
The Transit of Science and Philosophy Between the Dutch Republic and Italy: the Case of Newtonism

By inTRAlinea Webmaster

Abstract & Keywords

English:

Analyzing the scientific exchange between the Dutch Republic and Italy, this essay discusses the role of two Dutch scientists and the dissemination of their works. The scientific careers of Willem ’s Gravesande and Petrus van Musschenbroek are placed in the context of the controversies raised by the spread of Newtonian science and philosophy around the turn of the century. The article then turns to the role of the Dutch Newtonians in spread of Newtonianism in Italy. It concludes with a hint at further research.

Keywords: history of philosophy, history of science, Newtonianism, Dutch Republic, Italy

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In the last of his *Lettere accademiche*, Antonio Genovesi listed the most authoritative exponents of modern science and mentioned – in addition to Galileo Galilei, Evangelista Torricelli, René Descartes and Isaac Newton - the names of Willem ’s Gravesande and Pieter van Musschenbroek:

> My first teacher, bachelor of great fame, with some prime matter, four substantial forms, certain substantial qualities - even though suspended in the air - an antipathy, a sympathy, four chimerical questions, few distinctions, *modo cervellotico, concedo, aliter, nego: bibere et rebibere extinguit situm: pancialiter, nego, mascellariter, concedo,* I can tell you, he made up worlds. Now you hear some imposing men, that is, Galilei, Torricelli, Descartes, Maupertuis, Newton, Keill, ’s Gravesande, Musschenbroek, d’Alembert, say: *we do not know*; we have not experimented enough; it takes more time. They look like snails, it takes them many years to make a step forward. (Genovesi 1769: 226-27)**[1]**

In the middle of the Age of the Enlightenment, Genovesi suggested, the empty reveries of scholastic philosophy had given way to a new form of knowledge that, aware of the lack of an adequate number of experiments, did not want to pronounce a final judgment on the nature of things. In the view of Genovesi, all great philosophers and scientists of the modern age were exponents of this current of thought, which the religious orthodoxy and political absolutism preferred to label as ‘philosophical Pyrrhonism’ (Genovesi 1769: 228).

This passage also expresses an appraisal of the works of ’s Gravesande and van Musschenbroek which may at first sight appear rather puzzling today. Including the names of these Dutchmen among the afore-mentioned outstanding scientists apparently entails that Genovesi regarded them as the direct continuators of the work of those great masters. Furthermore, this passage suggests that he tacitly established a methodological continuity between Galilei, Descartes and Newton, which in the current academic discussion is seen as problematic, to say the least. And yet Genovesi’s judgment is revealing for two reasons: firstly, there was an awareness in Enlightened Europe that philosophers of the modern age were essentially united in their opposition to the Middle Ages and scholasticism; secondly, the passage shows that Genovesi (and with him Paolo Frisi and Giambattista Beccaria in Italy; Voltaire, David Hume and Benjamin Franklin elsewhere) identified the method and the scientific construction of Galilei and Newton with that of the later Newtonians, and especially of their Dutch followers. Indeed, Genovesi’s judgement was explicitly shared by Voltaire: ‘Ceux qui voudront s’instruire davantage, liront les excellentes Physiques des ’s Gravesande, des Keils, des Musschenbroek, des Pembertons’ (Voltaire 1738: 13). Genovesi and his contemporaries looked at the works of Galilei, Descartes and Newton through the eyes of ’s Gravesande and Van Musschenbroek, and preferred experiments and observations to mathematical discourse. In this sense, the interpretation of the Dutch Newtonians exerted an unquestionable influence on European philosophical and scientific circles.

The spread of Newtonian science reached much further than the field of physical science. For Voltaire, Newton meant freedom from a dogmatic and useless philosophy. In the eyes of Hume, Newton offered a model for building a science of man as rigorous as natural science was. And the Freemason John Theophilus Desaguliers took the laws of celestial motion revealed by Newton as a model for the construction of the laws of society (Gori 1972: 1-3).

