. As the dissemination of his works testifies, 's Gravesande is to be ranged among the most important expounders of Newtonian physics in Europe: in fact, he made possible its acceptance in a European context both by adapting its hardly understandable mathematical structure to a wide audience and by providing it with a justification and an introduction through logic and metaphysics. Eventually,

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Newtonianam, Leiden, apud Petrum van der Aa 1720-1721; id., *Physices elementa mathematica, experimentis confirmata. Sive introductio ad philosophiam newtonianam. Editio secunda, auctior et emendatior*, Leiden, apud Petrum vander Aa, 1725; id., *Physices elementa mathematica, experimentis confirmata. Sive introductio ad philosophiam newtonianam. Editio tertia duplo auctior*, Leiden, apud Johannem Arnoldum Langerak, Johannem et Hermannum Verbeek 1742. On their other editions, see Gori 1972, pp. 311-312.

672 W.J. 's Gravesande, *Philosophiae newtonianae institutiones, in usus academicos*, Leiden, apud Petrum vander Aa 1723. The book had different editions.

673 W.J. 's Gravesande, *Matheseos universalis elementa, quibus accedunt, specimen commentarii in arithmeticam universalem Newtoni: ut et de determinanda forma seriei infinitae adsumtae regula nova*, Leiden, apud Samuelem Luchtmans 1727.

674 W.J. 's Gravesande, *Orationes tres. De matheseos in omnibus scientiis, praecipue in physicis, usu, nec non de astronomiae perfectione ex physica haurienda*. *Altera. De evidentia*. *Tertia de vera et nunquam vituperata philosophia*, Leiden, apud Samuelem Luchtmans 1734 (a); id., *Orationes duae. Prima de vera, et nunquam vituperata, philosophia, Altera de evidentia*, Leiden, apud Samuelem Luchtmans 1734 (b).

675 W.J. 's Gravesande, *Introductio ad philosophiam, metaphysicam et logicam continens*, Leiden, s.n. 1736; id., *Introductio ad philosophiam: metaphysicam et logicam continens. Editio altera*, Leiden, apud Joh. et Herm. Verbeek 1737.

676 On the dissemination of Newtonianism in the Netherlands, see Ruestow 1973, pp. 113-139; Jorink-Maas 2012; W. van Bunge, *Dutch Cartesian Empiricism and the Advent of Newtonianism*, in Dobre-Nyden 2013, pp. 89-104, and Van Bunge forthcoming.

's Gravesande made Newton's physics fit the needs of academia. However, scarce attention was devoted to 's Gravesande until the appearance of Giambattista Gori's *La fondazione dell'esperienza in 'sGravesande* (sic)[677], who offered the first, deep overview of 's Gravesande's foundation of science by rejecting Cassirer's views on 's Gravesande's supposed biological and sociological account of the certainty of physics[678]. This work has been followed by the more recent studies of Cees de Pater, focusing on 's Gravesande's notion of moral evidence and interpretation of Newton's rules of philosophy[679], Paul Schuurman – who has highlighted the place of 's Gravesande's theories in the logic of ideas established by Descartes and Locke[680] – and Steffen Ducheyne, who focused on 's Gravesande's methodology of science and on the epistemological and theological implications of his theories[681]. In fact, these studies have highlighted the sources of 's Gravesande's arguments and the specificity of his approach with regard to Newton's. Accordingly, I will assume their conclusions while considering 's Gravesande's philosophy in the light of the interplay of his physics, metaphysics and his foundational arguments, arguing for the strength of the division between various possible foundations of philosophy and science – logical, metaphysical and theological – insofar as even after the demise of Cartesianism 's Gravesande adopted these three possible ways. The interconnectedness of 's Gravesande's philosophical introduction and defence of Newton's physics, in fact, can be explained by taking into consideration the demands of academic culture in the early eighteenth-century Dutch context. Since this was dominated by a Cartesian stance on philosophical knowledge – *scientia* –, 's Gravesande attempted to provide the empirical knowledge of natural laws with a certainty equal to mathematical evidence. As for Geulincx and De Volder, the foundation of *scientia* is the foundation of evidence. This attempt was designed to fulfil

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677 Gori 1972.

678 *Ibid*., p. 254. See E. Cassirer, *The Philosophy of the Enlightenment*, transl. by F. Koelin and J.Pettegrove, Princeton, Princeton University Press 1951, p. 61.

679 De Pater 1975; id., (ed.), *Willem Jacob 's Gravesande. Welzijn, wijsbegeerte en wetenschap, Baarn, Ambo 1988*; id. *The textbooks of 's Gravesande and Van Musschenbroek in Italy*, in C. S. Maffioli and L. C. Palm (eds.), *Italian Scientists in the Low Countries in the 17th and 18th Centuries*, Amsterdam, Rodopi 1989, pp. 231-241; id., *Willem Jacob 's Gravesande (1688-1742) and Newton's "Regulae philosophandi"*, «Lias» 21/2 (1994), pp. 257-294; id., *'s Gravesande on moral evidence*, in M.F. Fresco et al. (eds.) *Frans Hemsterhuis (1721-1790). Quellen, Philosophie und Rezeption*, Münster-Hamburg, LIT 1995, pp. 221-242.

680 P. Schuurman, *Willem Jacob 's Gravesande's Philosophical Defence of Newtonian Physics: on the Various uses of Locke*, in P. Anstey (ed.), *The Philosophy of John Locke: New Perspectives*, London and New York, Routledge 2003, pp. 43-57; id., *'s Gravesande, Willem Jacob (1688-1742)*, in Van Bunge et al. 2003, vol. II, pp. 865-872; Schuurman 2004, pp. 129-155.

681 S. Ducheyne, *'s Gravesande's Appropriation of Newton's Natural Philosophy, Part I: Epistemological and Theological Issues*, «Centaurus» 56/1 (2014), pp. 31-55; id., '*s Gravesande's Appropriation of Newton's Natural Philosophy, Part II: Methodological Issues*, «Centaurus» 56/2 (2014), pp. 97-120.

the need to provide physics with a mathematical or absolute certainty, while avoiding its development on the basis of metaphysical notions. Eventually, ‘s Gravesande pursued this objective by considering experience as a primary means in the accomplishment of God’s providential plan, since it allowed men to conduct a good life as the end God has put upon His creation. ‘s Gravesande thus aimed at giving Newton’s modern science the status of *scientia*. However, before I will be able to deal with ‘s Gravesande’s justification of Newtonian physic an outline of his methodology and of the structure of his academic manuals on Newtonian physics is required, in order to illustrate the specificity of his defence of Newtonianism. In fact, ‘s Gravesande’s foundation of Newton’s method went along with its reworking and with a reflection on the purposes and limits of scientific knowledge: in the end ‘s Gravesande provided a philosophy of science as we conceive it today.

6.2 The teaching and the method of Newtonian physics

The function of ‘s Gravesande’s *Physices elementa mathematica*, whose contents consistently increased in the three main editions (1720-1721, 1725, 1742)[682] – is to teach the contents of Newton’s *Principia* through the description of experiments rather than by mathematical demonstrations, which are confined to some *scholia* since the second edition of ‘s Gravesande’s book (1725). In fact, the teaching of experimental physics in Leiden had some relevant precursors, such as De Volder and Wolferd Senguerd, a colleague of ‘s Gravesande and teacher of experimental physics and director of the *Theatrum physicum* established by De Volder in 1675. Their teaching, carried out through experiments – mainly in pneumatics – paved the way for the acceptance of Newtonianism by an academic audience more versed in experiments than in the complex mathematics of Newton’s *Principia*. Actually, ‘s Gravesande was not the first in presenting a Newtonian physics based more on experiments than on mathematics: a similar attempt had been already carried out in 1700 by John Keill in his *Introductio ad veram physicam* – still provided,

[682] The first edition, which appeared in 1720 and 1721, includes four books devoted to the notion of body, to the movement of solid and fluid bodies, to the explanation of light and to celestial mechanics. In the second edition (1725), ‘s Gravesande added several *scholia* containing those mathematical demonstrations missing in the first edition. Finally, the third edition (1742) was enriched with the addition of two further books – enlarging those sections already included in the previous editions – and introduced by his *Oratio de evidentia* (1724).

however, with a complex mathematical backbone[683] – and by Francis Hawksbee and Jean-Théophile Desaguliers, mentioned in the third edition of 's Gravesande's *Elementa* as attempting to teach Newton's physics "without geometry"[684]. However, the structure of 's Gravesande's *Elementa* reveals not only their didactic and propagandistic purposes, but also some peculiarities of 's Gravesande's approach to Newton. While maintaining in his *Philosophiae newtonianae institutiones* (1723) and in his *Elementa* a rejection of the use of hypotheses and replacing for the mathematical deduction of the laws of nature by the observation of phenomena, «ex phaenomenis, reiectis hypothesibus conclusiones deducuntur»[685], 's Gravesande embraced a method of scientific discovery and exposition different from that of Newton, as observed by Ducheyne[686].

First of all, the structure of 's Gravesande's *Elementa* and his exposition of Newton's physics consistently differ from those of Newton's *Principia*. Whereas Newton provides an axiomatic consideration of the laws of motion and centripetal forces in the first and second book of his *Principia*, and systematically applies such laws to phenomena from book III[687] onwards, 's Gravesande begins his *Elementa* with a consideration of phenomena – those concerning attraction, fluidity and repulsion of bodies (book I, part I-II) and then expounds the laws to explain such phenomena: namely, those of Newton, Galileo and Huygens (book I, part III, chapters XVII-XX). Moreover, in his *Elementa* 's Gravesande does not mention Newton's fourth rule of philosophy, added in the third edition of Newton's *Principia*, admitting that the formulation of laws can be falsified by some counterexamples or replaced with other ones with a larger explanatory scope[688]. Indeed, 's Gravesande defines a law of nature as the rule by which God regulates the course of phenomena in every case[689], and aims, as I am going to show, to provide their knowledge with a certainty equal to that of mathematical demonstrations.

In the third place, the very consideration of scientific method itself provided by 's Gravesande

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683 See Gori 1972, pp. 94-95.

684 's Gravesande 1742, vol. I, *Praefatio tertiae editionis*, p. XVI.

685 's Gravesande 1723, *Ad lectorem*, p. VII (unnumbered). See' s Gravesande 1720, vol. I, *Praefatio*, p. X (unnumbered). See also the third edition of his *Elementa*, book I, ch. 5, pp. 24-25, and his *De matheseos*, pp. 14, 15, 17-18, 21.

686 See Ducheyne 2014b, pp.104-105.

687 See *ibid*., and Gori 1972, p. 101. See I. Newton, *Philosophiae naturalis principia mathematica. Editio tertia aucta et emendata*, London, apud Guil. & Joh. Innys 1726.

688 See Ducheyne 2014b, pp. 100-101; «in philosophia experimentali propositiones ex phaenomenis per inductionem collectae, non obstantibus contrariis hypothesibus, pro veris aut accurate aut quamproxime haberi debet, donec alia occurerint phaenomena, per quae aut accuratiores reddantur aut exceptionibus obnoxiae», Newton 1726, p. 389.

689 «Naturae lex ergo est, regula et norma, secundum quam Deus voulit certos motus semper, id est, in omnibus occasionibus, peragi», 's Gravesande 1742, vol. I, p. 2.

is different from Newton's. Both, actually, recalled the traditional differentiation between analysis and synthesis. Newton, in his *Opticks*, defined analysis as the method of discovery by means of observation and mathematical generalization, and synthesis as the application of the conclusion reached by analysis to the explanation of phenomena[690]. On the other hand, in the section devoted to the consideration of method of his *Introductio ad philosophiam*, that is, his *Logica*, 's Gravesande heavily relies on the methodological and logical rules of Descartes and Malebranche, providing a Cartesian account of analysis and synthesis, insofar as in analysis one proceeds from the complex to the simple, and in synthesis from the simple to the complex. Analysis, in fact, can concern *a priori* reasoning – having a mathematical certainty –, or *a posteriori* reasoning, having a more moral certainty. Analysis is the very method of discovery and explanation of phenomena: synthesis, on the other hand, concerns the mere exposition to other people of the knowledge acquired by analysis. 's Gravesande, furthermore, set forth five rules concerning *a priori* analytical reasoning, to which he adds a sixth rule concerning *a posteriori* reasoning, based on experience and providing moral evidence[691]. To these rules, he adds six further rules concerning the use of hypotheses in science – included for the first time in his *Introductio* –, whose use is allowed to acquire certain conclusions whenever they are confirmed by experience (rule V) or can explain new phenomena (rule VI)[692]. Ducheyne, actually, has shown that whereas Newton admitted that a hypothesis is true when it expresses a sufficient and necessary cause of a phenomenon[693], 's Gravesande merely requires that a hypothesis has to be confirmed by experience. Thus, 's Gravesande adopted a looser approach to the use of hypotheses, given the influence of Huygens's use of them in discovery[694] and the fact that from the 1730s on Newtonian physics was well established in the Dutch context: the supporters of

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690 I. Newton, *Opticks or a treatise of the reflections, refractions, inflections and colours of light*, London, printed for Sam. Smith, and Benj. Walford 1704, pp. 404-405.

691 's Gravesande 1736, pp. 278-292, 314-327. See Gori 1972, pp. 145-148; Schuurman 2004, pp. 150-152.

692 's Gravesande 1736, pp. 292-300.

693 «In order to avoid arbitrary speculation Newton required that the causes to be adduced in natural philosophy should be constrained by imposing the demand on them that they should be shown to be the necessary and sufficient causes of certain effects given the laws of motion, i.e. given a set of non-arbitrary principles which have been shown to be promising in the study of motion and which remain neutral with respect to the modus operandi of gravitation. Put differently, according to Newton not just any cause will do in natural philosophy: true causes in natural philosophy are those causes which have been shown to be necessary and sufficient given a set of prioritized theoretical principles, *in casu* the laws of motion. Furthermore, he demanded that independent measurements of causal parameters obtained from phenomena of the same kind should converge and that, given his focus on the systematic dependencies between causes and their effects, a theory should provide accurate measurements of its parameters from the phenomena they serve to explain», Ducheyne 2014b, p. 111. Cf. Newton's *Principia*, book I, propositions 1 and 2. Such differences in views, actually, are confirmed by the actual method 's Gravesande adopts to solve the *vis viva* controversy: see Ducheyne 2014b, pp. 111-112.

694 See, for instance, 's Gravesande 1736, p. 298, § 985.

the new experimental philosophy no longer banned hypotheses from the process of science in order to distinguish their theories from the speculative, metaphysical physics of Descartes, according to which the constitution of the universe can be derived from a few innate principles[695]. Eventually, the acceptance of the use of hypotheses can be noted in the *Praefatio tertiae editionis* of ‘s Gravesande’s *Elementa*[696].

‘s Gravesande’s approach, then, reveals some discrepancies with Newton’s, that is, some original points that can be traced back not only to ‘s Gravesande’s didactic aims but also to his peculiar standpoint on the method of physics. Such differences are to be appreciated in the light of ‘s Gravesande’s metaphysical and logical considerations, which aimed to provide science with a foundation. In fact, ‘s Gravesande’s use of observation as the first source of knowledge in science, his retaining of the first three rules of philosophy expounded by Newton[697], and his use of hypotheses as a means to acquire a probable knowledge found their justification in his views on the functioning of the human mind.

6.3 Mathematics and experience in the discovery of natural laws

First and foremost, the foundation of Newtonian physics is given by ‘s Gravesande in his 1736 *Introductio*. However, the problem of the reliability of the use of the human faculties and of the certainty of empirical knowledge is addressed also in his orations *De matheseos* (1717), *De evidentia* (1724), *De vera philosophia* (1734), as well as in the *Praefatio* to the first and third edition of his *Elementa*. The recurrence of the topic and the different editions these texts had, testify that the problem of a foundation was at the top of ‘s Gravesande’s philosophical agenda.

According to his *De matheseos*, physics is to be based on the observation of phenomena because natural laws rely only on the will of God: we can grasp them only through experience, without any recourse to hypotheses about the first constitutions of things[698]. Given the fact that

[695] Gori 1972, pp. 48-63.
[696] ‘s Gravesande 1742, vol. I, *Praefatio tertiae editionis*, p. XV.
[697] Quoted *infra*, n. 710.
[698] «Physica phaenomenorum naturalium causas tradit, id est, examinat quibus legibus Creator voluit universum adstringere, ut continuata motuum successione quaedam mutentur, et mutata maneant, alia semper ad primum statum redeant: et quo modo ope illarum legum phaenomena producantur, haec ars explicat. Hae leges a sola

motion is the basic phenomenon in nature, mathematics is the basis for physics, as it enables the quantification of motion, whose study applies to all the fields of natural philosophy and astronomy[699]. The problem of the relation of experience and mathematics in the discovery of natural laws, briefly addressed in his *De matheseos*, is a main topic of 's Gravesande's *Praefatio primae editionis* and of the first chapter of his *Elementa,* where he defines the end and the scope of physics. Since physics a sort of mixed mathematics, as it concerns things that exist outside the mind (whereas pure mathematics concerns abstract ideas of figures), physics explains how everything happens according to the laws of nature without considering the genesis of the world but providing a descriptive, mathematical account of natural regularities[700]. First of all, echoing Locke[701], 's Gravesande's denies the possibility of knowing material substances in themselves. Even if one can know some properties of matter, the knowledge of their subject is beyond our faculties, since body may have properties that we do not know: besides those properties flowing from the essence of matter as an extended and solid substance, one can admit that God provided matter with other properties not essential to body. Eventually, 's Gravesande dismisses Descartes's view on the perfectly evident knowledge of material, extended substance, from which one can deduce all its properties as necessarily belonging to it[702]. Indeed, he admits the possibility of the existence of a void through the sole analysis of the ideas of extension and matter: one can imagine a non-solid extension, because the idea of solidity is gained by the senses, whereas that of extension is

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Creatoris voluntate pendentes, cum nulla divina revelatione nobis denegantur, ex ipsis phaenomenis sunt quasi exhauriendae. Hypotheses fingere, illasque pro fundamento systematis habere, hominum est in errorem lubenter decurrentium et verae physices ianuam sic claudentium», 's Gravesande 1717, pp. 13-14.

699 *Ibid*., pp. 15-22.

700 's Gravesande 1720, vol. I, *Praefatio*, pp. I-III. see also p. VI. On 's Gravesande's criticisms to Descartes's genetic physics, see also his *De vera philosophia*, 's Gravesande 1734a pp. 21-22, and Gori 1972, pp. 48-63.

701 For a comparison of Locke, Newton and 's Gravesande's method, see Schuurman 2003, pp. 44-47.

702 «Substantiae quid sint inter nobis ignota referendum est. Quasdam ex. gr. materias proprietates novimus, sed in quo subiecto haereant has nos omnino latet. An corpori non multas alias tribuendas fini proprietates, de quibus nullam habemus ideam, quis asserere potest? Cui etiam enotuit an, praeter corporis proprietates, quae a materiae essentia profluunt, non dentur alias a Dei libera potestate pendentes, substantiamque extensam et solidam (haec enim a nobis corpus vocatur) quibusdam, sine quibus existere posset, proprietatibus ornari. De ignotis nihil affirmandum aut negandum est. Quantum ab hac regula aberrant illi, qui, quasi omnia quae ad corpus pertinent plenissime perspecta haberent, in physicis ratiocinantur, paucasque corporis proprietates notas ipsum corpus constituere asserere non dubitant! Quid obsecro sibi vult proprietates substantiae ipsam constituere substantiam? An quae separatim subsistere non possunt simul iuncta subsistent? An extensum, impenetrabile, mobile esse, et c. concipi possunt, sine subiecto cui has proprietates competant? Et an huius subiecti ullam habemus ideam? In dubio relinquendum quod certum non est; hoc ne ignorantiam fateri pudeat: neque timendum de ignoto nimium affirmari, dum subiectum omnino ignotum quibusdam incognitis proprietatibus forte praeditum esse asserimus. Qui vero cum hoc axiomate se nixos dicunt, quod de incognitis non sit ratiocinandum pro ratiocinii tamen fundamento habent, nil circa corpus ignoti dari, nisi forte fortuna errorem non vitabunt. Corporis proprietates a priori detegi nequeunt; corpus ipsum ideo est examinandum, huiusque proprietates exactissime perpendendae sunt, ut possimus determinare quid , in rerum phaenomenis, ex illis proprietatibus sequatur», 's Gravesande 1720, vol. I, *Praefatio*, pp. IV-V.

independent of touch. Hence, ‘s Gravesande can reject Descartes’s identification of the notions of matter and extension or space. In any case, extension and solidity are two essential properties of body, along with mobility and inertia[703].

Moreover, the discovery of natural laws does not rely on the consideration of such properties. It is unknown, indeed, whether natural laws flow from the essence of matter, or if they can be deduced from properties that can depend on the will of God (being not essential to body), or if such laws depend on other, unknown causes[704]. In the main text of his *Elementa*, finally, ‘s Gravesande will declare the immediate dependence of every natural laws on the will of God, and the possibility that phenomena flow from mediate causes or from the direct action of God. To that extent one can grasp natural laws only by induction[705]. Being merely concerned with phenomena, insofar as natural laws are universal effects, ‘s Gravesande assumes as a methodological, but also metaphysical criterion the unknowability of their causes, these being God himself or some other secondary causes[706]. Eventually, scientific discovery must follow the rules of philosophy of Newton and avoid any speculation on the causes of natural laws.

6.4 The survival axiom

The first formulation of the problem of the foundation of knowledge in natural philosophy as

[703] «Vacuum possibile ex solo examine idearum deducitur. Omne enim quod clare concipimus existere posse, possibile est. Quaestio ergo eo redit, an habeamus ideam extensionis non solidae. […] In extensionis autem idea non continentur idea soliditatis, hanc non nisi ex contactu, illam vero sine illo acquirimus, et si quis nunquam corpus tetigisset, ei soliditas omnino ignota esset», ‘s Gravesande 1720, vol. I, pp. 4-5. See also p. 3.

[704] «Corpus ulterius examinando videmus quasdam leges dari generales, secundum quas corpora moventur. *Corpus motum in motu continuare: actioni semper aequalem esse et contrariam reactionem* extra omne dubium est. Multaeque aliae similes circa corpus deteguntur leges, quae minime ex proprietatibus, quae ipsum Corpus constituere dicuntur, deduci possunt; cumque hae leges semper, id est, in omnibus occasionibus, et ubique obtineant, et omnia corpora iis subiciantur, pro generalibus naturae legibus habendae sint. Circa has in obscuro est, an ex materiae essentia fluant; an deducendae sint ex proprietatibus corporibus, ex quibus constat mundus, a Deo tributis, sed Corpori minime essentialibus*,* tandem an non pendeant effectus, qui pro naturae legibus habentur, a causiis extraneis nobis nequidem ideis attingendis», ‘s Gravesande 1720, vol. I, *Praefatio*, p. V.

[705] «Omnis lex immediate a Dei voluntate pendet. Est etiam nostri respectu lex naturae, omnis effectus, qui in omnibus occasionibus, eodem modo producitur, cuius causa nobis est ignota , et quem videmus ex nulla lege nobis nota fluere posse. Nostri enim respectu non interest, an quid immediate a Dei voluntate pendeat, an vero mediante causa, cuius nullam ideam habemus, producatur. Leges naturae nisi ex examine phaenomenorum naturalium, non possunt elici», ‘s Gravesande 1720, vol. I, p. 2.

[706] «Satis ergo patet, quinam sit scopus physices, ex quibus naturae legibus phaenomena sint deducenda; et quare, quando ad leges generales pervenimus, non ulterius in causarum inquisitione penetrare possimus», ‘s Gravesande 1720, vol. I, *Praefatio*, p. IV. See Gori 1972, pp. 170-177.

scientia , attained by following Newton's rules of philosophy[707], can be found in 's Gravesande's *De matheseos* and in his *Praefatio primae editionis*. With respect to mathematical statements, according to his *De matheseos* these are clear, indubitable, concern simple entities, and do not depend on the will of God, since He cannot violate the principle of contradiction[708]. Hence, mathematical statements are necessarily true, i.e., are endowed with a mathematical evidence. On the other hand, the knowledge of matters of fact has another kind of certainty, which relies on the use of testimony for history and of analogy for physics, allowing mathematical generalizations from the observation of phenomena[709]. Such certainty is firstly provided with a foundation in 's Gravesande's *Praefatio primae editionis*, where he addresses the legitimacy of the use of Newton's first three rules in physics, these being:

Regula 1. Causas rerum naturalium non plures admitti debere quam quae et verae sint, et earum phenomenis explicandis sufficient.

Regula 2. Effectuum naturalium eiusdem generis easdem esse causas.

Regula 3. Qualitates corporum quae intendi et remitti nequeunt, quaeque corporibus omnibus competunt in quibus experimenta instituere licet, pro qualitatibus corporum universorum habenda sunt[710].

Such rules concern matters of fact, whose existence is contingent, that is, their contrary is still possible[711]. One can grasp their existence only through the senses: however, God himself provided us with some rules aimed to ensure the truth of our knowledge of such matters, that is, Newton's *regulae philosophandi*[712]. Whereas the first rule, according to 's Gravesande, is self-justified as it is the expression of a principle of economy, the other two rules require some premise as they determine the use of analogy in reasoning. In any case, 's Gravesande still does not explicitly provide a foundation of science on divine goodness as he would do in his later works. Instead, he grounds such rules on his well-known survival axiom, «pro vero habendum omne quod si negetur societas inter homines destruitur»[713]. According to him, insofar as society cannot survive if men cease to reason on the basis of sense data and analogy, and given the fact that God himself put us in

[707] Quoted *infra*, n. 710.
[708] 's Gravesande 1717, pp. 7, 11.
[709] *Ibid.*, pp. 11-12.
[710] 's Gravesande 1720, vol. I, p. 2.
[711] *Ibid*., *Praefatio*, p. VII.
[712] *Ibid*., p. 7.
[713] *Ibid*., p. 8.

the necessity of reasoning by analogy, the second and third rules of Newton are given a foundation[714]. Such a foundation is theological since it appeals to the role of God in creating us as beings forced to use analogy. According to ‘s Gravesande, this argument leads to the necessary conclusion that reasoning by analogy will not deceive us. On the other hand, the conclusions reached by analogy are not as necessary as their foundation is, as one can fail in any particular reasoning[715]. However, ‘s Gravesande does not define what kinds of necessity are involved, nor does he appeal to divine goodness to ensure the truth of our statements. Given the roughness of his justification of analogical reasoning in the first edition of his *Elementa*, in his later works ‘s Gravesande would ground his foundation of science on more detailed definitions of the logical, metaphysical and theological concepts entailed by this early argument.

6.5 A logico-metaphysical introduction

A complete justification of the use of experience, analogical reasoning and testimony is provided by ‘s Gravesande in his *Oratio de evidentia*, given in 1724, and in a more comprehensive form in his *Introductio*. The core arguments of his *Introductio* are the very contents of his earlier *De evidentia*, and testify to a substantial continuity in his philosophical position.

As stated above, ‘s Gravesande’s *Introductio* is a logico-metaphysical treatise: it is divided into two books, devoted to metaphysics and to logic respectively. Logic, in fact, is the place of ‘s Gravesande’s foundational arguments: as underlined by Paul Schuurman, it is a logic of ideas, devoted to the use of the mental faculties, ideas and method[716]. However, such is introduced by a metaphysics as this concerns the most general concepts to be later used in logic, it helps in exercising our abstractive capacities, and introduces the reader to the problems concerning the

[714] «Quotidie, nequidem ad illud attendendo, sequentia ratiocinia unusquisque pro indubitatis habet, et clare videt horum conclusiones, sine praesentis rerum constitutionis destructione, in dubium vocari minime posse. *Aedificium*, *hodie in omnibus partibus firmissimum, crastino die sponte non ruet* […] Haec omnia ratiocinia analogiam pro fundamento habent, et extra omne dubium est, nos a rerum Conditore in necessitate per analogiam ratiocinandi redactos esse, et hanc ideo ratiociniorum legitimum esse fundamentum», *ibid*., pp. 8-9.

[715] «Adde ex necessitate quidem generaliter deduci, ratiocinandi methodum esse legitimam, ratiocinia vero peculiaria ab hac necessitate non pendere», *ibid*., p. 9.

[716] See Schuurman 2004, pp. 133-134.

classification of ideas, the objects of intelligence or *facultas percipiendi*[717]. The first part of the book on metaphysics, thus, concerns the concepts of being, essence, substance and mode, relation, possible and impossible, necessity and contingence, time, identity, effect and cause. His considerations (which show some influence of Jean Le Clerc's *Ontologia*[718]) are consistent with the ontology entailed by his *Elementa*. In the section *De ente*, for instance, one can find an account of the notions of substance and modes: substances can be thinking – i.e., mind and God – and not thinking, namely body and space distinguished by 's Gravesande[719]. Moreover, 's Gravesande examines the different kinds of causes, yet without any commitment to the study of causes as something different from universal effects in physics[720]. Thirdly, he focuses on the notions of possibility, impossibility, necessity and contingence, paving the way for his further evaluation of the knowledge of natural laws as morally evident, that is, as being as certain as mathematics but not acquired by just analysing ideas.

First of all, absolute impossibility characterizes what contains in itself the reason of its non existence, as "*mons sine valle*", and contradictory propositions in mathematics. Physical impossibility concerns a relation of two physical things: for instance, one cannot insert a cylinder into a hole smaller than its size – this kind of impossibility is determined by the geometrical features of a physical body. Finally, moral impossibility is a matter of probability, that is, its opposite has some degree of probability to exist. Its consideration is postponed by 's Gravesande until the book on logic; however, he assumes that it concerns intelligent actions: for instance, it is morally impossible that a reasoning man wants to step into boiling water, as this would contradict his being rational[721]. With such notions 's Gravesande develops his views on necessity and

[717] 's Gravesande 1736, pp. 1-2, 267.

[718] See Gori 1972, p. 135. See J. Le Clerc, *Logica, ontologia, et pneumatologia*, London, typis Johan. Churchill 1716, 5th ed., 1st ed. J. Le Clerc, *Logica: sive, Ars Ratiocinandi. Ontologia; sive de Ente in Genere. Pneumatologia seu de Spiritibus*, London, impensis Awnsham & Johan. Churchill 1692. Logic, ontology and pneumatology roughly correspond to the three parts of 's Gravesande's foundation: logic, metaphysics and rational theology. On Le Clerc's logic, see P. Schuurman, *The Empiricist Logic of Ideas of Jean Le Clerc*, in Van Bunge 2003, pp. 137-156; Schuurman 2004, pp. 70-109.

[719] 's Gravesande 1736, pp. 8-9.

[720] *Ibid.*, pp. 29-37.

[721] «Impossibilitas non semper ex eodem fonte fluit. Absolute impossibile dicitur, quod in se consideratum propriam impedit exsistentiam. Hoc revera nihil est, quamvis verbis exprimatur quasi esset aliquid. Mons sine valle impossibilis est, et proprie loquendo nihil est. […] Dantur variae impossibilitates […] diversae. […] Impossibilitas saepe tantum tribui debet relationi inter duas res; cylindrus foramen crassitie superans non potest intrudi propter relationem inter has magnitudines. […] Praeter hasce impossibilitates, quas omnes physicas vocamus, aliam non debemus negligere, quam moralem vocabimus. Impossibilitas saepe moralis dicitur, quando oppositum exiguam, sed quandam tamen, habet probabilitatem. De tali impossibilitate nunc non agitur: ad materiam probabilitatis pertinet

contingence. He first defines absolute necessity as concerning those things whose contrary is absolutely impossible, even if sometimes it refers to what is physically impossible. Hypothetical necessity, on the other hand, concerns those things whose contrary is impossible in relation to some other thing. ‘s Gravesande broadly defines necessity as characterizing those things whose contrary is impossible, no matter what the nature of this impossibility is. Absolute necessity, hence, concerns those things whose contrary is absolutely impossible, and physical or fatal necessity concerns those things whose contrary is physically impossible. Moral impossibility, finally, determines moral necessity: for instance, it is morally necessary that a rational man avoids poisoned food[722]. Contingency, on the other hand, characterizes what can exist or not exist, i.e., what is undetermined according to its nature. According to a vulgar meaning, everything opposed to necessity is contingent; according to a more precise meaning, however, “contingent” is what is ruled by moral necessity[723]. In fact, what is certain – such as what God foresees and creates – even if only contingent in itself, turns out to be necessary according to the general definition of necessity, even if not according to a fatal or absolute necessity[724]. This is the case of natural laws, which depend on

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haec, et in logicis examinanda erit. Moralem in hisce vocamus impossibilitatem, ubi huius causa in intelligentia quaerenda est. Ex. gr. Homo sana mente praeditus, sponte balneum aquae bullientis non intrabit, et impossibile hoc est, si intraret, non esset sana mente praeditus; sed impossibilitas non ad ullam ex ante explicatis, praeter ultimam, referri potest: non physica est, sed intelligentiae soli tribui debet», *ibid.*, pp. 14-16. See also the chapter *De libertate*, where ‘s Gravesande points out that perfect human freedom consists in the absence of physical constraints (*ibid*., p. 43), and coincides with moral necessity itself (p.45) and the chapter *De fato*, where he addresses Spinoza’s views on freedom by pointing out that the mind is not subject to mechanical causes (p. 53). This is restated in the chapter *Examen diversarum sententiarum de libertate*, (p. 62).

722 «Inter omnes quidem convenit, illud necessarium esse, cuius contrarium impossibile est; sed non intelligunt omnes impossibilitates de quibus egimus: saepe ad solam primam, id est, absolutam, attendunt […]. Hypotheticam quidam vocant necessitatem, quando contrarium impossibile est, non sua natura, sed aliunde. Ut omnis confusio vitetur, iisdem vocibus, semper eaedem ideae exprimendae sunt. Generaliter ergo necesse vocabimus cuius contrarium impossibile est, quaecunque sit impossibilitatis causa. Absolutam vocabimus necessitatem cuius contrarium absolute impossibile est; id est, ubi non datur contrarium […]. Hanc etiam physicam dicemus necessitatem, ut in omni alio casu, ubi impossibilitas contrarii physica est […]. Omnemque physicam necessitatem etiam fatalem vocabimus; sed si impossibilitas moralis sit […] moralis etiam necessitas. Talis est qua homo sana mente praeditus, inter venenum et cibum salubrem eligens, illud reiicit, hunc sumit: si aliter ageret, non esset sana mente praeditus», *ibid.*, pp. 17-18. See M. Mugnai, *“Necessità ex hypothesi” e analisi infinita in Leibniz*, in A. Lamarra (ed.), *L’infinito in Leibniz. Problemi e terminologia. Das Unendliche bei Leibniz. Problem und Terminologie*, Roma, Edizioni l’Ateneo 1990, pp. 143-155.

723 «Contingens dicitur, quod potest esse, aut non esse; id est, quod ex propria natura non determinatur. Confusionem autem non exiguam detegimus in usu huius vocis; nam multi contingentiam ita intelligunt, quasi omni necessitati opponeretur; sed minus vulgaris est haec significatio: quotidie contingens vocatur quod morali necessitate adstringitur, quod cum contingentiae definitione congruit; haec enim spectat rem, et moralis necessitas personam quae rem agit», *ibid.*, pp. 18-19.

724 «Inter illos qui dicunt nullum contingens esse necessarium, quidam distinguunt inter necessarium et certum; sed illud quod certum es, aliter esse non potest, et quod aliter esse non potest, hoc ipsum quotidie necessarium dicitur, et hoc cum ipsa huius vocis definitione congruit […], a qua si recedamus, confusio difficulter vitari poterit; sed distinguendo inter necessitates sua natura diversas. Hac de causa necessariam dicimus rem contingentem a Deo

God's free act of creation, entailing the highest degree of freedom, as He is governed only by himself[725]. Hence, natural laws are morally necessary and certain: their contrary is impossible (according to the broad definition of necessity), and they are the objects of our certain knowledge. Given these ontological assumptions, 's Gravesande can provide physics with the status of *scientia* as, like mathematics, this concerns necessary entities and is indubitable. Indeed, he does not admit that natural laws, even if morally necessary, are knowable with mere probability, as his account of moral impossibility may suggest[726]. Rather, they are the objects of a knowledge as persuasive as mathematics, even if gained by experience, whose reliability in providing us with certain conclusions is maintained by 's Gravesande by stressing its being a gift of God[727]. This apparent inconsistency, actually, goes back to one of the main philosophical problems of 's Gravesande, i.e., his need to maintain the universal or necessary status of the laws based on moral necessity and grasped by experience, and to avoid the absolute necessitarism of Spinoza on the constitution of the world[728].

After having defined the ontological premises of his theory of physical laws, 's Gravesande devotes his further ontological considerations to mental faculties, which are introduced in the second section of the book on metaphysics, *De mente humana*. In this section he defines the relation of identity between consciousness and perception, which makes the perception of the relation

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praevisam; con[tra]rium enim illius quod ita praevisum est, impossibile est; sed cum rem contingens sit, non agitur de necessitate absoluta, aut alia quacunque fatali», *ibid.*, p. 19. See also p. 59. 's Gravesande seems to address the distinction between certain and necessary expressed in Leibniz's *Discours de metaphysique*, § XIII (see G. W. Leibniz, *Sämtliche Schriften und Briefe*, Darmstadt-Leipzig-Berlin, Akademie Verlag, 1923-, series VI, vol. 4B, pp. 1546-1547).

725 On divine freedom, see 's Gravesande 1736, pp. 42, 56-57.

726 *Supra*, n. 722.

727 *Infra*, nn. 750, 755.

728 's Gravesande's identification of certainty with necessity would raise the criticisms contained in the anonymous *Lettre à monsieur G. J. S'Gravesande*: «il me semble, Monsieur, que vôtre distinction entre necessité physique et necessité morale […] n'est qu'une distinction faite à plaisir qui consiste seulement en paroles, n'y ayant au fond aucune difference réelle», *Lettre à monsieur G. J. S'Gravesande, Professeur en Philosophie à Leide, Sur son Introduction à la Philosophie, & particulierement sur la nature de la liberté*, Amsterdam, chez J. F. Bernard 1736, pp. 7-8. In his posthumously published *Essais de métaphysique*, 's Gravesande would point out that God did not create the world driven by a geometrical necessity – since a different constitution of the world is not contradictory in itself – but by a moral necessity, i.e. in accordance with his attributes. This is a Leibnitian solution: «pour ce qui regarde le Pouvoir physique, Dieu peut tout ce qui n'est pas contradictoire en soi […]. Mais si nous faisons attention ou Pouvoir moral, il est clair qu'il est contradictoire que Dieu fasse autre chose que ce qu'il veut; il ne peut donc que ce qu'il veut. Mais il est contradictoire qu'il ne veuille pas ce qui est conforme à ses attributs, ou qu'il veuille autre chose; il est donc contradictoire que Dieu eusse une autre volonté que celle qu'il a, & par conséquent il est de même contradictoire qu'il fasse autre chose que ce qui'l fait, & dans le sens moral Dieu ne peut que ce qu'il fait», 's Gravesande 1774, vol. II, p. 208. See Ducheyne 2014a, pp. 46-47.

between ideas unavoidable and indubitable[729]: this is the ground for the justification of mathematical evidence as this concerns mere ideas – no matter what their origin[730]. On the other hand, the problem of the foundation of science concerns ideas as these represent something different from themselves. In fact, a classification of ideas according to their properties is discussed in the first part of the second book of ‘s Gravesande’s *Introductio*, i.e., his *Logica*, which aims to introduce the topic of the method of scientific discovery and its foundation by considering, first, the different sorts of our ideas[731]. ‘s Gravesande distinguishes between simple and composite ideas – as they are considered in themselves –, and clear, obscure, adequate, inadequate, distinct, confused, abstract, concrete, singular, particular, universal, absolute and relative ideas – insofar as they represent something different from themselves[732]. Simple ideas are sensations themselves – which, strictly speaking, do not represent anything existent outside the mind – as well as the ideas of extension, motion and mental acts, which seem to be innate[733]: ‘s Gravesande relies on the Lockean distinction between ideas of sensations and reflection as the building blocks of all our knowledge, or simple ideas[734]. Simple ideas are all clear, whereas composite ideas can be obscure: these, in fact, include the ideas of substances, which are all obscure since we can know only their modes[735]. As mentioned above, in his *Elementa* ‘s Gravesande rejects the Cartesian clear and distinct notion of

[729] «A perceptione quacunque inseparabilis est conscientia ipsius perceptionis. Qui percipit conscius sibi est se percipere; et eo ipso propriae exsistentiae conscientiam habet», ‘s Gravesande 1736, p. 39.

[730] The problem of the actual source of ideas is left in doubt by ‘s Gravesande. Recalling Locke’s classification (for a detailed comparison, see Schuurman 2004, p. 135), in his *Metaphysica* ‘s Gravesande divides roughly ideas into three categories: those that the mind perceives in itself (i.e. are implied by self-perception, like the ideas of the affections of mind); those that the mind develops by comparing, judging and reasoning about other ideas, and the ideas coming from the senses. However, whereas the ideas of the first category are undoubtedly innate, and the ideas of the second category rely on more simple ideas, the ideas of the third kind cannot be defined in their origin (‘s Gravesande 1736, pp. 91-95), since both the solutions of Leibniz and Malebranche present some unavoidable difficulties in ascertaining whether all ideas are innate (pp. 95-101), and since the evidence of medicine and anatomy does not exclude an actual communication between substances (p. 84). In fact, ‘s Gravesande admits that the body as the instrument of the mind is required for the activity of the mind itself: however, we do not know to what extent the mind relies on the body to perform its function, because we do not have a complete knowledge of the nature of the mind (pp. 72-73).