Both ’s Gravesande and Van Musschenbroek wrote textbooks that were based on the contents of their university lectures. These books played an important role in the dissemination of experimental physics in the eighteenth century. Both kept a close eye on developments in the field of physics and made sure that their works remained up-to-date through the constant inclusion of the results of new investigations. When Voltaire was looking for someone to counsel him in Newtonian physics for the publication of his *Elemens de la philosophie de Neuton* (1737) his choice fell on ’s Gravesande (Pater 1989: 233).

From Newton to ’s Gravesande

The rise of Newtonianism offered a means to reconcile the sometimes-sharp contradictions between faith and science that had prevailed during the previous period. While Cartesianism apparently reduced natural phenomena to blind laws of nature, Newton left space for the work of invisible and incomprehensible forces. Therefore, his ideas seemed suitable for a reconciliation with traditional notions of providence.

The years preceding 's Gravesande's and Van Musschenbroek's appearance on the European intellectual scene were those of the offensive of Newtonian apologetics against the charges of impiety launched by Leibniz, against the accusations of occultism raised by the Cartesians, and against the sacrilegious deformations of the doctrine of attraction in the work of *esprits forts* such as John Toland.**[2]** Samuel Clarke and Newton exploited the metaphysical premises of Cambridge Platonism, renewing a tradition that went back to the *Boyle Lectures* by Richard Bentley**[3]** (1692) and Samuel Clarke**[4]** (1704-1705). The exaltation of final causes in the controversy with Descartes's anti-finalism, the recourse to space as God's *sensorium*, the appeal to 'active forces', the contrast between the a priori and deductive method of Cartesian physics and 'inductive method' of Newton's system, were recurring motifs in the second edition of the *Principia* (1713), in the general *Scholium* written by Newton for the same edition, in Clarke's response to Leibniz (1715-16), and in the final queries of the *Opticks*. In fact, a single centripetal force (inversely proportional to r2) is acting on the moving body, bending into an ellipse the straight line of its inertial motion. Thus, against the Cartesian view of the universe provided with a constant amount of motion, Newton required the continuous intervention of 'active forces', and accentuated the presence of God's hand in the natural realm. Subsequently, also 's Gravesande held that Descartes's anti-finalism may lead to mechanistic fatalism and atheism (Gori 1972: 49-51).

Newtonianism entered the Dutch Republic in 1715, when Herman Boerhaave at the University of Leiden declared Newton's method as the only trustworthy procedure for scientific research (Boerhaave 1715). Willem Jacob 's Gravesande ('s-Hertogenbosch, 26 September 1688 – 28 February 1742) occupied a peculiar place among the Newtonians. With respect to John Keill, he belonged to the scientific and philosophical tradition of the continent. For example, in the controversy on the 'living forces', 's Gravesande broke with the English Newtonians and endorsed Leibniz's doctrine of *vis viva* (in modern times we call it 'kinetic energy'). Vis-a-vis Musschenbroek, he boasts, together with Herman Boerhaave, the introduction of Newtonian science at a university on the continent (Pater 1988).

Biographical facts also confirm his leading role in the spread of Newtonianism. He was educated at the University of Leiden, where he defended a thesis on suicide, *De autocheiria*, and graduated in 1707. In The Hague he practised law and took part in intellectual discussions while cultivating his interest in the mathematical sciences. In 1711, he published his *Essai de perspective* and in 1713 he was among the founders of one of the most successful magazines of that period, the *Journal Litéraire*, which promoted British philosophy and science in the continent. His contributions to the *Journal Littéraire* consisted of moral essays and scientific papers, the two fields of knowledge which were most congenial to him.

's Gravesande combined scientific propaganda with diplomatic activity. In London he met both King George I and Isaac Newton, and was elected a Fellow of the Royal Society (Pater 1979: 10-11). This experience proved decisive for his academic career that began shortly after his return to Holland with his appointment as professor of mathematics and astronomy at the university of Leiden in 1717. From that position, he intensified his efforts for introducing Newton's work into the Netherlands and the rest of the continent. He then obtained the chairs of civil and military architecture in 1730, and that of philosophy in 1734.

The works of 's Gravesande had an enormous fortune: his treatise on physics, *Physices elementa mathematica, sive Introductio ad philosophiam Newtonianam* (1720), rapidly conquered Europe. In 1736, he published *Introductio ad philosophiam, metaphysicam et logicam*, where he discussed metaphysics, psychology, and logic. In the 1750s, a few years after his death, pages of this *Introductio* (1736) were resumed in the *Encyclopédie* in several epistemological entries. And in 1774 all his philosophical and mathematical works were published in a French translation ('s Gravesande 1774). In the same year 1822, a reprint appeared of his *Introductio ad philosophiam* (Gori 1972: 3-4).

When 's Gravesande took possession of the chair of mathematics and astronomy in 1717, he pronounced, according to custom, a lecture in Latin entitled *De matheseos in omnibus scientiis, praecipue physicis, usu; nec non de astronomiae perfectione ex physica haurienda*. Herein he argued 'that without geometry one cannot make any progress in physics, and that astronomy owes the high degree of perfection it has reached at these times to the aid it has drawn from what we call physical mathematics' ('s Gravesande 1774: 312; Gori 1972: 91).

The publication of *Physices elementa mathematica, experimentis confirmata* in 1720 responded to precise didactical and propagandistic needs. In this work, he laid the foundations for the teaching of Newtonian mechanics through experimental demonstrations. From this point of view, the situation of Newtonian science was paradoxical. Despite having demolished much of the Cartesian physics, forty years after the publication of the *Principia*, Newtonian science labored to penetrate British universities. Newton's science pointed out in a difficult work, fraught with mathematical calculations, suffered from the lack of easily readable manuals accessible to students and to the educated public of the upper classes. In fact, the first condition for making Newtonian physics accessible was reducing its mathematical apparatus. In 1697, Samuel Clarke published a Latin translation of Jacques Rohault's *Traité de physique*. His numerous annotations that purported to correct Rohault with reference to the theories of Isaac Newton, represented a first, albeit indirect, attempt at diffusing Newton's science and philosophy. Later Newtonians, such as David Gregory, either missed the target (Gregory 1702), or succeeded only partially in an accessible scientific dissemination. John Keill is a case in point in this regard (Keill 1700).

's Gravesande's *Physices elementa* went through a complex evolution. The first edition was written specifically for students, and was composed of four books that dealt, respectively, with the body in general and the movement of solids, with fluids, with light, and with celestial mechanics. In the second edition (1725), some *Scholii* with mathematical proofs were added, but only from the third edition on (1742) the treatise acquired its final structure: the books were now six and embraced the totality of natural phenomena. The first book was devoted to the body in general and its properties (extension, solidity, divisibility and mobility), as well as to several specific physical issues (among which balance of forces, gravity, pressure). The second book dealt with the inner forces and collision of bodies, the third discussed fluids, the fourth air and fire, the fifth light, and the sixth the 'system of the world' (Gori 1972: 154-59). In the first editions 's Gravesande did not mention any sources except for Newton. In 1742, in a scientific context now favorable to Newtonianism, he finally gave way to the complete enumeration of the authors of the experiments reported in the work.

In France, a treatise like that of 's Gravesande, announcing its commitment to the science of Newton from the very title, could not fail to encounter hostility in the Cartesian milieus. In England, by contrast, it was received with approbation. It was soon translated into English by John Theophilus Desaguliers and appeared in 1726 in London. The English translation was based on the second edition (1725) that included 's Gravesande's approval of

Leibniz's definition of force, and it immediately became an editorial success as well as being adopted as a textbook in several universities (Gori 1972: 105-12).