[731] ‘s Gravesande 1736, pp. 103-104. On the place of ‘s Gravesande’s logic in the early modern “logic of ideas”, see Schuurman 2004.

[732] See ‘s Gravesande 1736, part II, book I, chapters 1-6.

[733] *Ibid*., pp. 102-104.

[734] «Ideam vocamus simplicem, in qua plures detegere non possumus. Compositam, quae ex pluribus simplicibus constat. Simplices ideae sunt omnes sensationes, ut colorum, odorum sonorum, et c. gaudii, doloris, et c. […] Simplices etiam ideae extensionis, motus determinationis voluntatis, et similes», *ibid*., p. 105; In any case, he is not clear on the actual source of mathematical ideas, even if the simple idea of extension seems to be innate also according to his *Elementa*, where it is described as independent from the sense of touch (*supra*, n. 703). On the other hand, later in his *Introductio* ‘s Gravesande admits that by the senses we acquire the ideas of figures: still, mathematics deals with ideas alone, independently of their sources: ‘s Gravesande 1736, pp. 149-150.

[735] *Ibid*., p. 108.

material substance by admitting the distinction of body and space. Moreover, every clear idea is adequate and distinct, but not every distinct idea is clear[736]. This is the case with the idea of body, conceived as something extended and impenetrable, which can therefore be distinguished from other ideas but that we cannot grasp in its entirety. Eventually, in his *Introductio* this distinction is given with a logical justification. Even if body is extended and can be mathematically described, we cannot deduce all its properties and the natural laws from its essence. Hence, experience is our only means to grasp its properties, thus being a necessary foundation of its reliability. The main problem faced by ‘s Gravesande in his foundation of science, therefore, is whether can we know physical reality by experience, since the idea of geometrical body does not entirely match the essence of physical body and the basic laws of nature are not attainable my means of deduction.

6.6 The theological foundation of moral evidence

The foundation of the scientific role of experience is addressed by ‘s Gravesande by considering the notions of judgement and truth. Judgement is a comparison of ideas implying a perception of their relation[737], whereas truth is the correspondence of ideas and things, and has two classes. First of all, it concerns ideas of mental actions and passions: the truth of judgements pertains to this class, because a judgement is true if it represents the relation between two ideas, which is a mental act. However, one needs to distinguish between the truth of the ideas involved in judgement and the truth of judgement itself. In this way, ‘s Gravesande can maintain that by judgements we can grasp something different from mere mental acts[738]. Indeed, the other kind of truth concerns those ideas acquired though an external cause. This kind of truth is provided by ‘s Gravesande with a foundation on moral evidence. Like Descartes, ‘s Gravesande recognizes in evidence the criterion of truth: whenever we have an immediate perception of an idea, we are persuaded that this idea is true, or agrees with the thing it represents. Thus, evidence is the very immediateness of the perception of something. Therefore, all the ideas of mental acts are evident and true, as well as those we can acquire without any means different from the mind itself[739]. For instance, in

[736] *Ibid*., pp. 109-110.
[737] Judgement is treated in chapter VII-X.
[738] *Ibid*., pp. 135-136.
[739] «Evidentiam vocamus immediatam perceptionem. Evidentia haec criterium est veri, pro omnibus ideis rerum quas

mathematics one can attain evidence as it deals only with ideas, no matter if they correspond to physical things – whose existence is only hypothetical insofar as it must be acquired by means different from the mere immediate perception of ideas: i.e., sense experience, testimony and analogy.

These points are also considered in *De evidentia*, where ‘s Gravesande – like De Volder – stresses the importance of indubitability or forced assent as the mark of truth of judgements, i.e., of the perception of the relation of several ideas. The perception of two ideas entails the consciousness of their relation, which is thus indubitable: like the relation of the ideas of four and three, which is represented by the idea of seven[740]. Moreover, evidence characterizes all those disciplines concerning ideas grasped through a reflection on mental acts or affections: such as the ideas of being, spirits, soul and God[741]. Hence, mathematics, ontology, pneumatology and rational theology are characterized by evidence. In his *De evidentia*, moreover, syllogistic logic is added to the list of such disciplines[742]. Such reflection grounds the mathematical evidence of pneumatology, as the notion of mind is revealed by any mental act, as well as that of rational theology. Indeed, ‘s Gravesande provides a Lockean demonstration of the existence of God. Since something exists – i.e., the mind – something eternal must exist: that is, God, defined as an unlimited intelligence or the source of limited intelligences. Thus, God has an infinite wisdom from which one can deduce His infinite goodness[743]. Actually, ‘s Gravesande will base his foundation of moral evidence on this mathematical demonstration of the existence and goodness of God. From the acknowledgement of the existence and the attributes of God, moreover, one can deduce ethical rules, which are, as for

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immediate percipimus. Id est, haec ipsa est legitimum fundamentum persuasionis, et conclusionis huius, ideam quam acquirimus convenire cum re, quam immediate percipimus. Ipsa enim res cum huius immediata perceptione congruit. Dum cogito, cogitatio in mente distincta non est ab huius perceptione. Gaudium in mente mea, et huius perceptio, sunt unum et idem; haec perceptio, ideo, mihi veram dat illius gaudii, quo mens nunc fruitur, ideam. Haec observatio ad res omnes, quas immediate percipimus, referri debet; hae enim nisi cum ipsis ideis convenirent, immediate percipi non possent, cum mens nostra ideas tantum percipiat», *ibid*., pp. 137-138.

740 *Ibid*., pp. 139-140. See ‘s Gravesande 1734a, *De evidentia*, pp. 7-8; see also p. 21.

741 ‘s Gravesande 1736, p. 140.

742 ‘s Gravesande 1734a, *De evidentia*, p. 11.

743 «Si ad illam pneumatologiae partem nos convertamus in qua de Deo agitur et hanc in totum circa ideas versari videbimus, et ex talibus deduci, circa quas dubium nullum in mente haerere potest; quod ex ipsarum natura sequitur ideoque evidentia mathematica etiam niti, quae de intelligentia suprema et infinita disputantur. Aliquid nunc est; ergo aliquid ab aeterno fuit. Cogito ego; id est datur quid intelligens, inde deduco huius primum auctorem ab aeterno fuisse et infinitum intelligentia superare quam produxit intelligentiam […]. Constat ergo Deum esse unicum, aeternum, immensa scientia praeditum, huiusque nullis terminis circumscribi potentiam. Quibus demonstratis ex his alia quae de Deo deteguntur profluunt. Bonitas ex. gr. in gradu supremo, ex infinita deducitur sapientia. […] Illud ipsum quo probamus Deum esse, et sapientem esse, ex examine rerum deductum, argumentum mathematica concomitari evidentia defendimus», *ibid*., pp. 12-13.

Locke, capable of a mathematical evidence[744]. So all the disciplines dealing with mere ideas have a mathematical evidence, since our consciousness or perception of such ideas entails their existence. All the other disciplines, as they concern entities different from ideas, are provided with a moral certainty because one needs to asses their existence by means different from mere consciousness.

Given this notion of evidence as immediate perception – or indubitable perception of an idea – two problems arise: the explanation of the difficulties in reaching a consensus in those disciplines capable of a mathematical evidence, and the justification of the knowledge of things different from ideas themselves. Plainly, metaphysical considerations often gave rise to the most acrimonious dissensions among philosophers. Such dissensions are caused by the ignorance of the rules of reasoning, by the influence of the passions of the soul, and by the use of obscure terms, whereas in mathematics one always uses distinct terms and divides ideas into their simplest elements[745]. Hence, the immediateness in perception – or the only ground of mathematical evidence according to ‘s Gravesande’s *Introductio* – seems not to be a sufficient condition for the attainment of truth, according to his *De evidentia*: the analysis or the distinction of ideas is also required. Such a distinction, eventually, helps in avoiding any arbitrariness in the definition of the evidence of an idea[746].

The other main problem raised by his account of mathematical evidence is that of the justification of our knowledge of material things, or the application of mathematics to the study of natural phenomena (*mathesis mixta*). The knowledge of external things does not rely on ideas considered in themselves[747]. This is the case with the knowledge pertaining to history and to physics[748], where one can attain only a moral evidence and a consequent moral certainty. The sources of moral evidence are different from those of mathematical evidence, namely sense experience, testimony and analogy[749]. Moral evidence, indeed, characterizes the perception of things as these are something different from ideas: their knowledge, thus, is not immediate and must

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[744] *Ibid*., pp. 17-18

[745] *Ibid*., pp. 14-17. See the second part of ‘s Gravesande’s logic, concerning error. See Schuurman 2004, pp. 148-149.

[746] ‘s Gravesande 1734a, *De evidentia*, p. 15. The differences between the two treatises are to be evaluated in the light of his *Introductio* being a preliminary discourse to Newtonian physics: thus, it is more focused on moral evidence, whereas his *De evidentia* –again published in the third edition of his *Elementa* – has a more general character.

[747] ‘s Gravesande 1734a, *De evidentia*, pp. 17, 20; ‘s Gravesande 1736, pp. 143-144.

[748] ‘s Gravesande 1734a, *De evidentia*, p. 17.

[749] The source of ‘s Gravesande’s positions on moral evidence seems to have been Humphry Ditton’s *Discourse on the Resurrection of Jesus Christ* (London, printed by J. Darby 1712) apparently reviewed by ‘s Gravesande: see «Journal litéraire» I (1713), pp. 391-435. See. Gori 1972, pp. 218, 229, 231, 232, 247, 249.

rely on these three sources of knowledge, which are the sole means to assess the correspondence of ideas and things[750]. Therefore, ‘s Gravesande devotes several paragraphs in chapters XIV to XVII of the second book of his logic to the rules of the right use of the senses, testimony and analogy. The senses, plainly, are our means to know phenomena and the properties and laws of matter. In order to get a certain knowledge by means of experience, one must rely on more than one sense, the senses must not be affected by any disease, and, in case of doubt about the constitution of one body, one must experience other bodies. Finally, the senses should not be employed in quantitative analyses[751]. Testimony, on the other hand, proves to be crucial in collective scientific research. As a result of the propagandistic needs of his early edition of the *Elementa*, in which ‘s Gravesande presents all his experiments as if these were performed by Newton alone, testimony is not mentioned in his 1720 *Praefatio*. In his *Introductio*, on the other hand, ‘s Gravesande addresses the use of testimony and defines the criteria to accept others’ witnesses, to be traced back to his studies of law. Its use must be controlled and obey three conditions: a witness must not have been deceived, he must not want to deceive, and has to express his thoughts in the clearest way. Such conditions, to be fulfilled, must respect nine rules, which are borrowed from the practice of trials[752]. Finally, analogy or the generalization of sense observations and testimony is intended to ground the inductive reasoning entailed by Newton’s second and third rule[753]. Still, attention is to be paid to the use of analogy. Insofar as it can concern composite entities, which are to be analysed in all their parts and circumstances before arriving at a generalization of their properties[754]. Eventually, the combined, right use of such means leads to an evidence that provides us with a certainty as persuasive as mathematical evidence, even if with different means, i.e. not resulting from ideas

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[750] «Res aliae, extra mentem positae, non immediate percipiuntur; neque ad se ipsam attendendo, mens harum acquirere potest notitiam. Nunquam ergo, sine auxilio extraneo, cognosci hae possunt. Aliud, ergo, veri criterium, ab evidentia diversum, nobis in hisce quaerendum est. Ut tamen eodem nomine veri criterium, in omni casu, exprimeretur, evidentiam moralem dixere illud, quo veritate idearum, de quibus in hisce agitur, determinamus. Et, ad omnem confusionem vitanda, simplici evidentiae, de qua praecedenti capite egimus, nomen evidentiae mathematicae dedere. Rerum extranearum, id est, extra mentem positarum, tribus mediis homines acquirunt ideas; sensibus, testimonio, et analogia; et tria haec dantur evidentiae moralis fundamenta. Nullum ex his, per se, id est, sua natura, est veri criterium; et eo respectu, evidentia moralis differt a mathematica; conveniunt tamen, respectu persuasionis, quae utramque sequitur», ‘s Gravesande 1736, pp. 144-145. See also ‘s Gravesande 1720, vol. I, *Praefatio*, pp. VII-VIII; ‘s Gravesande 1734a, *De evidentia*, p. 19;

[751] ‘s Gravesande 1736, pp. 149-163.

[752] ‘s Gravesande 1736, pp. 164-171.

[753] Quoted *supra*, n. 710.

[754] ‘s Gravesande 1736, pp. 171-174. An example of the misuse of analogy in reasoning is Huygens’s conclusion that other planets are inhabited: see *Introductio*, p. 173.

itself but from the divine will[755]. Physics can then be defined as characterized by *scientia*, and its reliability is provided with a rational-theological foundation. Set forth in his early *Praefatio*, this solution is developed in his *De evidentia* and *Introductio*.

First of all, in his *De evidentia* 's Gravesande points out that the existence of bodies is not only morally evident, since we can perceive that some of our ideas depend on something external to the mind. Still, he does not openly declare whether the existence of bodies is subject to mathematical evidence[756]. In any case, the actual features and laws of matter are subject to moral evidence: according to his *Praefatio*, indeed, these rely on the will of God[757], being thus morally necessary. Moreover, according to his *De evidentia* and *Introductio*, the reliability of senses, testimony and analogy is guaranteed by their relying on the moral necessity governing His acts, hence, they provide us with a moral evidence. The core of 's Gravesande's arguments is that it is not contradictory that by the senses, testimony and analogy one can err: however, it is contradictory – in a moral sense, according to the aforementioned considerations on necessity – that such sources of persuasion were provided to us by God as deceptive means, since they are essential to living happily and for a long time, given the material goods we can collect through them. The demonstration of their reliability is mathematically, i.e. demonstratively clear[758]. Therefore, sense perception, when used with the due attention, provides us with a moral evidence and certainty;

[755] «Vidimus toto coelo differre evidentiam mathematicam a morali. Prima per se […], secunda, ex Dei voluntate […], id est, ex institutione, est criterium veri. Cum autem utriusque fundamentum sit firmum, plena etiam est persuasio quae moralem evidentiam sequitur», 's Gravesande 1736, pp. 175-176.

[756] 's Gravesande 1734a, *De evidentia*, p. 19.

[757] *Supra*, n. 705.

[758] «Moralis autem evidentia non sua natura, sed ex Dei voluntate, persuasionis est fundamentum. Non, si rem in se consideremus, contradictionem involvit, sensus, testimonium, analogiam, adhibitis cautelis quibuscumque, nos in errorem inducere, sed contradictionem involvit, Deum voluisse haec esse persuasionis fundamenta, et haec, adhibitis legitimis cautelis, nos ad veritatem non conducere. Deum autem voluisse sensus, testimonium, et analogiam, talia esse fundamenta, et illum non frustra hoc voluisse, non erit demonstratu difficile, argumentis mathematice perspicuis. Talibus constat argumentis Deum esse, huncque esse bonum, et quidem in summo gradu. Hinc deducimus illum voluisse, ut homines iis utantur commodis quae ipsis largitus est; iis autem rebus, quae ad vitam in superficie telluris ducendam, ubi Deus ipse homines collocavit, necessariae sunt, uti non posse demonstrabimus, nisi memorata admittamus criteria veri, unde patebit haec talia esse. Suprema sapientia sibi ipsi fuisset contraria, si datis ipsis rebus, facultatem de hisce diiudicandi denegasset. Quod tamen non excludit legitimas adhibendas esse cautelas», 's Gravesande 1734a, *De evidentia*, pp. 21-22. «Deus bonus hominibus magnam rerum ubertatem concessit, voluitque ipsos his uti, dum in superficie telluris vivunt; remotis autem sensibus, homines harum rerum cognitionem nullam omnino habere possent, et commodis ex his ipsis profluentibus privarentur. Unde manifestum est, universi moderatorem hominibus sensus dedisse, ut his in examine rerum uterentur, et ipsis fidem haberent. Sibi ipsi contraria esset suprema sapientia, si, concessis rebus, datisque mediis quibus cognoscantur, haec homines in errorem inducerent. […] concludimus ex his omnibus, sensus, testimonia, analogiam, esse valida evidentiae moralis fundamenta», 's Gravesande 1736, pp. 146-148. Given the use of such terminology, he was accused of embracing a Spinozistic standpoint, i.e. to see divine actions as governed by a mathematical or absolute necessity. These arguments were rejected by means of Leibnitian arguments: *supra*, n. 728.

testimony, even if provided by other men, can be evaluated by reason, which is a gift of God[759]. The use of analogy, finally, justifies the very existence of universal laws, insofar as God does not deceive us in the use of generalizations. If there were no be fixed rule, we would be deceived in our analogical reasoning[760]. Eventually, this is the ultimate foundation of Newton's second and third rule of philosophy[761], which in 's Gravesande's *Praefatio* was based on the survival axiom and which is provided in his *Introductio* and *De evidentia* with a more comprehensive theological justification.

Whenever the three means of moral evidence cannot find a complete application one must follow the hypothetical method, which leads to a probable knowledge or, according to a vulgar way of speaking – rejected by 's Gravesande – to moral certainty[762]. Aiming at providing Newtonian empirical physics with the status of *scientia*, that is, of indubitable knowledge, 's Gravesande stresses that experience, testimony and analogy can lead us to an indubitable certainty. Thus, in his *Introductio* he softens the distinction between certainty and necessity, while maintaining a difference between absolute, physical and moral necessity. In fact, he clearly distinguishes between *scientia* and probable knowledge. The latter, moreover, admits of several degrees and can finally acquire the status of *scientia*, or be provided with moral evidence. Its degrees are uncertainty, doubtfulness, probability, and certainty, all entailing the demonstration of possibility[763]. The first means in arguing for probable conclusions is the use of hypotheses, which is openly recognized and

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[759] 's Gravesande 1736, p. 148.

[760] «Infelices homines, qui singulis diebus in dubio haererent, utrum veneno an utili cibo vescerentur! […] Nos summi numinis liberavit benignitas; nobis concessit observationes nostra ad non observata applicare, quo ad vitam necessaria a noxiis separamus, et futura saepe determinamus. […] Non timeo aedificium firmum sponte casurum. Ex analogia ergo in rebus physicis mihi est ratiocinandum, et omnipotentem rerum conditorem illud voluisse quis dubitabit; qui dum conditorem bonum novit, ad rerum constitutione attendit. Sed dum Deus hoc voluit, et illa quae ut talibus ratiociniis vis communicetur necessario requiruntur etiam voluit; id est, fixis et immutatus rerum congeriem adstrinxit legibus. Positis enim his firmo stabilitur fundamento analogia, iisdem sublatis omnia sunt incerta in rebus physicis, et brevi genus integrum peribit humanum, 's Gravesande 1734a, *De evidentia*, p. 24. «Ratiocinia, quae analogiam pro fundamento habent, nos ad veram rerum cognitionem ducere vidimus […]. Circa hanc nunc observamus, ipsam admodum late patet, et hoc simplici principio niti. Rerum universitatem legibus immutatis regi. Nisi hanc admittamus propositionem, nullam omnino analogiam dari quis non videt? Huius firmitatem ex Dei voluntate deduximus. Manifestum idcirco est, hunc voluisse rerum materialium congeriem fixis adstringere legibus; et indubitatae erunt conclusiones quas ex principio deducemus», 's Gravesande 1736, p. 171. This is also stated in an interpolation in the *Praefatio primae editionis* printed in the second and third edition of his *Elementa* (1725, 1742): see 's Gravesande 1720, vol. I, *Praefatio*, p. IX with 's Gravesande 1742, p. IX. This interpolation makes the contents of his *Praefatio* more consistent with his *De evidentia*, published in 1724.

[761] Quoted *supra*, n. 710.

[762] 's Gravesande 1736, pp. 175-176.

[763] *Ibid*., pp. 179-180. Moreover, there are composed and opposing probabilities, which are mathematically dealt with by 's Gravesande: see pp. 181-211.

systematized by 's Gravesande in the section *De methodo* of his *Introductio*, after having assessed the rules of the analytical and the synthetic method, on which I have already focused. Hypotheses are used to provisionally explain those facts which are unexplainable otherwise: so they must be verified in order to lead to a scientific, morally evident knowledge[764]. In any case, their use must be subject to some rules, defined by 's Gravesande and applied to cryptography in his *Introductio*[765]. In fact, 's Gravesande's use of hypotheses is borrowed from Huygens's *Traité de la lumiere*[766], and has its primary use in understanding the intentions of men: that is, the proper field of moral impossibility and necessity as it was defined in his book on metaphysics. Moreover, hypothetical reasoning may concern the investigation of natural phenomena as these are ruled by laws rooted in the divine will. In both cases, its use is justified as both human and natural phenomena do not follow only mechanical or geometrical reasons.