In the course of the eighteenth century 's Gravesande became a prominent figure in cultivated Europe. His textbooks spread in France, England, America, Germany, Russia, Switzerland and in Italy. In 1724 he was offered a position at the Academy of Petersburg; in 1740 a similar proposal was made by the Royal Academy in Berlin, but in both cases 's Gravesande declined the offer (Gori 1972: 154-59).

Pieter van Musschenbroek: physical investigations and experiments

Pieter van Musschenbroek (Leiden, 14 March 1692 – Leiden, 19 September 1761) studied philosophy, mathematics, and medicine at the University of Leiden. He was a professor at the university in Duisburg from 1719 to 1723, and at the University of Utrecht from 1723 till 1739, when he returned to Leiden. Musschenbroek made a significant contribution to the development of methods of experimental physics. In 1745 his experiments with electricity led him—independently from the results of the German physicist E.G. von Kleist—to the invention of the Leyden jar, a first method to store electric energy. Musschenbroek's course in physics and several of his other books were translated into other languages. He was a member of the London Royal Society, a corresponding member of the Paris Academy of Sciences, and an honorary member of the St. Petersburg Academy of Sciences (1754).**[5]**

In 1726, Van Musschenbroek published *Epitome elementorum physico-mathematicorum*. An enlarged version of the work appeared in 1734. He reached a larger audience in Holland with the Dutch translation, *Beginselen der Natuurkunde, Beschreven ten dienste der landgenoten*, in 1736. What 's Gravesande did in Leiden – reforming the study of physics under Newton's influence – van Musschenbroek did in Utrecht. He can be regarded as a pupil of 's Gravesande, but he was by no means his slavish follower. There were noteworthy differences between the scientific attitudes of these countrymen.

's Gravesande, the great propagandist of Newton's theories, did not apparently bother too much about the Holy Scripture. He repeatedly emphasized the incompatibility of the traditional literal explanation of the Bible text with scientific facts. According to him, Copernicanism itself was undeniable in the light of the laws of nature discovered by Newton. In Musschenbroek's view, the religious, physical-theological element could not be eschewed. According to him the construction of the world is a proof of God's intervention.

's Gravesande was more cautious, more mathematical, and strictly phenomenalistic. He kept to Newton's adagio 'hypotheses non fingo', and he did not use his experimental results to speculate on the underlying causes, such as the *nature* of light or of electricity. Van Musschenbroek, by contrast, was more daring, relied less on numbers and placed more emphasis on collecting experimental data than on formulating general laws. Although he warned his students against the introduction of unverifiable hypotheses and advocated an honest acknowledgement of what was not known, he was willing to accept such concepts as atoms and sharp acid particles. He was also willing to tackle magnetism, electricity, heat, and other similar phenomena which were difficult to quantify or to cast into general laws, and which were, for that reason, hardly investigated by 's Gravesande.**[6]**

However, they shared a common scientific methodology, which was characterized by three fundamental aspects: first, only experiments which are carried out carefully should form the basis of science; secondly, natural laws must be inferred from observations and experiments by means of induction and with the help of logic and mathematics; thirdly, every natural phenomenon should be explained with mathematically formulated natural laws (Pater 1989: 231).

The spread of Newtonian science in Italy

Cultural exchange between Italy and the Low countries dates back to the Middle Ages and gradually intensified during the fifteenth and sixteenth centuries.**[7]** All through the seventeenth and eighteenth centuries, many Dutch authors, painters, scientists and philosophers visited Italy, and vice versa. Furthermore, in this period the Dutch Republic played a prominent role in the printing and commerce of books.**[8]**

Scientific transit and exchange between the two countries increased accordingly.**[9]** During the first half of the eighteenth century there were several occasions for scientific exchange between Italian and Dutch scientists. The well-known abbot Celestino Galiani (1681-1753) kept up a correspondence with 's Gravesande from 1713 to 1717. As one of the main editors of the *Journal Litéraire*, 's Gravesande had asked Galiani in 1713 information about the events and developments in Italy. And in 1715 the printer of the *Journal*, Thomas Johnson, sent him Newton's *Principia* as well as the *Praelectiones astronomicae* by William Whiston (1667-1752) and the *Introductio ad veram* by John Keill. In 1717, Galiani asked 's Gravesande for advice on the possibility of having the river Rhine flow into the Po. 's Gravesande then wrote him that he had passed the letter on to Newton and the Royal Society for an expert opinion.**[10]**

In 1745, the Neapolitan Antonio Genovesi (1713-1769), professor of metaphysics, ethics and political economics, **[11]** wrote a preface to the Neapolitan edition of Pieter van Musschenbroek's *Elementa physicae conscripta* in which he took sides against Descartes and with Newton. He argued that the latter 'wanted to philosophize, not with vague hypotheses and conjectures, but with conclusive experiments and solid reasoning, confirmed by experiments (...) As a result it came about that in all famous European academies physics moved away from a 'Roman' [that is, Cartesian] base and returned to a firmer and more solid one' (Genovesi 1745: 69).

As said before, an important aspect of the presentation of Newtonian philosophy is the polemic with the Cartesians. Both 's Gravesande and Van Musschenbroek repeatedly made a stand against the hypothetical-deductive method of Descartes. Both carried out physical investigations, especially Van Musschenbroek. He concentrated on magnetism and the strength of materials. His treatises in these fields were well-known in Italy too. When Pope Benedict XIV requested advice for the restauration of the dome of St. Peter's basilica in 1743, the results of van Musschenbroek's investigations on the tensile strength of iron cables were considered. This was no doubt due to the presence, among the Pope's advisers, of Giovanni Poleni (1683-1761), Ruggero Giuseppe Boscovich (1711-1787), and several other scientists who were acquainted with Van Musschenbroek's work.**[12]**

The textbooks written by 's Gravesande and Van Musschenbroek rapidly spread throughout Europe, also in translation. 's Gravesande's physics text book was translated into English (7 editions), French and Dutch. The philosophy textbook he wrote in 1736 was translated into French, German, Dutch, and even Greek. Van Musschenbroek's physics textbook was, in some version, translated into English, French, German and Swedish, and he prepared a Dutch edition himself, entitled *Beginselen der Natuurkunde, beschreven ten dienste der landgenooten* (Elements of Natural Science, described for the fellow countrymen, 1736).

A strong interest in the work of these Dutchmen had risen also in Italy: however, no Italian translation ever appeared. Giambattista Gori has suggested that the social and economic regression did not encourage the publication of an Italian translation (Gori 1972: 114), but this does not explain why other works were instead being translated. By contrast, Paolo Casini has argued that in Italy Newtonianism hardly surfaced in the first half of the eighteenth century, owing to the strong position of the ecclesiastical bodies of doctrinal control, that is, the Congregations of the Inquisition and the Index of Forbidden Books. Indeed, endorsing the Newtonian world view entailed adhering to Copernicanism, which had been condemned in 1616, and again in 1633 in the trial against Galileo Galilei.**[13]** However, some caveats are due.

Francesco Algerotti's *Il Newtonianismo per le dame* (1737), for instance, was placed on the Index in 1738, and despite modifications in later editions (1739 to 1752), it was not removed. Newton's *Principia*, by contrast, had been never condemned. This apparent contradiction was due to the censorial strategy of the Inquisition and Index. Works in vernacular that were accessible to a large audience were deemed a more serious threat than complicated mathematical works.**[14]** A partial unbanning of Galilei's *Dialogue* occurred during the papacy of Benedict XIV (1740-1758), when Toaldo obtained permission to publish an edition of Galilei's works in Padua (1744). The ban on Copernicanism in general also became less strict: following Pietro Lazzari's consultant report (1757) in 1758 the anti-Copernican clause was removed from the (new) Index, but not the works condemned in 1616.**[15]**

In my view, the reasons put forth by Gori and Casini – namely social, economic and intellectual stagnation, the attitude of the Inquisition, political fragmentation - are merely subsidiary: as the intellectual élite had the Latin edition of the textbooks, there was hardly any need for an Italian translation.