6.7 Newtonian philosophy in context

In basing his criterion of truth on the survival axiom in his *Praefatio primae editionis*, 's Gravesande recognizes the moral function of the exercise of experience, testimony and analogical reasoning. The right use of mental faculties allows the establishment of human society as a wish of God; hence, such ways are the right means in attaining the truth, in accordance with the survival axiom. Moreover, insofar as the establishment of society is enabled by our capacity to foresee events – such as that houses do not collapse, or that some food will not poison us[767] – God has established fixed laws corresponding to our ideas in order to take care of men as His privileged creatures. This is determined by His goodness and wisdom, the keystone of 's Gravesande's foundational arguments in his *Introductio*. Not surprisingly, in presenting his views on the purpose of philosophy in his *Oratio de vera philosophia* (1734) 's Gravesande declares the coincidence of the "true philosophy" with moral philosophy, aimed at the good life. Astronomy, mathematics, physics or mixed mathematics, as well as mechanics, optics and hydraulics – or the scope of his

[764] 's Gravesande 1736, p. 292; see's Gravesande 1742, vol. I, *Prefatio tertiae editionis*, p. XV
[765] 's Gravesande 1736, pp. 292-314.
[766] *Ibid*., pp. 295-296. See Gori 1972, pp. 271-272.
[767] *Supra*, nn. 714, 760.

academic teaching – relate to true philosophy but do not constitute philosophy as such[768]. This is the search for wisdom (*sapientia*) enabling men to fulfil the end God destined for them[769], i.e., the attainment of the happiness or beatitude for which God provided them with reason, made possible as all men act for the good of other men[770]. To a social life, indeed, men are driven by the right use of those faculties God provided them with[771]. In sum, the use of our faculties as given by God, the acknowledgment of His ends and the establishment of society are unmistakeably related in 's Gravesande's view. In accordance with this view, he can set forth his system of philosophy, in which logic as the art of reasoning is the first part and is followed by metaphysics as the study of the human faculties and of being – according to an order later reversed in his *Introductio*. Physics finds a place in philosophy as it aims to grasp the order of nature[772]. Finally, philosophy includes rational theology, or the acknowledgement of the providential order of creation and the moral duties of men[773]. Recalling his studies in law, 's Gravesande praises *iurisperiti* as those able to embrace the true philosophy, underlining the difficulties in keeping law and theology detached from philosophy, since these upper arts concern the same topics of philosophy[774]. As underlined by Gori, the establishment of society through the right use of the mental faculties as the end of Providence is

[768] «Haec omnia utilia sunt, haec philosophiae debentur: sed non constituunt philosophiam», see 's Gravesande 1734a, *De vera philosophia*, pp. 27-28.

[769] «Hominem non fortuito natum, sed scopo cuidam peculiari destinatum esse, dum vitam in telluris superficie cum reliquis hominibus agit, illi tantum negant, qui ei quod evidentissime demonstrari potest assensum dare recusant. Summa hominis sapientia est huic scopo satisfacere; et ille merito philosophus vocatur, qui ut eo perveniat omnem operam impendit, neque alter hocce nomen meretur», *ibid*., p. 30.

[770] «Beatitudinis ergo capax est homo, et hac sola de causa quia intelligentia praeditus est. Hanc autem amat, hanc optat beatitudinem, propriamque potius ipse destrueret naturam, quam hunc extingueret affectum; quod ab illa non potest separari perceptione, qua sibi constat se esse. Quaerit ideo homo, omne quod felicitatem, augere potest, et cum hanc tantum possideat quia est intelligens, etiam cognoscendi facultatem extendere cupit, haecque dum profluunt ex ipsa hominis natura, omnibus hominibus innata sunt. Homo, cum aliis hominibus in telluris superficie aetatem degens, singulis momentis aliorum indiget auxilio, quod ab his sperare non poterit, nisi et ipse alios adiuverit; et ab hoc mutuo officiorum commercio magis, extenso, augmentum illius, quam dum in vivis est sperare potest, felicitatis pendere detegit. Unde hanc deducimus conclusione, tunc esse hominum felicitatem in tellure maximam, quando omnibus bonum aliorum cordi est: ubi quisque hanc officiorum primam ponit regulam, unumquemque quantum potest alios adiuvare debere; quaerere ut ipsis utilis sit; nihil humani a se alienum putare», *ibid*., pp. 33-35.

[771] «Ita etiam res disposuit, ut homo homini prodesse possit, aut potius inter omnes homines societatem esse voluit; hocque in ipsa rerum constitutione manifeste declaravit», *ibid*., p. 36.

[772] *Ibid*., pp. 38-41. According to his *Praefatio primae editionis*, physics has the main purpose of disclosing the power and wisdom of God (see 's Gravesande 1720, vol. I, *Praefatio*, p. VI). Still, 's Gravesande does not embrace any cosmological argument and rejects any metaphysical implications of his physics – while still maintaining its theological foundation: see Gori, pp. 48-63, Ducheyne 2014a, pp. 38-40.

[773] «Officiorum tamen doctrina philosopho scopus erit, huic omnes animi vires applicabit et omnium primum investigabit quid debeat illi, a quo omnia accepit a quo omnia sperat. Dei perfectiones meditabitur, et ex his officia erga ipsum deducet», *ibid*., pp. 40-41. In fact, rational theology is present in logic also, as to the foundation of science.

[774] *Ibid*., pp. 43-45.

a concept unmistakeably characterizing the views on natural law of Grotius and Pufendorf, which came to 's Gravesande's acquaintance under the influence of Gerardus Noodt, professor at Leiden University, addressing in his *De religione ab imperio iure gentium libera* (1706) the correspondence of nature and society, both following divine obligations[775]. In fact, 's Gravesande's arguments evidently recall Grotius' and Pufendorf's views – as interpreted by Barbeyrac – on our being provided with means able to establish human society as one of the ends of God[776], and on the possibility of a demonstrative morality[777].

6.8 From law to philosophy of science

In conclusion, 's Gravesande provides a foundation of science by arguments to be traced back to logic, metaphysics and rational theology, as in the case of his Cartesian predecessors. This foundation is both an introduction of scholars to the new science, and its justification as a means to understand natural phenomena. Such a foundation has a metaphysical nature since metaphysics provides the basic ontology for physics, whilst not being any physical principle[778]. Moreover, it is carried out by logical means, as logic defines what is the method of natural philosophy and what are the limits of science. Accordingly, it is within logic that 's Gravesande provides a rational-theological foundation of moral evidence. His foundation, therefore, entails both a de-metaphysicalization of physics and a reflection on its limits.

The premises of such arguments mainly rely on the theories of Descartes, Malebranche and Locke, used by 's Gravesande to support his own metaphysical and logical considerations. On the

[775] See Gori 1972, pp. 66-67. Noodt's *Dissertatio de religione ab imperio jure gentium libera*, Leiden, apud Fredericum Haaring 1708, is referred to by 's Gravesande in his *De vera philosophia*. See 's Gravesande 1774, vol. II, p. 364 (n.).

[776] See S. Pufendorf, *Le droit de la Nature et des Gens, or systeme general des principes les plus importans de la morale, de la jurisprudence, et de la politique*, translated and commented on by J. Barbeyrac, London, chez Jean Nours 1740, book I, ch. I, §§ 3-4, ch. III, §§ 3, 5 (especially p. 71); id., *Les Devoirs De L'Homme, Et Du Citoien, Tels qu'ils lui sont prescrits par La Loi Naturelle*, translated and commented on by J. Barbeyrac, Amsterdam, P. de Coup 1723, book I, ch. III, §§ 7-11; H. Grotius, *De iure belli ac pacis*, commented on by J. Barbeyrac and J. Gronovius, Leipzig, s.n. 1768, book I, ch. I, § 10, comment 5. See also the text of 's Gravesande's teacher P.R. Vitrarius, *Institutiones iuris naturae et gentium*, Lausanne, apud Antonium Chapuis 1745, p. 9. See Gori 1972, pp. 130-133, 236-238, 256.

[777] See Pufendorf 1740, book I, ch. II, §§ 9-11. See Gori 1972, pp. 82, 184.

[778] The "anti-metaphysical" attitude of 's Gravesande had been noticed for the first time by Ernst Cassirer: see Cassirer 1951, pp. 61-64. On this topic, see also Schliesser 2011 and Ducheyne 2014a.

other hand, the core of his theological foundation is evidently influenced by Pufendorf's views on divine law. The recourse to natural law arguments can actually be explained by taking into account that 's Gravesande aimed at prevailing over Descartes's differentiation between moral certainty, which serves life and is open to doubt, and mathematical certainty or *scientia*. If according to Descartes empirical knowledge only serves the good life, the vindication of the "scientific" status of such knowledge rests on its definition as the means given to us by God in order to conduct a good life as the accomplishment of His providential order. For this reason, 's Gravesande borrowed his arguments from the natural law theories of Pufendorf and Grotius. However, this foundation of science not merely served to support the validity of the new physics in defiance of Cartesian philosophy, but resulted from a broader philosophical view also found in his *Lettre sur le mensonge*, where he justifies the use of lying as a means to preserve society, in accordance with right reason and the plan of God. The same view had been expressed by Pufendorf and his commentator Barbeyrac[779]. So 's Gravesande's foundation of science was determined by two main factors: first, by the need to defend the reliability of empirical knowledge as *scientia*, since Newtonian physics had to be defended in order to allow its inclusion among the philosophical disciplines. Secondly, it served to show the truth of such knowledge as one of the means enabling the achievement of the providential plan of God. Therefore, 's Gravesande's foundation had a further end than demonstrating the status of *scientia* of Newtonian physics and to make it a part of the academic curriculum of studies. Yet, following the Cartesian revolution in philosophy he pulled the final transformation of logic, metaphysics and rational theology into foundational theories, embodying a philosophy of science as a justification and a reflection on the methods and the concepts of mathematical-experimental physics.

[779] See 's Gravesande 1774, vol. II, p. 258; Pufendorf 1740, vol. II, p. 172. n. 1. See Gori 1972, pp. 82-85.

Conclusion

In the present study I have highlighted some alternatives in the foundation of philosophy and science by focusing on the Dutch reception of Cartesian and Newtonian ideas. Each alternative entails a different view on foundational arguments, which can be grouped into theological, metaphysical and logical ones. This research reveals the essential features of a philosophical milieu created by Descartes and constituting the framework for the dissemination of Newtonian science in Europe, leading to the birth of a philosophy of science as the study of the foundations, assumptions, methods and limits of the study of natural realms.

In fact, one can recognize several reasons for such foundation: on a general level, the need of providing philosophy with a secure foundation against the "sceptical crisis" of the sixteenth and seventeenth centuries highlighted by Richard Popkin. More specifically, the foundation of Cartesian and Newtonian philosophy and science served to defend the conceptual premises of new ways of thinking in an academic context, demonstrating the validity of such new ways and rejecting the commonsensical and non-explanatory assumptions of Scholastic philosophy, and, in the case of 's Gravesande, the speculative character of Descartes's physics.

The first philosopher here taken into account is Henricus Regius, who was interested in the development of a Cartesian physics aimed at providing medicine with a basis – as elaborated upon by Descartes with his metaphor of the tree – but with no rational foundation, since Regius rejected Descartes's metaphysics. This rejection was based on metaphysical reasons, that is, by Regius's assumption of an empiricist standpoint with respect to the sources of knowledge and of an ontological unconcern about the nature of the mind. Accordingly, he rejected any purely rational solution to philosophical problems, such as the formulation of an explanatory model of the constitution of the world. Still concerned with the problem of a foundation, however, he appealed to the Bible as the only solution to the metaphysical problems raised by Descartes and as the guarantee for the reliability of the use of the mental faculties, the use of which, however, can lead us only to a hypothetical or moral certainty with regard to our knowledge of natural laws.

The second chapter is on Johannes Clauberg, who had a view on the function of philosophy broader than Regius's. Indeed, Clauberg aimed to replace the whole corpus of Scholastic thought

with Descartes's philosophy, providing a basis to medicine, law and theology. In other words, Clauberg aimed at developing a Cartesian scholasticism. For this sake, he developed a metaphysical foundation, with relevant implications for logic and *ontosophia*. According to him, metaphysics – which embodies rational theological arguments on the role of God as guarantor of the truth of our knowledge – is the first discipline in the corpus of the sciences as it introduces students to a radically new way of thinking, *via* Cartesian doubt. Hence, metaphysics has the function of granting the reliability of the use of the mental faculties by theological arguments and of outlining the basic concepts of philosophy. Moreover, metaphysics finds its methodological counterpart in logic, aimed at guiding the mind in the formation of ideas and in their expression in words, but still including foundational arguments, as Clauberg analyses the degrees of certainty of metaphysical arguments though logical considerations. These, in turn, include concepts expressly dealt with in *ontosophia* as the last part of philosophy. So there is a threefold foundation of philosophy in Clauberg's case: logic, metaphysics and *ontosophia*, with metaphysics as the major part. His solution shows that the problem of the foundation of philosophy as a comprehensive corpus of diverse disciplines required a metaphysical foundation embodying natural theology as the guarantee of the truth of philosophical arguments. Moreover, it required the development of a comprehensive methodology to be explained through a logical introduction.

The third chapter is about Johannes de Raey, who rejected both Regius's and Descartes's solutions and proposed more straightforward foundational arguments. His case shows that the foundation of philosophy as a purely rational enterprise – in response to the problem of the use of philosophy in practical disciplines raised by Regius, Sylvius, Meijer and Spinoza – led to a foundation examining the basic rules of philosophical reasoning, their metaphysical presuppositions, and a rational theology aimed at guaranteeing their reliability. This foundation has a logical nature because it primarily shows how we can deal with philosophical notions and because it entails metaphysics, since by considering concepts and words it takes into account their reference. According to De Raey, logic has the function of providing physics with a foundation: physics, in turn, is the main part of philosophy and is to be distinguished from all the other academic disciplines and from any kind of practical art. Indeed, physics is aimed only at the formulation of a theoretical model of the constitution of the world on a purely rational basis. It has to be based on logic, since logic teaches us to use the four rules of Descartes's method, it provides the demonstration, via rational theology, of the existence of God as guarantor of our knowledge, and it

consists in the analysis of the main notions and principles of philosophy. Thus, logic provides both the guarantee of the right functioning of the mind, and discloses the basic notions of science. Moreover, since language is the vehicle of concepts, De Raey provides his analysis of the main notions of philosophy through a Cartesian interpretation of language. This is carried out by paying attention to the errors arising from a rejection of Descartes's metaphysics, and from the application of the Cartesian paradigm of knowledge to the empirical disciplines and everyday practice. These errors, prompted by Regius's misuse of Cartesian philosophy, lead to a materialist standpoint on the references of ordinary and philosophical language: accordingly, to the collapse of communication among men and of the formulation of philosophical arguments. De Raey thus developed a foundation of philosophy that was, at the same time, a reflection on the actual method of philosophers and practitioners.

The fourth chapter analyses Arnold Geulincx's theological foundation. Mainly interested in the development of an ethics responding toboth the demands of Reformed theology and the philosophical standard of Leiden University, Geulincx developed a philosophical ethics conceived as the keystone of his system of philosophy. The foundation of philosophy intended as a rational ethics has a more consistent theological character, since it is aimed at the attainment of salvation and beatitude. According to him, logic is the basement, metaphysics is the column, physics is the floor and ethics is the roof of the House of Philosophy. In fact, rational theology plays an essential role in Geulincx's metaphysics as it is by an analysis of the role of God that he defines the status of physics as a hypothetical science (since natural laws rely on the will of God and can be grasped only through experience), and he defines the basics of his ethics, whose acknowledgement begins with the awareness of the dependence on God of our actions. On the other hand, logic has no foundational role as it neither delivers the basic concepts of sciences nor guarantees the right functioning of the mind. Rather, it has a mere instrumental value as it helps to exercise the mind in demonstrative reasoning.

The fifth alternative is the metaphysical foundation of physics by Burchard de Volder, who was mainly interested in teaching natural philosophy by means of experiments confirming a Cartesian worldview. Moreover, he showed an openness to an empirical method of discovery inspired by Galileo, Huygens and Newton, that is, the early figures of the modern experimental-mathematical science. Attracted by the successes of English science, De Volder's appreciation of an

empirical methodology in the discovery of natural laws goes along with his unconcern with the deduction of the first principles of science from the attributes of God, carrying out a "de-metaphysicalization" of natural philosophy that already commenced with Geulincx's hypothetical physics. Moreover, his interest in the practice of teaching which prevailed over the development of a comprehensive theory led him to neglect the formulation of a clear scientific methodology. Therefore, his foundation of physics does not entail a deduction of natural laws from the attributes of God, and mainly consists in the justification of the validity of the basic notions of mechanicism as our only means to formulate explanatory hypotheses on the causes of phenomena. Moreover, according to De Volder nothing but mere consciousness show us that such principles are valid, which is only confirmed by the demonstration of the existence of God. Also, their actual causal role with regard to phenomena cannot be demonstrated, since they concern only one possible explanatory model. Therefore, the development of an empirical physics, having a hypothetical certainty, goes along with a metaphysical foundation including some theological arguments, being mainly focused on the assessment of the main concepts to be experimentally dealt with.

Finally, the sixth chapter confirms my views on the categorization of foundational arguments, since my threefold classification is assumed by 's Gravesande in his foundation of Newtonian physics. The development of a systematic, experimental-mathematical physics, aimed at gaining a necessary knowledge in an Academic framework dominated by a Cartesian stance on *scientia* as evident, purely intellectual knowledge, required the development of a comprehensive foundation. This concerns both metaphysical and logical (i.e. methodological) aspects; moreover, it includes a rational theology as the only basis for a justification of the reliability of sense perception. The core of the justification of the use of Newton's *regulae philosophandi* is theological, and bears witness to the influence of Pufendorf's and Grotius's views on the role of God in the establishment of human society. Indeed, this is made possible by the goodness of God, which makes the use of the senses, testimony and analogy reliable in discovering the constant laws of nature. 's Gravesande's theological foundation, however, is introduced by an overview of the metaphysical assumptions underlying Newtonian physics, and serves as the guarantee of the ways the mind can be acquainted with the truth, that is, the methodological rules of analysis, synthesis and hypothetical reasoning, which are considered from a logical point of view. By means of this threefold foundation of science 's Gravesande aims at providing Newtonian experimental-mathematical physics with the status of *scientia*: that is, with a certainty as persuasive as that of mathematics, even if provided by different

means. While avoiding the development of a "metaphysical physics", as Descartes's did, 's Gravesande still provided physics with the highest degree of certainty.

These six cases prove that philosophers paid attention to a defence of the reliability of Cartesian and Newtonian philosophy and science, and to their systematization according to the needs of academia. One may object, however, that the case of Regius is a counter-proof to the claim that a foundation of philosophy and science was required by academic needs: indeed, he did not provide either a philosophical or a consistent foundation of philosophy, relying on a few biblical quotations as the only guarantee of the reliability of the mental faculties. This may prove Regius's lack of interest in metaphysical issues and the foundation of physics itself, but also to a particular strategy to avoid any accusation of enthusiasm to the new philosophy, as those occurred during the Utrecht and Leiden crises. In this manner, Regius facilitated the introduction of the new philosophy in the academy by avoiding to provide it with a foundation on Cartesian metaphysics: rather, he adopted a foundation on revealed theology. Yet, he could not demonstrate the status of scientia – i.e. as indubitable knowledge – of physics itself, which was vulnerable to the argumentations of the sceptics.