Shortly after their publication in the 1720s, 's Gravesande's and van Musschenbroek's textbooks also found their way to Italy. Giovanni Poleni in Padua as well as Paolo Frisi in Milan, Giambattista Beccaria in Turin, and Genovesi in Naples quoted or paraphrased and used them in their lessons. They were so frequently used, that there was a need for local editions. In 1737, when 's Gravesande published the second edition of his *Introductio* in Holland, a Venetian edition appeared, and a fourth was printed in 1792. 's Gravesande had written a summarized version of his physics textbook for his students: three years after its third Leiden edition in 1746, a reprint appeared in Bassano and Venice (1749). However, Italian editors preferred van Musschenbroek's handbooks, probably because they were more accessible and required only a minimal mathematical preparation. In 1741 Van Musschenbroek had published a second enlarged edition of *Elementa physicae*, of which a reprint appeared in 1745 in Venice and Naples. The latter was edited by Antonio Genovesi and Giuseppe Orlandi, professor of mathematics and experimental physics and known as a capable experimental scientist. Genovesi had his *Disputatio physico-historica* prefaced to van Musschenbroek's treatise.**[16]** Many annotations and additions, mostly by Orlandi, were added in the footnotes. Both in Venice and in Naples, this edition ran though several reprints, and in 1794 a fifth edition was issued in Venice. In 1768 an Italian edition of Van Musschenbroek's *Introductio ad philosophiam naturalem* (1762) appeared.

The textbooks of the two Dutch authors also appeared in a partially combined version. Indeed, van Musschenbroek's textbook, although highly appreciated, needed a supplement, as it did not include an explanation of the world system, while 's Gravesande's work did. Genovesi and Orlandi decided therefore to include the relevant part of 's Gravesande's *Physices elementa* in their edition, under the title *De rebus coelestibus tractatus*. It was preceded by a preface in which they expressed some caution with respect to Newton's Copernicanism, and they pointed out that the arguments for the movement of the Earth formulated by 's Gravesande and other Copernicans 'possess no small measure of probability.' In contrast to Newton, Huygens, Gregory and others, they plainly stated they did not accept that the issue was settled beyond any dispute, although the Copernican system could be used as a suitable hypothesis to explain a wide range of phenomena.**[17]**

The interaction between Italy and the Dutch Republic was one of mutual appreciation. Van Musschenbroek supervised an edition of the experiences of the Accademia del Cimento, adding many *additamenta* with experiments of his own to it, and including a description of his famous pyrometer.**[18]** As said before, in the 1742 edition of *Physices elementa*, 's Gravesande mentioned the authors of the experiments reported in the treatise, including several Italian scientists: Galilei, Torricelli, the Accademia del Cimento, Giovanni Alfonso Borelli, Giandomenico Cassini, Paolo Casati, Domenico Guglielmini, Guido Grandi and Giovanni Poleni (Pater 1989: n.26). The latter, together with 's Gravesande, played an important role in the so-called 'vis viva' issue: they shared the view that the effect of a force should be measured by mv^2. 's Gravesande accepted the outcomes of the experiments carried out by Poleni, and mentioned them in his works, while the latter appreciated 's Gravesande's work in this field (Pater 1989: 239-40).

Van Musschenbroek also mentioned some Italian scientists in his works, and the auction catalogue of his library enumerates many works of Italian philosophers and scientists, including Girolamo Cardano, Christoph Clavius, Giambattista Riccioli, Nicola Cabeo, Ulisse Aldrovandi, Michele Mercati, Ruggero Boscovich, Giovanni Alfonso Borelli, Evangelista Torricelli and Francesco Redi.

Some historiographical issues: hints for further research

The dissemination of Newtonian science involves larger historiographical issues. Firstly, in intellectual history in the last decades, traditional labels have lost much of their meaning: it is increasingly difficult to distinguish between the period of the scientific revolution and that of the Enlightenment. By consequence, the seventeenth and eighteenth centuries, which were thought to be distinct and separate, are being united as the period of a fundamental shift in European thought. The Dutch authors of scientific handbooks discussed here played a central role in this shift. Further research might shed light on the social distribution of their ideas and the intellectual adaptation processes that were part of it, which in the period under discussion immensely expanded the number of agents involved in the process of idea formation. Craftsmen, self-employed men, and shopkeepers were probably just as important as scholars were in the intellectual shift of the seventeenth and eighteenth centuries.

Secondly, Dutch Newtonian handbooks were functional in spreading all over Europe a powerful model: Newton's description of a universe of mathematically lawful physical forces. Newtonianism itself was controversial, both within England and overseas, and English authors in particular were concerned that his philosophy might be another form of materialism. In the Netherlands, by contrast, Newtonianism found its first footing in the university curricula because of the critical perspective that it provided on Cartesianism and Spinozism. During

Newton's lifetime, mathematical descriptions of natural laws already underpinned the *physico-theology* of Richard Bentley (1657-1735) and Samuel Clarke (1675-1729). The success of these authors helped to ensure the long-term visibility of Newton as a guarantor of the scientific accuracy of natural theology (Mandelbrote 2013: 90-91). Further research might investigate whether the idea of the lawfulness of creation that came to dominate English and Dutch natural theology, had any impact on the development of scholastic views on the relationship between theology and science in Italy and other Catholic countries.

The third issue regards the tradition of national history writing in the history of science. Though the concern with national histories has been steadily on the decline since the 1960s, the concept of nation has retained some importance. Disguised as universal principles, seminal historical axioms dating back to the high tide of national history are still in full force. It is a common place, for example, that countries need to experience a 'French' as well as an 'industrial' revolution to enter modernity. Because of the dominant position of France and England in world politics and economy, these touchstones became part of generally accepted standard for historical development, thereby reducing the deviant trajectories seen in most European nations, including Italy, to a state of unimportance if not oblivion. Further research might show that continental European issues and contributions were not merely auxiliary stepping-stones in a great narrative populated by Anglo-French facts and figures.

References

Alexander-Skipnes, Ingrid (ed.) (2007) *Cultural Exchange between the Low Countries and Italy (1400-1600)*, Turnhout, Brepols.

Badaloni, Nicola (1968) *Un abate libero pensatore fra Newton e Voltaire*, Milano, Feltrinelli.

Baldini, Ugo (2000) "Teoria boscovichiana, newtonismo, eliocentrismo: dibattiti nel Collegio Romano e nella Congregazione dell'Indice a metà Settecento" in Idem, *Saggi sulla cultura della Compagnia di Gesù (secoli XVI-XVIII)*, Padova, CLEUP: 281-347.

Bentley, Richard (1724) *Eight Sermons Preach'd at the Honourable Robert Boyle's Lecture, In the First Year,* MDCXCII, Cambridge, Cornelius Crownfield.

Berkvens-Stevelinck, Christiane, Hans Bots, Paul Hoftijzer and Otto Lankhorst (eds) (1992) *Le magasin de l'univers. The Dutch Republic as the Centre of the European Book Trade*, Leiden, Brill.

Boerhaave, Herman (1715) *Sermo Academicus de comparando certo in physicis*, Lugduni Batavorum, apud Petrum vander Aa.

Carpenter, Audrey T. (2011) *John Theophilus Desaguliers. A Natural Philosopher, Engineer and Freemason in Newtonian England*, London-Oxford, Bloomsbury.