The next cases, which do entail a philosophical foundation of science, can indeed be interpreted as a reaction to Regius's solution, and at the same time as a response to the demands of academia. In the cases of Clauberg and De Raey, both active during the quarrels over the new philosophy, this is confirmed by their open rejection of Regius's standpoint: whereas De Raey expressly wanted his logical foundation to stop the corruption of Cartesian philosophy begun with Regius, Clauberg separated Regius's thought from Descartes's original philosophy in his *Logica vetus et nova*[780]. Accordingly, Clauberg developed a metaphysics serving as an introduction of students to new ways in philosophy, and a logic teaching them how to conduct reason in every academic discipline. In a similar way, De Raey developed a foundational theory defining the very limits of Cartesian philosophy, making it consistent with the use of a commonsensical approach in medicine, law, theology and the practical arts. Both Clauberg and De Raey provided the new philosophy with a foundation aimed at justifying the function of the new philosophy in the academic culture. Similarly, Geulincx was deeply concerned with the integration of the new philosophy to the academic context. He developed a philosophical ethics based on a coherent

[780] *Supra*, n. 145.

system of disciplines replacing the traditional matters of teaching. On the other hand, Spinoza, who was not concerned with academic demands, did not provide his ethics with a proper foundational theory, as he starts with a list of definitions and develops his theory of substance, mind and passions through a demonstrative reasoning which is neither justified nor clarified in its methodological implications[781]. In fact, he developed a metaphysics without a foundation, since the use of metaphysical notions is aimed at developing an ethics but is not justified in its reliability. On the other hand, De Volder was mainly concerned with the practice of academic teaching by means of experiments, and with a method of discovery roughly inspired by that of Galileo, Huygens and Newton, even though he maintained a Cartesian cosmological model. Therefore, he developed a Cartesian foundation of the principles of mechanicism for the benefit of students while avoiding deducing from these all the physical explanations. As in the case of Geulincx's hypothetical physics, based on a set of notions dealt with by metaphysics (*somatologia*) but then developed by means of experience and generalizations, one can recognize a progressive de-metaphysicalization of physics, as foundational theories were progressively kept detached from the discovery of new truths. Finally, 's Gravesande's *Introductio ad philosophiam* embodies all the mentioned solutions to the problem of a foundation, fitting the needs of the introduction, justification and teaching of the basics of a new paradigm in the university. 's Gravesande's solution confirms that metaphysics, logic and rational theology assumed a specific function in the introduction of new philosophies in early modernity, aimed at defending and clarifying their methodological and conceptual assumptions. So foundational theories led to the emergence of a philosophy of science, but also to a radical shift in the function of philosophy and in the very system of academic teaching, since philosophy progressively lost its character as the handmaiden of the higher faculties, which can still be recognized in Regius's and Clauberg's theories but which disappears in the next generations of Cartesian and Newtonian philosophers. Provided with an increasing autonomy, justified through its foundational theories, philosophy found in itself the problems it aimed to solve, rather than being a mere preparation of scholars for the law, medicine and theology. Furthermore, this transformation was the prelude to a more substantial change in the organization of knowledges in modern age: that is, to the differentiation of philosophy and science. As natural philosophy progressively diversified

[781] As pointed out by Paul Schuurman, «neither the *Ethica* nor the *Tractatus de intellectus emendatione* […] devote much attention to the two stages of the logic of ideas. Spinoza is interested primarily in establishing how we can obtain the clear and distinct ideas by which we can overcome our passions», Schuurman 2004, p. 65. See Spinoza, *Ethica*, V, *Praefatio*. Cf. *supra*, n. 28.

its branches into independent sciences, logic and metaphysics as philosophical disciplines would increasingly assume the function of philosophy of science.

In this dissertation many themes have been left unexamined, such has the problem of the actual methodologies entailed by Cartesian and Newtonian physical theories, and their inconsistencies with purported methods. Indeed, this study serves – from a meta-philosophical point of view –, to test the possibility of a history of philosophy of science as a study of the reflection of early modern philosophers and scientists on the assumptions underlying their theories. With this study, I aimed at showing why and how a philosophy of science emerged in the history of western thought. A mere study of actual natural-philosophical and scientific methods, in fact, would rather belong to a history of philosophy of science as a "philosophy of science by other means", which would deprive the history of philosophy of science as a historiographical discipline of its independence. Given my purpose, moreover, the evolution of the foundation of Newtonian science, and the development of a Newtonian philosophy beyond 's Gravesande were not examined. I have not dealt with the foundation of the scientific theories of Christiaan Huygens and Herman Boerhaave, who showed scarce philosophical interests, and of eclectic figures such as Wolferd Senguerd either. A follow-up study might be useful to test the wider applicability of the heuristic scheme that is elaborated upon on the basis of a six-case study here.

Bibliography

Primary sources

R. Andala, *Examen Ethicae Clar. Geulingii sive Dissertationum Philosophicarum, in quibus praemissa Introductione sententiae quaedam paradoxae ex Ethica Clar. Geulingii examinantur, Pentas*, Franeker, Wibius Bleck 1716.

Anonymous, *Bibliotheca Volderina: seu catalogus selectissimorum librorum Burcheri de Volder*, Leiden, van der Linden et Voorn 1709.

Anonymous, *Lettre à monsieur G. J. S'Gravesande, Professeur en Philosophie à Leide, Sur son Introduction à la Philosophie, & particulierement sur la nature de la liberté*, Amsterdam, chez J. F. Bernard 1736.

Aristotle, *Opera*, ed. by Immanuel Bekker, Berlin, G. Reimer 1831-1870.

Augustine, *Opera omnia*, Roma, Città Nuova Editrice 1970-.

F. Bacon, *Novum Organum*, London, apud Joannem Billium 1620.

F. Bacon, *De principiis atque originibus secundum fabulas Cupidinis et Coeli: sive Parmenidis et T. et praecipue Democriti philosophia*, in *Scripta in naturali et universali philosophia*, Amsterdam, apud Ludovicum Elzevirum 1653, pp. 208-284.

L. Bellini, *Opuscula aliquot ad Archibaldum Pitcarnium*, Pistoia, ex nova officina Stephani Gatti 1695.

C. Bontekoe, A. Geulincx, *Metaphysica, et liber singularis De motu, nec non eiusdem Oeconomia animalis, opera posthuma: quibus accedit Arnoldi Geulincx* […] *Physica vera, opus posthumum*, Leiden, apud Johannem de Vivié, et Frédéricum Haaring 1688.

G.A. Borelli, *De motu animalium*, Rome, ex typographia Angeli Bernabò 1680.

R. Boyle, *New experiments physico-mechanicall, touching the spring of the air and its effects*, Oxford, printed by H. Hall 1660.

F. Burgersdijk, *Institutionum logicarum libri duo, decreto illustr. ac potent. dd. ordinum Hollandiae et West-Frisiae, in usum scholarum eiusdem provinciae, ex Aristotelis, Keckermanni, aliorum praecipuorum logicorum praeceptis recensitis, nova methodo ac modo formati, atque editi*, Leiden, apud Abrahamum Commelinum 1626.

——, *Institutionum logicarum synopsis, sive Rudimenta logica. In quibus praecipuae definitiones, divisiones, et regulae, ad artem logicam pertinentes, per quaestiones et responsiones, breviter et dilucide proponuntur; in usum scholarum Hollandicarum*, Leiden, apud Abrahamum Commelinum 1645.

——, *Institutionum logicarum libri duo, editio novissima*, Amsterdam, apud Aeodium Walckenier et Casparum Commelinum 1660.

Cicero, *Tusculanae Disputatione*s, ed. by M. Pohlenz, Leipzig, Teubner 1918.

J. Clauberg, *Elementa philosophiae seu Ontosophia. Scientia prima, de iis quae Deo creaturisque suo modo communiter attribuuntur*, Groningen, typis Joannis Nicolai 1647.

——, *Defensio Cartesiana, adversus Jacobum Revium et Cyriacum Lentulum*, Amsterdam, apud Ludovicum Elzevirium 1652.

——, *Initiatio philosophi, sive dubitatio cartesiana, ad metaphysicam certitudinem viam aperiens*, Leiden-Duisburg, ex officina Adriani Wyngaerden 1655.

——, *De cognitione Dei et nostri, quatenus naturali rationis lumine, secundum veram philosophiam, potest comparari, exercitationes centum*, Duisburg, ex officina Adriani Wyngaerden 1656.

——, *Unterschied zwischen der cartesianischer und der sonst in Schulen gebraeuchlicher Philosophie*, Duisburg, bey Adryan Wyngarten 1657.

——, *Logica vetus et nova modum inveniendae ac tradendae veritatis, in genesi simul et analysi, facili methodo exhibens, editio secunda*, Amsterdam, ex officina Elzeviriana 1658 (1st ed. 1654).

——, *Ontosophia nova, quae vulgo Metaphysica, Theologiae, Iurisprudentiae et Philologiae, praesertim Germanicae studiosis accomodata. Accessit Logica contracta, et quae ex ea demonstratur Orthographia Germanica*, Duisburg, typis Adriani Wyngaerden 1660.

——, *Metaphysica de ente, quae rectius Ontosophia*, Amsterdam, apud Danielem Elzevirium 1664.

——, *Physica, quibus rerum corporearum vis et natura, mentis ad corpus relatae proprietates, denique corporis ac mentis acta et admirabilis in homine coniunctio explicantur*, Amsterdam, apud Danielem Elzevirium 1664.

——, *Differentia inter cartesianam et in scholis vulgo usitatam philosophiam*, Berlin, Völckern 1680.

——, *Opera omnia philosophica*, Amsterdam, ex typographia P. & T. Blaev 1691.

J. Le Clerc, *Logica: sive, Ars Ratiocinandi. Ontologia; sive de Ente in Genere. Pneumatologia seu de Spiritibus*, London, impensis Awnsham & Johan. Churchill 1692.

——, *Bibliothèque choisie*, vol. 18, Amsterdam, chez Henri Schelte 1709.

——, *Logica, ontologia, et pneumatologia*, London, typis Johan. Churchill 1716 (5th ed.).

J. Cocceius, *Ad ultima Mosis, hoc est, sex postrema capita Deuteronomii considerationes*, Franeker, s.n. 1650

T. Craanen, *Oeconomia animalis in duas partes distributa. Nec non Oeconomiae animalis ad circulationem sanguinis et chyli dispositae, brevis delineatio,* Gouda, ex officina Guilhelmi vander Hoeve 1685; 2nd ed., Amsterdam, apud Joannem Wolters 1703.

——, *Lumen rationale medicum, hoc est Praxis medica reformata sive Annotationes in praxin Henrici Regii*, Middelburg, apud Johannem de Reede 1686.

——, *Tractatus physico-medicus de homine, in quo status eius tam naturali, quam praeternaturalis, quoad theoriam rationalem mechanice demonstratur*, Leiden, apud Petrum vander Aa 1689.

——, *Observationes, quibus emendatur & illustratur Henrici Regii Praxis medica, medicationum exemplis demonstrata*, Leiden, apud Petrum Vander Aa 1689.

H. Denzinger, Adolf Schönmetzer, *Enchiridion symbolorum definitionum et declarationum de rebus fidei et morum*, Freiburg-Basel-Rome-Vienna, Herder 1991 (37th ed., 1st ed. 1854).

R. Descartes, *Les passions de l'âme*, Paris, chez Henry Le Gras 1649.

——, *Oeuvres*, ed. by C. Adam, P. Tannery, Paris, L. Cerf 1897-1913.

——, H. Regius, *The Correspondence between Descartes and Henricus Regius*, ed. by E-J. Bos, Utrecht, Utrecht University: Publications of the Department of Philosophy 2002.

S. Desmarets, *Collegium theologicum sive systema breve universae theologiae*, Groningen, ex officina J. Nicolai 1645. 2nd ed. Groningen, ex officina J. Nicolai 1649.

H. Ditton, *Discourse on the Resurrection of Jesus Christ*, London, printed by J. Darby 1712.

Eustache de Saint-Paul, *Summa philosophiae quadripartita, de rebus dialecticis, moralibus et metaphysicis*, Paris, Chastelain 1620 (1st ed. 1609).

J. Fernel, *Universa medicina*, Paris, apud Andream Wechelum 1567.

Galen, *Opera Omnia*, ed. by C.G. Kühn Leipzig, C. Cnobloch 1821-1833 (reprint Hildesheim, Georg Olms 1964-1965).

Galileo Galilei, *Systema cosmicum*, London, apud Thomam Dicas 1663.

A. Geulincx, *Questiones quodlibeticae in utramque partem disputatae*, Antwerp, bij de We Cnobbaert 1653.

——, *Logica fundamentis suis restituta*, Leiden, apud Henricum Verbiest, 1662.

——, *Methodus inveniendi argumenta*, Leiden, apud Isaacum de Waal, 1663.

——, *De virtute et primis eius proprietatibus*, Leiden, apud Philippum de Croy 1665

——, *Saturnalia, seu (ut passim vocantur) Quaestiones Quodlibeticae in utramque partem disputatae. Editio secunda ab auctore recognita et aucta*, Leiden, ex officina Henrici Verbiest 1665.

——, *Van de Hooft-deuchden: De eerste Tucht-verhandeling*, Leiden, bij Philips de Croy 1667.

——, *Γνῶθι σεαυτόν, sive Ethica*, ed. by C. Bontekoe, Leiden, apud Adrianum Severini 1675.

——, *Metaphysica vera et ad mentem peripateticam*, Amsterdam, apud Joannem Wolters 1691 (a).

——, *Annotata maiora in Principia philosophiae Renati des Cartes*, Dordrecht, ex officina T. Goris 1691 (b).

——, *Opera philosophica*, ed. by J.P.N. Land, The Hague, M. Nijhoff 1891-1893: vol. I (1891), vol. II (1892), vol. III (1893).

——, *Ethics: With Samuel Beckett's notes*, ed. by H. van Ruler, A. Uhlmann, M. Wilson, transl. by M. Wilson, Leiden, Brill 2006.

R. Goclenius, *Lexicon philosophicum*, Frankfurt, typis viduae Matthiae Beckerii 1613.

W. J. 's Gravesande, *Essai de perspective*, The Hague, veuve A. Troyel 1711.

——, *Discours sur la Resurrection de J. Christ, et c. par M. Ditton*, «Journal litéraire» I (1713), pp. 391-435.

——, *Remarques sur la construction des machines pneumatiques & sur les dimensions qu'il faut leur donner*, «Journal Literaire» IV (1714), pp. 182-208.

——, *Oratio inauguralis de matheseos in omnibus scientiis, praecipue in physicis, usu, nec non de astronomiae perfectione ex physica haurienda*, Leiden, apud Samuelem Luchtmans 1717.

——, *Examen des Raisons de Mr. Bernard contre le Mensonge officieux*, «Journal literaire» XI (1721), pp. 344-366.

——, *Physices elementa mathematica, experimentis confirmata. Sive introductio ad philosophiam Newtonianam*, Leiden, apud Petrum van der Aa 1720-1721;

——, *Physices elementa mathematica, experimentis confirmata. Sive introductio ad philosophiam newtonianam. Editio secunda, auctior et emendatior*, Leiden, apud Petrum vander Aa, 1725;

——, *Physices elementa mathematica, experimentis confirmata. Sive introductio ad philosophiam newtonianam. Editio tertia duplo auctior*, Leiden, apud Johannem Arnoldum Langerak, Johannem et Hermannum Verbeek 1742.

——, *Philosophiae newtonianae institutiones, in usus academicos*, Leiden, apud Petrum vander Aa 1723.

——, *Matheseos universalis elementa, quibus accedunt, specimen commentarii in arithmeticam universalem Newtoni: ut et de determinanda forma seriei infinitae adsumtae regula nova*, Leiden, apud Samuelem Luchtmans 1727.

——, *Orationes tres. De matheseos in omnibus scientiis, praecipue in physicis, usu, nec non de astronomiae perfectione ex physica haurienda*. *Altera. De evidentia*. *Tertia de vera et nunquam vituperata philosophia*, Leiden, apud Samuelem Luchtmans 1734 (a).

——, *Orationes duae. Prima de vera, et nunquam vituperata, philosophia, Altera de evidentia*, Leiden, apud Samuelem Luchtmans 1734 (b).

——, *Introductio ad philosophiam, metaphysicam et logicam continens*, Leiden, s.n. 1736;

——, *Introductio ad philosophiam: metaphysicam et logicam continens*. *Editio altera*, Leiden, apud Joh. et Herm. Verbeek 1737.

——, *Ouvres philosophiques et mathématiques*, ed. by J. Allamand, Amsterdam, chez Marc Michel Rey 1774.

J. Gronovius, *Burcheri de Volder laudatio*, Leiden, apud Cornelium Boutestein 1709.

H. Grotius, *De iure belli ac pacis*, commented by J. Barbeyrac and J. Gronovius, Leipzig, s.n. 1768.

A. Heidanus et al*., Consideratien over eenige saecken onlanghs voorgevallen in de Universiteyt binnen Leyden*, Leiden, bij Aernout Doude, 1676

C. Huygens, *Oeuvres complètes*, Den Haag, M. Nijhoff 1888-1950, ed. by D. Bierens de Haan (tome 1-5), J. Bosscha (6-10), D.J. Korteweg (11-15), A.A. Nijland (15), J.A. Vollgraf (16-22).

——, *Kosmotheoros*, ed. by B. de Volder, A. Fullenius, The Hague, apud Adrianum Moetjens 1698.

——, *Opuscula posthuma*, ed. by B. de Volder, A. Fullenius, Leiden, apud Cornelium Boutesteyn 1703.

P.-D. Huet, *Censura philosophiae cartesianae*, Paris, apud Danielem Horthemels 1689.

B. Keckermann, *Systema physicum*, Hannover, impensis Ioannis Stockelii 1623 (3rd ed., 1st ed. 1610).

J. Locke, *An essay concerning humane understanding*, London, printed for The. Bassett 1690 (1689).

G. W. Leibniz, *Die philosophische Schriften*, ed. by C. I. Gerhardt, Berlin-New York, Georg Olms Verlag 1978.

——, *Sämtliche Schriften und Briefe*, Darmstadt-Leipzig-Berlin, Akademie Verlag, 1923-.

J. Maccovius, *Metaphysica ad usum quaestionum in philosophia ac theologia adornata et applicata. Tertium edita et explicata, vindicata, refutata, per Adrianum Heereboord*, Leiden, ex officina Francisci Hackii 1658 (1st ed. 1645)

I. Newton, *Philosophiae naturalis principia mathematica. Editio tertia aucta et emendata*, London, apud Guil. & Joh. Innys 1726.

——, *Opticks or a treatise of the reflections, refractions, inflections and colours of light*, London, printed for Sam. Smith, and Benj. Walford 1704.

G. Noodt, *Dissertatio de religione ab imperio jure gentium libera*, Leiden, apud Fredericum Haaring 1708.

A. Pitcairne, *Oratio, qua ostenditur, medicinam ab omni philosophorum secta esse liberam*, Leiden, apud Abrahamum Elzevier 1692.

Plato, *Opera*, ed. by Burnet, Oxford, Oxford Classical Texts 1900-1907.

S. Pufendorf, *Le droit de la Nature et des Gens, or systeme general des principes les plus importans de la morale, de la jurisprudence, et de la politique*, translated and commented by J. Barbeyrac, London, chez Jean Nours 1740.

——, *Les Devoirs De L'Homme, Et Du Citoien, Tels qu'ils lui sont prescrits par La Loi Naturelle*, translated and commented by J. Barbeyrac, Amsterdam, P. de Coup 1723.

J. de Raey, *Disputationes philosophicae ad Problemata Aristotelis*, Leiden, e typographeo Francisci Hackii, et ex officina Joannis Maire 1651-1652.

——, *Clavis philosophiae naturalis, seu introductio ad naturae contemplationem, aristotelico-cartesiana*, Leiden, ex officina Joannis et Danielis Elsevier 1654.

——, *Dissertatio philosophica de sapientia veterum, recitata in Illustri Amstelodamensium Athenaeo cum primariam philosophiae professionem auspicaretur*, Amsterdam, apud Joannem Ravensteinium 1669.

——, *Clavis philosophiae naturalis aristotelico-cartesiana. Editio secunda, aucta opuscolis philosophicis varii argumenti*, Amsterdam, apud Danielem Elsevirium 1677.

—— (*praeses*), J. Targier (*resp*.), *Miscellanea philosophica*, Amsterdam, apud Joannem Rieuwertsz 1685.

——, L. Wolzogue, G. van Leeuwen, *Copie van de acte van de heeren professoren der Illustre Schoole tot Amsterdam, J. de Raei, L. Wolzogue, en G. van Leeuwen, in dato den 6 October 1689, tegen het misbruyk der philosophie*, Amsterdam, s.n. 1689.

——, *Cogitata de interpretatione*, Amsterdam, apud Henricum Wetstenium 1692

H. Regius, *Physiologia sive cognitio sanitatis*, Utrecht, ex officina Aegidii Roman 1641 (a).

——, *De illustribus aliquot quaestionibus physiologicis*, Utrecht, ex officina Aegidii Roman 1641 (b).

——, *Fundamenta physices*, Amsterdam, apud Lodovicum Elzevirium 1646.

——, *Fundamenta medica,* Utrecht, apud Theodorum Ackersdycium 1647 (a).

——, *Explicatio mentis humanae*, also as *Medicatio viri cachexia leucophlegmatica affecti. Corollaria*, Utrecht, Johannes à Noortdyck 1647 (b).

——, *Brevis explicatio mentis humane*, Utrecht, ex officina Theodori Ackersdicii 1648.

——, *De affectibus animi dissertatio*, Utrecht, typis Theodori ab Ackersdijck, et Gisberti a Zijll 1650.

——, *Philosophia naturalis, editio secunda*, Amsterdam, apud Lodovicum Elzevirium 1654.

——, *Medicinae libri quatuor*, Utrecht, typis Theodori ab Ackersdijck, et Gisberti a Zijll 1657.

——, *Philosophia naturalis*, Amsterdam, apud Lodovicum et Danielem Elzevirios 1661.

H.A. Roëll (*praeses*), D. Brouwer (*resp*.), *Disputatio philosophica de principio veritatis cognoscendae*, Franeker, apud Johannem Gyselaar 1686.

J. Rohault, *Traité de physique*, Paris, de l'imprimerie de Denys Thierry 1671.

F. Sylvius, *Oratio inauguralis de hominis cognitione*, Leiden, ex officina Joannis Elsevier 1658.

B. de Spinoza [anonymous], *Tractatus theologico-politicus: Continens Dissertationes aliquot, Quibus ostenditur Libertatem Philosophandi non tantum salva Pietate, & Reipublicae Pace posse concedi: sed eandem nisi cum Pace Reipublicae, ipsaque Pietate tolli non posse*, Hamburg [Amsterdam], apud Henricum Kunrath [J. Riewerts] 1670.

——, *Opera posthuma*, s.l., s.n. 1677.

C. Vinson, *Burcherus de Volder, of Leyden: Experimenta philosophica naturalia: 1676, 1677* in Sloane 1292, ms., British Library, ff. 78-141.
P.R. Vitrarius, *Institutiones iuris naturae et gentium*, Lausanne, apud Antonium Chapuis 1745.

L. van Velthuysen, *Epistolica Dissertatio de principiis iusti et decori, continens apologiam pro tractatu clarissimi Hobbaei De Cive*, Amsterdam, apud Ludovicum Elzevirium 1651, recently edited and translated by M. de Mowbray: L. van Velthuysen, *A Letter on the Principles of Justness and Decency, Containing a Defence of the Treatise De Cive of the Learned Mr Hobbes*, Leiden, Brill 2013.

——, *Disputatio de finito et infinito, in qua defenditur sententia clarissimi Cartesii, De Motu, Spatio et Corpore*, Amsterdam, apud Ludovicum Elzevirium 1651.

——, *De initiis primae philosophiae, nec non de Deo, et mente humana*, Utrecht, apud Theodorum ab Ackersdijck 1662.

——, *Opera omnia*, Rotterdam, typis Reineri Leers 1680.

——, [anonymous], *Bewys dat het gevoelen van die genen, die leeren der sonne stilstandt en des aertrycks beweging niet strydich is met Godts-Woort*, s.l (Utrecht), D. van Ackersdijck & G. van Zijll, 1655.

G. Voetius et al., *Testimonium Academiae Ultraiectinae, et Narratio Historica*, Utrecht, ex typographia Wilhelmi Strickii, 1643.

G. Voetius, M. Schoock, *Admiranda Methodus novae philosophiae Renati des Cartes*, Utrecht, ex officina Joannis van Waesberge 1643.

B. de Volder, *Quaestiones academicae de aëris gravitate*, Middelburg, typis viduae Remigii Schreverii 1681 (a).

——, *Disputationes philosophicae sive cogitationes rationales de rerum naturalium principiis*, Middelburg, typis Remigii Schreverii 1681 (b).

——, *Oratio de coniugendis philosophicis et mathematicis disciplinis, cum philosophicae professioni adiunctam mathematicam rite auspicaretur*, Leiden, apud Jacobum Voorn 1682.

——, *Disputationes philosophicae omnes contra atheos,* Middelburg, apud Joannem Lateranum 1685.

——, G. vander Tak (*resp*.), *Disputatio philosophica de certitudine clarae et distinctae perceptionis*, Leiden, apud Abrahamum Elzevier 1689.

——, *Exercitationum philosophicarum prima-vicesima octava*, Leiden, apud Abrahamum Elzevier 1691-1693.

——, G.H. Casembroot (*resp*.), *Disputatio philosophica quae est de mundi systemate*, Leiden, apud Abrahamum

Elzevier 1694.

——, *Exercitationes academicae quibus Ren. Cartesii philosophia defenditur adversus Petri Danielis Huetii Episcopi Suessionensis Censuram philosophiae cartesianae*, Amsterdam, apud Arnoldum van Ravestein 1695.

——, *Oratio de rationis viribus, et usu in scientiis, dicta publice cum rectoris Academiae Lugd. Bat. munere abiret*, Leiden, apud Fredericum Haringium 1698.

C. Wittich, *Consideratio theologica de stylo Scripturæ, quem adhibet cum de rebus naturalibus seremonem instituit,* Leiden, apud A. Wyngaerden 1656.

L. Wolzogen, *De Scripturarum interprete adversus exercitatorem paradoxum libri duo*, Utrecht, apud Johannem Ribbium 1668.

Secondary literature

M. Aalderink, *Philosophy, Scientific Knowledge, and Concept Formation in Geulincx and Descartes*, Utrecht, Utrecht University: Publications of the Department of Philosophy 2009.

P. Achinstein, *Concepts of Science: A Philosophical Analysis,* Baltimore, J. Hopkins Press 1968.

J. Agassi, *Science and Its History: A Reassessment of the Historiography of Science*, Boston, Springer 2008, revised edition of his *Towards an Historiography of Science*, The Hague, Mouton 1963.

L. Alanen, *Descartes's Concept of Mind*, Cambridge-London, Harvard University Press 2003.

V. Alexandrescu, *Regius and Gassendi on Human Soul*, «Intellectual History Review», 23/2 (2013), pp. 1-20.

P. Anstey, *Experimental versus Speculative Natural Philosophy*, in P. Anstey, J.A. Schuster (eds.), *The Science of Nature in the 17th Century: Patterns of Change in Early Modern Natural Philosophy*, Dordrecht, Kluwer/Springer 2005, pp. 215-242.

——, D. Jalobeanu, (eds.), *Vanishing Matter and the Laws of Motion: Descartes and Beyond*, London, Routledge 2011.

R. Ariew, *Descartes among the Scholastics*, Leiden-Boston, Brill 2011 (revised edition of his *Descartes and the Last Scholastics*, Ithaca, Cornell University Press 1999).

E.J. Ashworth, *Do Words Signify Ideas or Things?*, «Journal of the History of Philosophy» 19 (1981), pp. 299-326.

W. J. van Asselt, *The Federal Theology of Johannes Cocceius: (1603-1669)*, Leiden, Brill 2001.

M. Ayers, *Theories of Knowledge and Belief*, in D. Garber, M. Ayers (eds.), *The Cambridge History of Seventeenth-Century Philosophy*, Cambridge, Cambridge University Press 1998, vol. II, pp. 1003-1061.

J.-F. Battail, *Arnold Geulincx*, in Jean-Pierre Schobinger (ed.), *Grundriss der Geschichte der Philosophie*, vol. 2, Basel, Schwabe 1993, pp. 375-397.

D. Bellis, *Empiricism without Metaphysics: Regius' Cartesian Natural Philosophy*, in M. Dobre, T. Nyden (eds.), *Cartesian Empiricism*, Dordrecht-Heidelberg-New York-London, Springer 2013, pp. 151-183.

E. Bizer, *Reformed Orthodoxy and Cartesianism*, in R.W. Funk (ed.), *Translating Theology into the Modern Age*, New York, Harper Torchbooks 1965, pp. 20-82.

J. Bohatec, *Die cartesianische Scholastik in der Philosophie und reformierten Dogmatik des 17. Jahrhunderts*, Leipzig, A. Deichert 1912

R. Bordoli, *Dio ragione verità. Le polemiche su Descartes e su Spinoza presso l'Università di Franeker*, Macerata, Quodlibet 2009.

E.-J Bos, *Henricus Regius et les limites de la philosophie cartésienne*, in D. Kolesnik-Antoine (ed.), *Qu'est-ce qu'être cartésien?*, Lyon, ENS 2013, pp. 53-68.

E.-P. Bos, H.A. Krop (eds.), *Franco Burgersdijk (1590-1635): Neo-Aristotelianism in Leiden*, Amsterdam, Rodopi 1993.

D. Boyle, *Descartes on Innate Ideas*, London & New York, Continuum 2009.

J. Broughton, *Descartes's Method of Doubt,* Princeton, Princeton University Press 2002.

G. Buchdahl, *Metaphysics and the Philosophy of Science: The Classical Origins, Descartes to Kant*, Cambridge (Massacchussets), MIT Press 1969.

W. van Bunge, *Van Velthuysen, Batelier and Bredenburg on Spinoza's Interpretation of the Scripture*s, in P. Cristofolini (ed.), *The Spinozistic Heresy. The debate on the Tractatus Theologico-Politicus, 1670-1677 and the immediate reception of spinozism. Seminar Cortona 1991*, Amsterdam-Maarssen, APA-Holland University Press 1995, pp. 49-65.

——, *Dutch Cartesian Empiricism and the Advent of Newtonianism*, in Dobre-Nyden 2013, pp. 89-104.

——, *From Stevin to Spinoza. An Essay on Philosophy in the Seventeenth-Century Dutch Republic*, Leiden-Boston-Köln, Brill 2001

——, *The Waning of the Radical Enlightenment and the Rise of Newtonianism in the Eighteenth-Century Dutch Republic*, in S. Ducheyne (ed.), *Radical Enlightenment. Critical Studies*, forthcoming.

R. Buning, *Henricus Reneri (1593-1639), Descartes' Quartermaster in Aristotelian Territory*, Utrecht, Utrecht University: Publications of the Department of Philosophy 2013.

E. A. Burtt, *The Metaphysical Foundations of Modern Physical Science: A Historical and Critical Essay*, London, Routledge and Kegan Paul 1932.

R. Buys, *Between Actor and Spectator: Arnout Geulincx and the Stoics*, «British Journal for the History of Philosophy» 18 (2011), pp. 741-761.

V. Carraud, *L'ontologie peut-elle être cartésienne? L'exemple de L'*Ontosophia *de Clauberg, de 1647 à 1664: de l'*ens *à la* mens, in T. Verbeek (ed.), *Johannes Clauberg (1622-1665) and Cartesian Philosophy in the Seventeenth Century*, Dordrecht, Kluwer Academic Publisher 1999, pp. 13-38.

E. Cassirer, *Das Erkenntnisproblem in der Philosophie und Wissenschaft der neueren Zeit*, Berlin, Bruno Cassirer 1906-1920.

——, *The Philosophy of the Enlightenment,* transl. by F. Koelin and J. Pettegrove, Princeton, Princeton University Press 1951.

L. Catana, *The Historiographical Concept 'System of Philosophy': Its Origin, Nature and Legitimacy*, Leiden-Boston, Brill 2008.

D.M. Clarke, *Descartes' Philosophy of Science*, Manchester, Manchester University Press 1982.

——, *Descartes's Theory of Mind*, Oxford, Clarendon Press 2005.

——, *Descartes. A Biography*, New York, Cambridge University Press 2006.

B. Cooney, *Arnold Geulincx: A Cartesian Idealist*, «Journal of the History of Philosophy» 16 (1978), pp. 167-180.

J. Cottingham, *Cartesian Reflections. Essays on Descartes's Philosophy*, Oxford, Oxford University Press 2008.

J. Cottingham, *The Role of God in Descartes's Philosophy*, in J. Broughton, J. Carriero (eds.), *A Companion to Descartes*, Blackwell, Malden, MA and Oxford 2008 , pp. 288-301.

D. Cunning, *Argument and Persuasion in Descartes' Meditations*, Oxford, Oxford University Press 2010.

——, *The First Meditation: Divine Omnipotence, Necessary Truths and the Possibility of Radical Deception*, in D. Cunning (ed.), *The Cambridge Companion to Descartes' Meditations*, Cambridge, Cambridge University Press 2014, pp. 68-87.

E. Curley, *Certainty: Psychological, Logical and Metaphysical*, in S. Voss, *Essays on the Philosophy and Science of Rene Descartes*, New York, Oxford University Press 1993, pp. 11-30.

——, *The Cogito and the Foundations of Knowledge*, in S. Gaukroger (ed.), *The Blackwell Guide to Descartes' Meditations*, Malden-Oxford-Carlton, Blackwell 2008, pp. 30-47.

L. Datson, *Probability and Evidence*, in Garber-Ayers 1998, vol. II, pp. 1108-1144.

P. Dear, *Philosophy of Science and its Historical Reconstruction*, in S. Mauskopf, T.M. Schmaltz (eds.), *Integrating History and Philosophy of Science: Problems and Prospects*, Dordrecht-Heidelberg-New York-London, Springer 2012, pp. 67-82.

——, *Method and the Study of Nature*, in Garber-Ayers 1998, vol. I, pp. 147-177.

M. Della Rocca, *Descartes, the Cartesian Circle, and Epistemology without God*, «Philosophy and Phenomenological Research» 70/1 (2005), pp. 1-33.

P. Dibon, *La Philosophie néerlandaise au siècle d'or. Tome I. L'enseignement philosophique dans les Universités à l'époque pre-cartésienne* (1575-1650), Paris-Amsterdam-Londres-New York, Elsevier Publishing Company 1954.

H. de Dijn, S*pinoza: The Way to Wisdom*, West Lafayette, Purdue University Press 1996.

E.J. Dijksterhuis (ed.), *Descartes et le cartésianisme hollandais – Etudes et documents*, Presses Universitaires de France, Paris 1950.

M. Dobre, *Metaphysics and Physics in Cartesian Natural Philosophy: Descartes and Early French Cartesians on the Foundation of Natural Philosophy*, Nijmegen, Proefschrift Radboud Universiteit 2010.

——, T. Nyden (eds.), *Cartesian Empiricism*, Dordrecht-Heidelberg-New York-London, Springer 2013.

——, *Knowledge and Certainty in the Foundation of Cartesian Natural Philosophy*, «Revue Roumaine de philosophie» 57/1 (2013), pp. 95-110.

S. Donati, *La dottrina delle dimensioni indeterminate in Egidio Romano*, «Medioevo», 14 (1988), pp. 149-233.

S. Ducheyne, *'s Gravesande's Appropriation of Newton's Natural Philosophy, Part I: Epistemological and Theological Issues*, «Centaurus» 56/1 (2014), pp. 31-55 (a).

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

K. Dürr, *Die mathematische Logik des Arnold Geulincx*, «The Journal of Unified Science» 8 (1939-1940), pp. 361-368.

N.E. Emerton, *The Scientific Reinterpretation of Form*, Ithaca and London, Cornell University Press 1984.

P. Farina, *Sulla formazione scientifica di Henricus Regius: Santorio Santorii e il* De statica medicina, «Rivista Critica di Storia della Filosofia», 30 (1975), pp. 363-399.

——, *Il corpuscolarismo di Henricus Regius: materialismo e medicina in un cartesiano olandese del seicento*, in U. Baldini (ed.), *Ricerche sull'atomismo del Seicento* (conference acts, Santa Margherita Ligure, 14-16 October 1976), Firenze, La Nuova Italia 1977, pp. 119-178.

M. Fichant, *Science et métaphysique dans Descartes et Leibniz*, Paris, PUF 1999.

D.E. Flage, C.A. Bonnen, *Descartes and Method. A Search for a Method in Meditations*, Routledge, London and New York 1999.

W. Frijhoff, M. Spies, *Dutch Culture in a European Perspective I: 1650: Hard-won Unity*, Assen, Van Gorcum 2004.

D. Garber, *Descartes' Metaphysical Physics*, Chicago, University of Chicago Press 1992.

——, *Descartes Embodied. Reading Descartes's Philosophy through Cartesian Science*, Cambridge, Cambridge University Press 2001.

——, *Physics and Foundations*, in K. Park, L. Daston (eds.), *The Cambridge History of Science. Volume 3, Early Modern Science*, New York, Cambridge University Press 2006, pp. 21-69.

S. Gaukroger, *Descartes: An Intellectual Biography*, Oxford, Oxford University Press 1995.

——, J. Schuster and J. Sutton (eds.), *Descartes' Natural Philosophy*, Routledge, London 2000.

——, *Descartes' System of Natural Philosophy*, Cambridge, Cambridge University Press 2002.

——, *Knowledge, Evidence and Method*, in D. Rutherford (ed.), *The Cambridge Companion to Early Modern Philosophy*, Cambridge, Cambridge University Press 2008, pp. 39-66.

——, *The Collapse of Mechanism and the Rise of Sensibility. Science and the Shaping of Modernity, 1680-1760*, Oxford, Oxford University Press 2010.

N.W. Gilbert, *Renaissance Concepts of Method*, New York, Columbia University Press 1960.

G. Gori, *La fondazione dell'esperienza in 's Gravesande*, Firenze, La Nuova Italia 1972

M. Grene, *Descartes and Skepticism*, «The Review of Metaphysics» 52/3 (1999), pp. 553-571.

M. Guéroult, *Descartes selon l'ordre des raisons*, Paris, Aubier 1953, vol. II, pp. 250-259.

A.R. Hall, *Further Newton Correspondence*, «Notes and Records of the Royal Society of London», 37/1 (1982), pp. 7-34.

G. Hatfield, *Metaphysics and the New Science*, in D. Lindberg, R. Westman (eds.), *Reappraisals of the Scientific Revolution*, Cambridge, Cambridge University Press 1990, pp. 93-166.

M. Heyd, *"Be Sober and Reasonable": The Critique of Enthusiasm in the Seventeenth and Early Eighteenth Centuries*,

Leiden, Brill 1995.

J. Israel, *Radical Enlightenment. Philosophy and the Making of Modernity*, Oxford, Oxford University Press 2001.

D. Jalobeanu, *The Cartesians of the Royal Society. The Debate Over Collisions and the Nature of Body (1668-1670)*, in Anstey-Jalobeanu 2011, pp. 103-129.

M. Karsksen, *Subject, Object and Substance in Burgersdijk's logic*, in Bos-Krop 1993, pp. 29-36.

A. Koyré, *Metaphysics and Measurement: Essays in Scientific Revolution*, Cambridge (Massachusetts), Harvard University Press 1968.

W. Klever, *Burchardus de Volder (1643-1709): A Crypto-Spinozist on a Leiden Cathedra*, «Lias» 15 (1988), pp. 191-241.

D. 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), pp. 125-145.

H. Krop, *Spinoza and the Calvinistic Cartesianism of Lambertus van Velthuysen*, «Studia Spinozana» 15 (1999), pp. 107-132.

H. Krop, *Medicine and Philosophy in Leiden around 1700: Continuity or Rupture?*, in W. van Bunge (ed.), *The Early Enlightenment in the Dutch Republic*, 1650-1750, Leiden-Boston, Brill 2003, pp. 173-196.

D. Jalobeanu, *The Cartesians of the Royal Society. The Debate Over Collisions and the Nature of Body (1668-1670)*, in Anstey-Jalobeanu 2011, pp. 103-129.

A. Janiak, E. Schliesser (eds.), *Interpreting Newton. Critical Essays*, Cambridge, Cambridge University Press 2012.

E. Jorink, A. Maas (eds.), *Newton and the Netherlands : How Isaac Newton was Fashioned in the Dutch Republic*, Leiden, Leiden University Press 2012;

M. Laerke, J.E.H. Smith, E. Schliesser (eds.), *Philosophy and Its History. Aims and Methods in the Study of Early Modern Philosophy*, New York, Oxford University Press 2013.

J. Lagrée, *Sens et vérité chez Clauberg et Spinoza*, «Philosophiques», 29, vol. 1 (2002), pp. 121-138.

J.P.N. Land, *Arnold Geulincx te Leiden (1658-1669)*, «Verslagen en Mededeelingen der Koninklijke Akademie van Wetenschappen, Afdeeling Letterkunde» 3 (1887), pp. 277-327.

——, *Arnold Geulincx and His Works*, «Mind» 16 (1891), pp. 223-242

——, *Arnold Geulincx und seine Philosophie,* The Hague, M. Nijhoff 1895.

U.G. Leinsle, *Comenius in der Metaphysik des jungen Clauberg*, in Verbeek 1999, pp. 1-12

T.M. Lennon, *The Plain Truth. Descartes, Huet, and Skepticism*, Leiden-Boston, Brill 2008.

——, *The Fourth Meditation: Descartes's Theodicy avant la lettre*, in Cunning 2014, pp. 168-185.

M. Lenz, A. Waldow (eds.), *Contemporary Perspectives on Early Modern Philosophy*, Boston, Springer 2013.

P. Lodge, *The Failure of Leibniz's Correspondence with De Volder*, «Leibniz Society Review», 8 (1998), pp. 47-67.

——, *The Debate over Extended Substance in Leibniz's Correspondence with De Volder*, «International Studies in the Philosophy of Science» 15 (2001), pp. 155-166.

——, *Burchard de Volder: Crypto-Spinozist or Disenchanted Cartesian?*, in T.M. Schmaltz (ed.), *Receptions of Descartes - Cartesianism and anti-Cartesianism in early modern Europe*, London and New York, Routledge 2005, pp. 128-145.

—— (ed.), *The Leibniz-De Volder Correspondence: With Selections from the Correspondence Between Leibniz and Johann Bernoulli*, New Haven, Yale University Press 2013.

A. M. Luyendijk-Elshout, *Oeconomia Animalis, Pores and Particles*, in Lunsingh Scheurleer - Posthumus Meyjes 1975, pp. 294-307.

P. Marchand, *Dictionnaire historique*, The Hague, chez Pierre de Hondt 1758-1759.

J.-L. Marion, *Sur l'ontologie grise de Descartes. Science cartésienne et savoir aristotélicien dans les «Regulae»*, Paris, Vrin 1993.

A. McGahagan, *Cartesianism in the Netherlands. 1639-1676. The New Science and the Calvinist Counter-Reformation*, Ph.D. Dissertation, University of Pennsylvania, 1976.

D. van Miert, *Humanism in an Age of Science: The Amsterdam Athenaeum in the Golden Age*, Leiden, Brill 2009.

F. Mignini, *Sur la genèse du Court Traité: l'hypothèse d'une dictée originaire est-elle fondée?*, «Cahiers Spinoza», V (Hiver 1984-1985), Éditions Réplique, Paris, 1984, pp. 147-165;

——, *Nuovi contributi per la datazione e l'interpretazione del Tractatus de Intellectus Emendatione*, in E. Giancotti, *Spinoza nel 350° anniversario della nascita. Atti del congresso internazionale (Urbino 4-8 ottobre 1982)*, Napoli, Bibliopolis 1985, pp. 515-525.

W. Mijnhardt, *The Construction of Silence: Religious and Political Radicalism in Dutch History*, in Van Bunge 2003, pp. 231-262.

P.C. Molhuysen (ed.), *Bronnen tot de Geschiednis der Leidsche Universiteit 1574-1811*, 's-Gravenhage, M. Nijhoff 1913-1924, vol. III (1918), vol. IV (1920).

T. Morman, *History of Philosophy of Science as Philosophy of Science by Other Means? Comment on Thomas Uebel*, in F. Stadler (ed.), *The Present Situation in the Philosophy of Science*, Dordrecht-Heidelberg-New York-London, Springer 2010., pp. 29-40

M. Mugnai, *"Necessità ex hypothesi" e analisi infinita in Leibniz*, in A. Lamarra (ed.), *L'infinito in Leibniz. Problemi e terminologia. Das Unendliche bei Leibniz. Problem und Terminologie*, Roma, Edizioni l'Ateneo 1990, pp. 143-155.

S. Nadler, *Knowledge, Volitional Agency and Causation in Malebranche and Geulincx*, «British Journal for the History of Philosophy» 7 (1999), pp. 263-274.

G. Nuchelmans, *Geulincx' Containment Theory of Logic,* Amsterdam, Koninklijke nederlandse Akademie van Wetenschappen 1988.

G. Nuchelmans, *Deductive Reasoning*, in Garber-Ayers 1998, vol. I, pp. 132-146.

T. Nyden, *Spinoza's Radical Cartesian Mind*, New York, Continuum 2007.

——*, De Volder's Cartesian Physics and Experimental Pedagogy*, in Dobre-Nyden 2013, pp. 227-249.

——, *Living Force at Leiden: De Volder, 's Gravesande and the Reception of Newtonianism*, in E. Schliesser, Z. Biener (eds.), *Newton and Newtonianism*, Oxford Press, forthcoming.

C. de Pater, *Experimental Physics*, in Th. H. Lunsingh Scheurleer, G. H. M. Postumus Meyjes (eds.), *Leiden University in the Seventeenth Century, An Exchange of Learning*, Leiden, Universitaire Pers Leiden/E. J. Brill 1975, pp. 308-327;

—— (ed.), *Willem Jacob 's Gravesande. Welzijn, wijsbegeerte en wetenschap, Baarn, Ambo 1988*;

——, *The textbooks of 's Gravesande and Van Musschenbroek in Italy*, in C. S. Maffioli and L. C. Palm (eds.), *Italian Scientists in the Low Countries in the 17th and 18th Centuries*, Amsterdam, Rodopi 1989, pp. 231-241;

——, *Willem Jacob 's Gravesande (1688-1742) and Newton's "Regulae philosophandi"*, «Lias» 21/2 (1994), pp. 257-294;

——, *'s Gravesande on moral evidence*, in M.F. Fresco et al. (eds.) *Frans Hemsterhuis (1721-1790). Quellen, Philosophie und Rezeption*, Münster-Hamburg, LIT 1995, pp. 221-242.

S. Patterson, *Clear and Distinct Perception*, in Broughton-Carriero 2008, pp. 216-234.

R. Popkin, *The History of Scepticism from Savonarola to Bayle*, New York, Oxford University Press 2003, third revised and expanded edition of his *The History of Scepticism From Erasmus to Descartes*, Assen, Van Gorcum 1960.

B. Rousset, *Geulincx entre Descartes et Spinoza*, Paris, Vrin 1999.

S. Roux, *L'Essai de logique de Mariotte. Archéologie des idées d'un savant ordinaire*, Paris, Garnier 2011.

——, *An Empire Divided: French Natural Philosophy (1670-1690)*, in D. Garber, S. Roux (eds.), *The Mechanization of Natural Philosophy*, New York, Kluwer 2012, pp. 55-95.

E.G. Ruestow, *Physics at Seventeenth and Eighteenth-Century Leiden: Philosophy and the New Science in the university*, The Hague, Nijhoff 1973.

H. van Ruler, *The Crisis of Causality, Voetius and Descartes on God, Nature and Change*, Brill, Leiden/New York/Köln 1995.

——, *"Something, I know not what". The Concept of Substance in Early Modern Thought*, in L. Nauta and A. Vanderjagt (eds.), *Between Imagination and Demonstration. Essays in the History of Science and Philosophy Presented to John D. North,* Leiden, Brill 1999, pp. 365-393 (a).

——, *Geulincx and Spinoza: Books, Backgrounds and Biographies*, «Studia Spinozana: An International and Interdisciplinary Series» 15 (1999), pp. 89-106 (b).

——, *Minds, Forms, and Spirits: The Nature of Cartesian Disenchantment*, «Journal of the History of Ideas» 61 (2000), pp. 381-395.

——, *Reason Spurred by Faith: Abraham Heidanus and Dutch Philosophy*, «Geschiedenis van de Wijsbegeerte in Nederland» 12 (2001), pp. 21-28.

D. Rutherford, *Descartes' Ethics*, in *Stanford Encylopedia of Philosophy* (plato.stanford.edu/entries/descartes-ethics/, accessed on 16 January 2015).

F. Sassen, *Henricus Renerius, de eerste "Cartesiaanse" hoogleraar te Utrecht*, Amsterdam, Noord-Hollandse Uitgeversmaatschappij 1941.

M. Savini, *Le développement de la méthode cartésienne dans les Provinces-Unies (1643-1665)*, Lecce, Conte 2004.

——, *L'invention de la logique cartésienne: la Logica vetus et nova de Johannes Clauberg*, «Revue de Métaphysique et de Morale» 1 (2006), pp. 73-88.

——, *Johannes Clauberg: methodus cartesiana et ontologie*, Paris, Vrin 2011, pp. 25-33.

E. Schliesser, *Newton's Challenge to Philosophy: A Programmatic Essay*, «HOPOS: The Journal of the International Society for the History of Philosophy of Science» I/1 (2011), pp. 101-128

T.M. Schmaltz, *Radical Cartesianism: The French Reception of Descartes*, Cambridge, Cambridge University Press 2002.

——, *Descartes on Causation*, New York, Oxford University Press 2008.

J. Schuster, *Whatever Should We Do with Cartesian Method? Reclaiming Descartes for the History of Science*, in Voss 1993, pp. 195-223.

——, *Descartes-Agonistes. Physico-mathematics, Method & Corpuscular-Mechanism 1618-33*, Dordrecht-Heidelberg-New York-London, Springer 2012.

P. Schuurman, *Ex naturæ lumine et Aristotele: Johannes de Raeys verdediging van de Cartesiaanse fysica*, «Algemeen Nederlands Tijdschrift voor Wijsbegeerte» 23 (2001), pp. 237-254.

——, *De Raey, Johannes (1620-1202)*, in W. van Bunge, H. Krop, B. Leeuwenburgh, H. van Ruler, P. Schuurman, M. Wielema (eds.), *The Dictionary of Seventeenth and Eighteenth-Century Dutch Philosophers*, Bristol, Thoemmes Press 2003, vol. II, pp. 813-816.

——, *'s Gravesande, Willem Jacob (1688-1742)*, in Van Bunge et al. 2003, vol. II, pp. 865-872.

——, *Willem Jacob 's Gravesande's Philosophical Defence of Newtonian Physics: on the Various Uses of Locke*, in P. Anstey (ed.), *The Philosophy of John Locke: New Perspectives*, London and New York, Routledge 2003, pp. 43-57.

——, *The Empiricist Logic of Ideas of Jean Le Clerc*, in Van Bunge 2003, pp. 137-156.

——, *Ideas, Mental faculties and Method: The Logic of Ideas of Descartes and Locke and Its Reception in the Dutch Republic, 1630-1750*, Leiden-Boston, Brill 2004.

C. Sécretan, *La réception de Hobbes aux Pays Bas*, «Studia Spinozana» 3 (1987), pp. 27-46, Van Bunge 2001, pp. 75-119.

J. van Sluis, *Hermann Alexander Röell*, Diss. R. U. Groningen, Leeuwarden, Friske Akademy 1988.

T. Sorell, *Descartes Reinvented*, Cambridge, Cambridge University Press 2005.

——, G.A. Rogers, J. Kraye (eds.), *Scientia in Early Modern Philosophy. Seventeenth-Century Thinkers on Demonstrative Knowledge from First Principles*, Dordrecht-Heidelberg-London-New York, Springer 2010.

T. Sorell, *Scientia and Sciences in Descartes*, in Sorell-Rogers-Kraye 2010, pp. 71-82.

A. Strazzoni, *La filosofia aristotelico-cartesiana di Johannes de Raey*, «Giornale critico della filosofia italiana» Settima serie – VII/1, 2011, pp. 107-132.

——, *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, pp. 251-281.

——, *A Logic to End Controversies: The Genesis of Clauberg's Logica Vetus et Nova*, «Journal of Early Modern Studies» II/2 (2013), pp. 123-149.

——, *On Three Unpublished Letters of Johannes de Raey to Johannes Clauberg*, «Noctua» I/1 (2014), pp. 68-106 (a).

——, *The Crypto-Dualism of Henricus Regius*, in S. Caroti, M. Spallanzani (eds.), *Individuazione, individualità, identità personale*, Firenze, Casa Editrice Le Lettere, 2014, pp. 133-151 (b).

E.W. Strong, *Procedures and Metaphysics: A Study of the Philosophy of Mathematical-Physical Science in the Sixteenth and Seventeenth Centuries*, Berkeley, University of California Press 1936.

C.L. Thijssen-Schoute, *Nederlands cartesianisme, avec sommaire et table des matières en français*, Amsterdam, Noord-Hollandsche Uitg. Mij. 1954.

F. Trevisani, *Descartes in Germania. La ricezione del cartesianesimo nella Facoltà filosofica e medica di Duisburg (1652-1703)*, Milano, Franco Angeli 1992.

T. Uebel, *Some Remarks on Current History of Analytical Philosophy of Science*, in Stadler 2010, pp. 13-28.

G. Vanpaemel, *De mechanistische natuurwetenschap aan de Leuvense Artesfakulteit (1650-1797)*, Leuven, Katholieke Universiteit 1985.

T. Verbeek, *La Querelle d'Utrecht*, Paris, Les Impressions nouvelles 1988.

——, *Descartes and the Dutch. Early Reactions to Cartesian Philosophy, 1637-1650*, Carbondale and Edwardsville 1992 (a).

——, *Ens per accidens: le origini della Querelle di Utrecht*, «Giornale critico della filosofia italiana», 71 (1992), pp. 276-288 (b).

——, *Descartes et Regius. Autour de l'Explication de l'esprit humain* (ed.), Rodopi, Amsterdam 1993.

——, *Tradition and Novelty: Descartes and Some Cartesians*, in T. Sorell (ed.), *The Rise of Modern Philosophy: the Tension between the New and Traditional Philosophies from Machiavelli to Leibniz*, Oxford, Clarendon Press 1993, pp. 167-196.

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

——, *Les cartésiens face à Spinoza: le cas de Johannes de Raey*, in P. Cristofolini (ed.), *The Spinozistic Heresy. The debate on the Tractatus Theologico-Politicus, 1670-1677 and the immediate reception of spinozism. Seminar Cortona 1991*, Amsterdam-Maarssen, APA-Holland University Press 1995, pp. 77-88.

——, *Geulincx, Arnold (1624-69)*, in Edward Craig (ed.), *Routledge Encyclopedia of Philosophy*, vol. 4, London, Routledge 1998, pp. 59-61.

——, *The Invention of Nature. Descartes and Regius*, in Gaukroger-Schuster-Sutton 2000, pp. 149-167.

——, *Dutch Cartesian Philosophy*, in S.M. Nadler, *A Companion to Early Modern Philosophy*, Oxford, Blackwell 2002

R. Vermij, *The Calvinist Copernicans. The Reception of the New Astronomy in the Dutch Republic, 1575-1750*, Amsterdam, Royal Netherlands Academy of Arts and Sciences 2002.

E. Viola, *Scolastica e cartesianesimo nel pensiero di J. Clauberg*, «Rivista di Filosofia Neo-Scolastica» 67 (1975), pp. 247-266.

H.J. de Vleeschauwer, *Three centuries of Geulincx research: A bibliographical survey*, Pretoria, Communications of the University of South Africa 1957.

R.A. Watson, *The Breakdown of Cartesian Metaphysics*, Atlantic Islands, Humanities Press International 1998.

G. Wiesenfeldt, *Leerer Raum in Minervas Haus. Experimentelle Naturlehre an der Universität Leiden, 1675-1715,* Amsterdam, Koninklijke Nederlandse Akademie van Wetenschappen 2002.

M. Williams, *Descartes and the Metaphysics of Doubt*, in J. Cottingham (ed.), *Descartes*, Oxford, Oxford University Press 1998, pp. 28-49.

Samenvatting

Dit proefschrift analyseert hoe in de vroegmoderne Nederlandse filosofie de wetenschappen werden gefundeerd. De besproken periode loopt van de eerste introductie van het cartesianisme door Henricus Regius in Utrecht tot aan het moment dat de invloed van de Newtoniaanse fysica zich deed gelden door het werk van Willem Jacob ‘s Gravesande. Mijn hoofdstelling luidt dat een dergelijke fundering van de wetenschappen niet alleen noodzakelijk was om de nieuwe filosofie te presenteren als een levensvatbaar alternatief voor het traditionele aristotelische paradigma of om het hoofd te bieden aan de “sceptische crisis” gesignaleerd door Richard Popkin, maar ook om voor die nieuwe filosofie een plaats te vinden in het academisch curriculum. Verschillende manieren om de wetenschappen te rechtvaardigen worden besproken. In het licht van de specifieke vragen die de Nederlandse wijsgeren zich stelden worden hun theorieën geanalyseerd.

Daarbij komt aan de orde 1) het algemene doel van hun filosofie, 2) hun opvatting over de verhouding tussen de wetenschappen en 3) welke vormen van kennis voor wetenschap door konden gaan. Het zal duidelijk worden dat de natuurwetenschap met behulp van metafysische, logische en theologische argumenten werd gefundeerd. Die argumenten kwamen tegemoet aan de didactische en propedeutische eisen die aan de nieuwe paradigma’s werden gesteld. Zij bepaalden bovendien de betrouwbaarheid van de nieuwe methodologie en zijn boden voor die methodologie een nieuw conceptueel apparaat. Zo ontstond in de Nederlandse Republiek een nieuwe wetenschapsfilosofie als een reflectie op de grondslagen, methoden, concepten en toepassing van de moderne wetenschap.

De eerste filosoof die aan de orde komt is Henricus Regius. Hij wilde eencartesiaanse natuurkunde ontwikkelen ten einde de geneeskunde van een grondslag te voorzien - zoals Descartes die had beoogd met zijn metafoor van de boom - , maar hij voorzag die niet van een strikt rationele basis. Hij had hier zowel kentheoretische als metafysische redenen voor: hij combineerde een empiristische visie op de bronnen van onze kennis met een gebrek aan interesse in de ontologische status van de geest. Regius verwierp dientengevolge de mogelijkheid een zuiver rationele oplossing van filosofische problemen te vinden en hij deed geen poging middels een analytisch model de structuur van de wereld te verklaren. Volgens hem laten zich de wetenschappen alleen

rechtvaardigen door op de Bijbel een beroep te doen, want alleen de Openbaring bevat een oplossing voor de metafysische problemen die Descartes had opgeworpen en alleen zij staat garant voor de betrouwbaarheid van onze geestelijke vermogens bij het kennen van de wereld en onszelf. Zij verschaffen ons echter louter een hypothetische of morele zekerheid van de natuurwetten.

Het tweede hoofdstuk behandelt Johannes Clauberg, die aan de filosofie een breder werkterrein toekende dan Regius, want hij meende dat de filosofie van Descartes de geneeskunde, de rechtsgeleerdheid en de theologie van een grondslag kon voorzien omdat deze het gehele corpus van de scholastiek kon vervangen zonder de scheidslijnen tussen deze disciplines op te heffen. Clauberg ontwikkelde met andere woorden een cartesiaanse scholastiek. Met dit doel voor ogen ontwikkelde hij een metafysische grondslag, die ook voor de logica en de "*ontosophia*" consequenties had. Volgens hem is de metafysica – die als een rationele theologie de rol van God als garantie van de waarheid van onze kennis aantoont – de eerste discipline binnen het geheel der wetenschappen en zij verschaft de studenten middels de cartesiaanse twijfel inzicht in een radicaal nieuwe manier van denken. De metafysica heeft daarom de taak de betrouwbaarheid van het gebruik van de geestelijke vermogens met behulp van theologische argumenten aan te tonen en de basisbegrippen van de filosofie te schetsen. De metafysica vindt verder zijn methodologische tegenhanger in de logica, die de geest leidt bij de vorming van ideeën en bij de manier waarop we die ideeën in woorden uitdrukken. Toch heeft zij ook een rol bij de fundering van de wetenschappen, want met een logische analyse bepaalt Clauberg de mate van zekerheid van zijn metafysische argumenten. Zij bevat op haar beurt begrippen die expliciet in de ontosophia, het slotdeel van de filosofie aan de orde komen. Er bestaat dus een drievoudige fundering van de wetenschappen in de filosofie van Clauberg: met behulp van de logica, de metafysica en de ontosophia, waarbij de metafysica het belangrijkste aandeel heeft.

Het derde hoofdstuk gaat over Johannes de Raey, die de oplossing van zowel Regius als van Descartes verwerpt en een eenvoudiger fundering van de wetenschap voorstaat. Volgens De Raey heeft de logica als taak de fysica van een grondslag te voorzien: de natuurkunde is het belangrijkste onderdeel van de filosofie en moet van al de andere academische disciplines en van de praktische kunsten worden onderscheiden. Op zuiver rationele grondslag wil zij immers komen tot een theoretisch model van de wereld. De fysica moet daarbij van de logica uitgaan, aangezien deze ons de vier regels van de cartesiaanse methode leert gebruiken, en met behulp van een rationele

theologie het bestaan van God als garantie van onze kennis bewijst. De logica verheldert verder de belangrijkste wijsgerige begrippen en principes. Zij garandeert daarom dat de geest op de juiste wijze functioneert, en legt de grondbegrippen van de wetenschappen bloot. Aangezien de taal het werktuig van het denken is, biedt De Raey zijn analyse van de belangrijkste begrippen van de filosofie in het kader van een cartesiaanse interpretatie van taal. Hij doet dit door te wijzen op de fouten die ontstaan wanneer men de metafysica van Descartes verwerpt en door het cartesiaanse paradigma op de empirische wetenschappen en op het leven van alledag toe te passen.

Het vierde hoofdstuk analyseert Arnold Geulincx' theologische fundering van de wetenschappen. Vooral geïnteresseerd in een ethiek die zowel aan de eisen van de gereformeerde theologie tegemoet komt als aan de filosofische maatstaven die aan de Leidse Universiteit opgeld deden, schiep Geulincx een ethiek die de sluitsteen van zijn wijsgerig systeem vormt. Volgens hem vormt de logica de kelder, de metafysica de pijler, de natuurkunde de vloer en de ethiek het dak van het Huis der Filosofie. De rationele theologie speelt een zo wezenlijke rol in Geulincx' metafysica vanwege de nadruk op de rol van God, dat de natuurkunde de status van een hypothetische wetenschap krijgt (aangezien de natuurwetten op de wil van God berusten en alleen door middel van de ervaring kunnen worden begrepen), en dat zijn ethiek van het bewustzijn uitgaat dat al onze handelingen van God volledig afhankelijk zijn. Aan de andere kant heeft de logica geen funderende rol omdat zij noch de grondbegrippen aan de wetenschap verschaft, noch garandeert dat de geest goed functioneert. Zij heeft veeleer een louter instrumentele waarde omdat zij de geest helpt zich te oefenen in het leveren van bewijzen.

Het vijfde hoofdstuk gaat over de metafysische fundering van de fysica door Burchard de Volder, die in het onderwijzen van de natuurfilosofie vooral experimenten gebruikte ter bevestiging van een cartesiaanse wereldbeeld. Hij stond verder open voor een empirische methode van onderzoek in de geest van Galileï, Huygens en Newton. De Volders erkenning van het belang van een empirische onderzoeksmethode van de natuurwetten gaat omgekeerd gepaard met een gebrek aan belangstelling voor de afleiding van de eerste principes van de wetenschap van Gods eigenschappen. Doordat hij meer aandacht voor zijn onderwijspraktijk had dan voor de ontwikkeling van een alomvattende theorie, ontbreekt in zijn werk een duidelijke geformuleerde wetenschappelijke methodologie. Hij rechtvaardigt de natuurwetenschap daarom niet door de natuurwetten uit de eigenschappen van God af te leiden. De Volder geeft in hoofdzaak niet meer

dan een bewijs van de geldigheid van de grondbegrippen van mechanica. Zij vormen ons enige middel om hypothesen te formuleren over de oorzaken van de verschijnselen. Volgens De Volder kan alleen het bewustzijn ons van de geldigheid van dergelijke principes overtuigen. Alleen een Godsbewijs geeft ons de bevestiging van hun juistheid. Aangezien we echter niet kunnen aantonen dat deze principes de verschijnselen werkelijk veroorzaken, geven zij slechts een mogelijk verklaringsmodel. De Volder geeft daarom een zuiver metafysische fundering van de wetenschap.

Het zesde hoofdstuk ten slotte bevestigt mijn indeling van de argumenten, die ter fundering zijn gebruikt, omdat mijn drievoudige classificatie terugkeert bij ‘s Gravesande die ter rechtvaardiging van de newtoniaanse fysica metafysische, logische en theologische argumenten gebruikt. De kern van zijn rechtvaardiging van het gebruik van de “*regulae philosophandi*” van Newton is van theologische aard en staat onder invloed van Pufendorf en Grotius, die aan God een belangrijke rol toekennen bij de totstandkoming van de maatschappij. Een samenleving is namelijk mogelijk door de goedheid van God, die de zintuigen, het getuigenis van andere mensen en de analogie tot betrouwbare instrumenten bij het ontdekken van de onveranderlijke wetten van natuur maakt. Deze theologisch fundering van ‘s Gravesande wordt echter ingeleid door een overzicht van de metafysische veronderstellingen van de newtoniaanse fysica en zij dient als de garantie van alle manieren waarop de geest de waarheid kan kennen: de methodologische regels van de analyse, synthese en hypothetische redenering, die vanuit een logisch gezichtspunt worden beschouwd. Op grond van dit drievoudige fundament kent ‘s Gravesande aan de empirische natuurkunde een wetenschappelijke status toe, dat wil zeggen: haar zekerheid is even overtuigend als die van de wiskunde, ook al komt ze op een andere wijze tot stand. Hoewel we dus bij ‘s Gravesande in tegenstelling tot bij Descartes geen “metafysische fysica” vinden, kent hij aan de fysica de hoogste graad van zekerheid toe.

Deze zes voorbeelden geven blijk van de aandacht die filosofen hadden voor de noodzaak tot systematisering van de cartesiaanse en de newtoniaanse filosofie die voortvloeide uit de eisen die het academisch onderwijs stelde. Door de nieuwe filosofie van haar metafysische grondslag los te maken, vergemakkelijkte Regius haar introductie aan de Nederlandse universiteiten: hij gaf er de voorkeur aan het fundament van de natuurwetenschap in de geopenbaarde theologie te zoeken.

De twee volgende voorbeelden die van een filosofische fundering van de wetenschap uitgaan zijn als een reactie op Regius’ ideeën te beschouwen, maar zij beantwoorden ook aan de

eisen van de academische wereld. Clauberg ontwikkelde een metafysica die de studenten in de filosofie kon inleiden en zijn logica leerde hun hoe zij in elke academische discipline goed konden argumenteren.

Op een vergelijkbare manier bepaalde de theorie die De Raey ter fundering ontwikkelde de uiterste reikwijdte van de cartesiaanse filosofie. Zij maakte haar verenigbaar met een nuchtere en praktische benadering in de geneeskunde, de rechtsgeleerdheid, de theologie en de praktische kunsten. Zo werd de nieuwe filosofie van een fundament voorzien met het doel haar plaats in het academisch curriculum te rechtvaardigen. Ook Geulincx wilde de nieuwe filosofie in het academisch onderwijs integreren. Zijn wijsgerige ethiek voldeed aan de eisen van de gereformeerde theologie aan de Leidse Universiteit en ontwikkelde een samenhangend systeem van wetenschappen dat in de plaats van de traditionele lesstof kwam. Aan de andere kant ging De Volders belangstelling vooral uit naar de praktijk van het wetenschappelijk onderwijs met behulp van experimenten. Zijn methode van onderzoek was geïnspireerd door Galilei, Huygens en Newton, ook al hield hij vast aan een cartesiaans kosmologisch model. Hij voorzag de beginselen van mechanica ten behoeve van de studenten van een cartesiaanse grondslag maar probeerde hier niet een verklaring van alle fysische verschijnselen in te vinden. *De inleiding tot de newtoniaanse wetenschap* van ‘s Gravesande bevatte alle genoemde oplossingen voor het probleem van de fundering. Het handboek voorzag in de behoefte aan de universiteit van inleiding, rechtvaardiging en het onderwijs van de grondbeginselen van een nieuw paradigma.

Deze theorieën ter fundering hebben dus tot het ontstaan van een wetenschapsfilosofie geleid en tot een ingrijpende verandering van de functie van de filosofie binnen het systeem van het universitair onderwijs. De wijsbegeerte verloor geleidelijk haar karakter van de dienstmaagd van de hogere kunsten, waarvan nog steeds sporen bij Regius en Clauberg te vinden zijn, maar die bij de volgende generaties van cartesiaanse en newtoniaanse filosofen volledig verdwenen.

Summary

The present study defines the function of the foundation of science in early modern Dutch philosophy, from the first introduction of Cartesian philosophy in Utrecht University by Henricus Regius to the acceptance of Newtonian physics by Willem Jacob ‘s Gravesande. My main claim is that a foundation of science was required because the conceptual premises of new ways in thinking had to be justified not only as alternatives to the established philosophical paradigms or as an answer to the “sceptical crisis” signalled by Richard Popkin, but also in order to be introduced in the academia. This being my general thesis, different kinds of foundation of scientific knowledge are analysed in the light of the specific problems philosophers had to face. To this end, foundational theories are analysed in the light of 1) the overall aim of their philosophy, 2) the relations of disciplines they thought out, 3) what they regarded as scientific knowledge. Through this analysis, I assess that the foundation of science was carried out by metaphysical, logical and theological arguments, which fitted the needs of answering the didactical and introductory requirements of new paradigms, assessed the reliability of new methodology in leading us to grasp the truth, and provided philosophy with its conceptual apparatus. Finally, I demonstrate that a philosophy of science as a reflection on the principles, methods, concepts and application of modern science emerged in the Dutch Republic.

The first philosopher here taken into account is Henricus Regius, who was interested in the development of a Cartesian physics aimed at providing medicine with its basis – as worked out by Descartes with his metaphor of the three – but with no rational foundation, as he rejected Descartes’s metaphysics. This rejection was determined by metaphysical reasons, i.e., by Regius’s assumption of an empiricist standpoint on the sources of knowledge and of an ontological unconcern on the nature of the mind. Accordingly, he rejected any purely rational solution to philosophical problems, such as the formulation of an explanatory model on the constitution of the world. Still concerned with the problem of a foundation, however, he appealed to the Bible as the only solution to the metaphysical problems raised by Descartes and as the guarantee for the reliability of the use of the mental faculties, whose use, however, can lead us only to a hypothetical or moral certainty with regard to our knowledge of natural laws.

The second chapter is on Johannes Clauberg, who had a view on the function of philosophy broader than Regius's. Indeed, Clauberg aimed to replace the whole corpus of Scholastic thought with Descartes's philosophy, providing a basis to medicine, law and theology even if avoiding any mixing with them. In other words, Clauberg aimed at developing a Cartesian scholastic. For this sake, he developed a metaphysical foundation, still with relevant implications for logic and *ontosophia*. According to him, metaphysics – which embodies rational theological arguments on the role of God as guarantor of the truth of our knowledge – is the first discipline in the corpus of the sciences as it introduces students to a radically new way of thinking, *via* Cartesian doubt. Hence, metaphysics has the function of granting the reliability of the use of the mental faculties by theological arguments and of outlining the basic concepts of philosophy. Moreover, metaphysics finds its methodological counterpart in logic, aimed at guiding the mind in the formation of ideas and in their expression in words, but still including foundational arguments as it is through logical considerations that Clauberg analyses the degrees of certainty of metaphysical arguments. These, in turn, include concepts expressly dealt with in *ontosophia* as the last part of philosophy. So there is a threefold foundation of science in Clauberg's philosophy: through logic, metaphysics and *ontosophia*, with metaphysics as the major part.

The third solution is that of Johannes de Raey, who rejected both Regius's and Descartes's solutions and proposed more straightforward foundational arguments. According to him, logic has the function of providing physics with a foundation: physics, in turn, is the main part of philosophy and is to be distinguished from all the other academic disciplines and from any kind of practical art. Indeed, physics is aimed only at the formulation of a theoretical model of the constitution of the world on a purely rational basis. It has to be based on logic, since logic teaches us to use the four rules of Descartes's method, it provides the demonstration, via rational theology, of the existence of God as guarantor of our knowledge, and it consists in the analysis of the main notions and principles of philosophy. Thus, logic provides both the guarantee of the right functioning of the mind, and discloses the basic notions of science. Moreover, since language is the vehicle of concepts, De Raey provides his analysis of the main notions of philosophy through a Cartesian interpretation of language. This is carried out by paying attention to the errors arising from a rejection of Descartes's metaphysics, and from the application of the Cartesian paradigm of knowledge to the empirical disciplines and everyday practice.

The fourth chapter analyses the theological foundation of science of Arnold Geulincx. Mainly interested in the development of an ethics answering both to the demands of Reformed theology and the philosophical standard of Leiden University, Geulincx developed a philosophical ethics conceived as the keystone of his system of philosophy. According to him, logic is the basement, metaphysics is the column, physics is the floor and ethics is the roof of the House of Philosophy. In fact, rational theology plays an essential role in Geulincx's metaphysics as it is by a consideration of the role of God that he defines the status of physics as a hypothetical science (since natural laws rely on the will of God and can be grasped only through experience), and defines the basics of his ethics, whose acknowledgement begins with the awareness of the dependence on God of our actions. On the other hand, logic has no foundational role as it neither delivers the basic concepts of science nor guarantees the right functioning of the mind. Rather, it has a mere instrumental value as it helps to exercise the mind in demonstrative reasoning.

The fifth alternative is the metaphysical foundation of physics of Burchard de Volder, who was mainly interested in teaching natural philosophy by means of experiments confirming a Cartesian worldview. Moreover, he showed an openness to an empirical method of discovery inspired by Galileo, Huygens and Newton. Accordingly, De Volder's appreciation of an empirical methodology in the discovery of natural laws goes along with his unconcern with the deduction of the first principles of science from the attributes of God. Moreover, his interest in the practice of teaching more than in the development of a comprehensive theory led him to neglect the formulation of a clear scientific methodology. Therefore, his foundation of science does not entail a deduction of natural laws from the attributes of God, and mainly consists in the justification of the validity of the basic notions of mechanicism as our only means to formulate explanatory hypotheses on the causes of phenomena. Moreover, according to De Volder nothing but mere consciousness can ensure us of the validity of such principles, which is only confirmed by the demonstration of the existence of God. Moreover, their actual causal role with regard to phenomena cannot be demonstrated, since they concern only one possible explanatory model. Therefore, De Volder provides a purely metaphysical foundation of science.

Finally, the sixth chapter confirms my views on the categorization of foundational arguments, since my threefold classification is assumed by ‘s Gravesande in his foundation of Newtonian physics on metaphysical, logical and theological arguments. The core of his justification

of the use of Newton's *regulae philosophandi* is theological, and bears witness to the influence of Pufendorf's and Grotius's views on the role of God in the establishment of human society. Indeed, this is made possible by the goodness of God, which makes the use of the senses, testimony and analogy reliable in discovering the constant laws of nature. 's Gravesande's theological foundation, however, is introduced by an overview of the metaphysical assumptions underlying Newtonian physics, and serves as the guarantee of the ways the mind can be acquainted with the truth, that is, the methodological rules of analysis, synthesis and hypothetical reasoning, which are considered from a logical point of view. By means of this threefold foundation of science 's Gravesande aims at providing empirical physics with a scientific status: that is, with a certainty as persuasive as that of mathematics, even if provided by different means. While avoiding the development of a "metaphysical physics", as Descartes's did, 's Gravesande still provided physics with the highest degree of certainty.

These six cases testify to the attention philosophers gave to a systematization of Cartesian and Newtonian philosophy according to the needs of academia. Regius facilitated the introduction of the new philosophy in the academy by avoiding to provide it with a foundation on Cartesian metaphysics: rather, he adopted a foundation of science on revealed theology. The next cases, which do entail a philosophical foundation of science, can indeed be interpreted as a reaction to Regius's solution, and at the same time as answering to the demands of academia. Clauberg developed a metaphysics serving as an introduction of students to new ways in philosophy, and a logic teaching them how to conduct reason in every academic discipline. In a similar way, De Raey developed a foundational theory defining the very limits of Cartesian philosophy, making it consistent with the use of a commonsensical approach in medicine, law, theology and the practical arts. In so far, they provided the new philosophy with a foundation aimed at justifying the function of the new philosophy in the academic culture. Also Geulincx was deeply concerned with the integration of the new philosophy to the academic context. He developed a philosophical ethics complying with the requirements of the Reformed theologians of Leiden University, and based on a coherent system of disciplines replacing the traditional matters of teaching. On the other hand, De Volder was mainly concerned with the practice of academic teaching by means of experiments, and with a method of discovery roughly inspired by that of Galileo, Huygens and Newton, even if maintaining a Cartesian cosmological model. Therefore, he developed a Cartesian foundation of the principles of mechanicism for the benefit of students while avoiding deducing from these all the

physical explanations. Finally, ‘s Gravesande’s *Introductio ad philosophiam* embodies all the mentioned solutions to the problem of a foundation, fitting the needs of the introduction, justification and teaching of the basics of a new paradigm in the university. So, foundational theories led to the emergence of a philosophy of science: also to a radical shift in the function of philosophy and in the very system of academic teaching, since philosophy progressively lost its character as the handmaiden of the higher faculties, which can still be recognized in Regius’s and Clauberg’s theories but which disappears in the next generations of Cartesian and Newtonian philosophers.

Curriculum Vitae

Education

2009: MA in philosophy, *cum laude*, University of Parma. Thesis: *La difesa della nuova filosofia nelle università olandesi: Johannes de Raey*. Supervisors: Prof. Stefano Caroti, Beatrice Centi and Mariafranca Spallanzani.

2007: BA in philosophy, *cum laude*, University of Parma. Thesis: *Leibniz e l'intervento divino sul mondo: libertà, finalismo e immutabilità dei motivi della creazi*one (awarded as best dissertation in philosophy 2005/2006). Supervisors: Prof. Stefano Caroti and Beatrice Centi.

2005: Erasmus exchange program, Radboud University Nijmegen.

2004: award as best student in philosophy 2003/2004.

Publications

Subjectivity and Individuality: Two Strands in Early Modern Philosophy, in «Society and Politics», IX/1, 2015, pp. 5-9 (introductory essay).

Tying the Double Metaphysics of Johannes Clauberg: Ontosophia and Rational Theology, in S. Caroti, A. Siclari (eds.), *Filosofia e religione. Studi in onore di Fabio Rossi*, Parma 2014 (Quaderni di Noctua, 2), pp. 156-187.

Review of S. Roux, *L'Essai de logique de Mariotte. Archéologie des idées d'un savant ordinaire*, Paris, Classiques Garnier Paris, 2011, in «Journal of Early Modern Studies», III/2, 2014, pp. 147-152.

The Crypto-Dualism of Henricus Regius, in S. Caroti, M. Spallanzani (eds.), *Individuazione, individualità, identità personale*, Firenze, Casa Editrice Le Lettere 2014 (Quaderni del Giornale Critico della Filosofia Italiana, 27), pp. 133-151.

On Three Unpublished Letters of Johannes de Raey to Johannes Clauberg, in «Noctua», I/1, 2014, pp. 66-103.

«Vix sciebant legere clerici», la fortuna di una citazione campanelliana nella cultura olandese, in «Bruniana & Campanelliana», XIX/1, 2013, pp. 237-247.

A Logic to End Controversies: The Genesis of Clauberg's Logica Vetus et Nova, in «Journal of Early Modern Studies», II/2, 2013, pp. 123-149.

Le premesse del discorso sulla soggettività nell'età moderna: il dibattito cartesiano, in «I quaderni della ginestra», VIII/1, 2013, pp. 6-13.

The Dutch fates of Bacon's philosophy: libertas philosophandi, Cartesian logic and Newtonianism, in «Annali della Scuola Normale Superiore di Pisa – Classe di Lettere e Filosofia», series V, vol. IV/1, 2012, pp. 251-281.

Review of P. Dessì, B. Lotti (eds.), *Eredità cartesiane nella cultura britannica*, Firenze, Le Lettere 2011, in «Giornale Critico della Filosofia Italiana», series VII, vol. VIII/3, 2012, pp. 745-748.

La filosofia aristotelico-cartesiana di Johannes de Raey, in «Giornale Critico della Filosofia Italiana», series VII, vol. VII/1, 2011, pp. 107-132.

Review of M. Spallanzani, *L'arbre et le labyrinthe, Descartes selon l'ordre des Lumières*, Paris, Honoré Champion 2009, in «Nuncius. Journal of the Material and Visual History of Science», XXVI/2, 2011, pp. 428-431.

Editorial activities

2014-2015: invited editor at *Society and Politics*, journal in the history of ideas and intellectual history. Edited issue: *Individuation, Individuality and Subjectivity*, vol. 9, n. 1, April 2015.

2013-present: editor at the open access journal in the history of philosophy *Noctua* and at the open access book series in the history of philosophy *Quaderni di Noctua*, Parma.

Talks

Cartesian Foundationalism and the Birth of Philosophy of Science: 8th Nordic Early Modern Philosophy Workshop, Södertörn University, Stockholm, 3-4 June 2015.

The Hidden Presence of Ramism in Early Modern Dutch Philosophy: The Tree of Knowledge: Theories of Sciences and Arts in Central Europe, 1400-1700, University of Warsaw, 28-29 May 2015.

Depiction as Means of Scientific Innovation: Descartes and the Dutch Cartesians: Observing, Depicting and Disseminating, international conference, Centre for History of Science, Graz, 7-9 May 2015.

The Quest for Scientific Knowledge in a Cartesian Age (or the birth of the philosophy of science): lecture, Federal University of Pernambuco, Recife, 24 March 2015.

A fundação do conhecimento após Descartes: da metafísica à filosofia da ciência: lecture, Centro de Epistemologia e História da Ciência, Universidade Federal do Rio de Janeiro, 17 March 2015.

Medicine and Materialism in the Natural Philosophy of Henricus Regius: OZSW Conference 2014, Radboud University, Nijmegen, 7-8 November 2014.

Nature: from Real Essence to Logical Notion: De rerum natura: Naturalism, Supernaturalism, Unnaturalism – Bucharest-Princeton Seminar in Early Modern Philosophy, Bran, 8-13 July 2014.

The Didactics of Physics: Experience and Imagination in the Manuals of Henricus Regius: Dal commentario al manuale: l'insegnamento della filosofia in età moderna, international conference, Parma, 8-9 May 2014.

The Role of Experiments in Cartesian Philosophy: Scientiae Conference 2014, Vienna, 23-25 April 2014.

Cartesian Logic facing Aristotelian Categories: OZSW Conference 2013, Rotterdam, 15-16 November 2013.

Burchard de Volder and the Cartesian Experimental Philosophy: Promotie-OnderzoeksParade (POP) 2013, workshop, Rotterdam, 28 June 2013.

Bacon and the Dutch Cartesians (panel discussion): Experiments and the Arts of Discovery in Early Modern Europe, international conference, Bucharest, 12-14 May 2013.

Denying Evidence: Regius's Theological Foundation of Cartesian Physics: Scientiae Conference 2013, Warwick, 18-20 April 2013.

A Logic to End Controversies: Clauberg's Logica Vetus et Nova as Means to Settle the Disputes on Cartesian Philosophy: Debates, Polemics and Controversies in Early Modern Philosophy – Third International Conference of the European Society for Early Modern Philosophy, Grenoble, 30 January-1 February 2013.

Between Gassendi and Spinoza: Regius's Crypto-Dualism: "Individuazione – individualità – identità personale. Le ragioni del singolo", international conference, Parma, 13-14 December 2012.

Foundational Theories in Seventeenth Century Dutch Philosophy: Workshop on the History of Philosophy, Eindhoven, 3 November 2012.

La relazione fra anima e corpo secondo i primi cartesiani olandesi: "Percorsi nella Soggettività: Dottorandi di Filosofia a confronto tra modernità e contemporaneità", post-graduate workshop, Parma, 21 April 2011.