Casini, Paolo (1978) "Les debuts du newtonianisme en Italie, 1700-1740", in *Dix-Huitième Siècle*, 10: 85-100.

Clarke, Samuel (1708) *A discourse concerning the unchangeable obligations of natural religion: and the truth and certainty of the Christian revelation. Being eight sermons preach'd at the Cathedral-Church of St Paul, in the year 1705, at the lecture founded by the Honourable Robert Boyle*, London, printed by Will. Botham.

Cook, Harold J. (2007) *Matters of Exchange: Commerce, Medicine, and Science in the Dutch Golden Age*, New Haven (Conn.), Yale University Press.

Finocchiaro, Maurizio (2005) *Retrying Galileo 1633-1992*, Berkeley-Los Angeles-London, University of California Press.

Foscarini, Paolo Antonio (1615) *Lettera sopra l'opinione de' Pittagorici, e del Copernico. Della mobilità della terra, e stabilità del sole, e del nuouo pittagorico sistema del mondo*, In Napoli, per Lazaro Scoriggio.

Garin, Eugenio (1969) "Antonio Genovesi e la sua introduzione storica agli *Elementa physicae* di Pietro van Musschenbroek" in *Physis*, 11: 211-22.

Genovesi, Antonio (1745) *Disputatio physico-historico de rerum corporearum origine et constitutione*, in Petrus van Musschenbroek, *Elementa physicae conscripta in usus academicos*, 2 vols., Neapoli, Typis Petri Palumbo.

Genovesi, Antonio (1769) *Lettere accademiche su la questione se sieno più felici gl'ignoranti che gli scienziati dell'ab. ** al signor canonico ***, In Napoli, nella Stamperia Simoniana (first edition: 1764).

Gibbs, Graham (1971) "The role of the Dutch Republic as the intellectual entrepôt of Europe in the seventeenth and eighteenth centuries" in *Bijdragen en mededelingen betreffende de geschiedenis der Nederlanden*, 86: 323-49.

Gori Giambattista (1972) *La fondazione dell'esperienza in 's Gravesande*, Firenze, La Nuova Italia.

's Gravesande, Willem (1774) *Oeuvres philosophiques et mathématiques de Mr. G.J. 's Gravesande, rassemblées & publiées par Jean. Nic. Seb. Allamand qui y a ajouté l'histoire de la vie & des écrits de l'auteur*, 2 vols., Amsterdam, M. Rey.

Gregory, David (1702) *Astronomiæ physicæ & geometricæ elementa*, Oxoniæ: e theatro Sheldoniano.

Keill, John (1700) *Introductio ad veram physicam: Seu lectiones physicæ*, Oxoniæ, e Theatro Sheldoniano, impensis Thomæ Bennet.

Lindeboom, Gerrit Arie (1968) "Boerhaave and his Italian correspondents" in *Atti del XXI Congresso internazionale di storia della medicina*, Siena, Soc. Internazionale di Storia della Medicina: 49-61.

Lindeboom, Gerrit Arie (1978) *Adriaan van den Spiegel (1578-1625): hoogleraar in de ontleed- en heelkunde te Padua*, Amsterdam, Rodopi.

Luyendijk-Elshout, Antonie Maria (1983) "Morgagni, Ruysch and Boerhaave, three musketeers for *Anatomia subtilis*" in *Scienza e cultura. Informazione dell'Università di Padova with English Translation*, vol. 6, Padova: 312-20.

Luyendijk-Elshout, Antonie Maria (1991) "Der Einfluss der italienischen Universitäten auf die medizinische Fakultät Leiden (1575-1620)" in Georg Kaufmann (ed.), *Die Renaissance im Blick der Nationen Europas*, Wiesbaden, Harrassowitz: 339-53.

Maffioli, Cesare (1989) “Italian hydraulics and experimental physics in eighteenth-century Holland. From Poleni to Volta”, in Maffioli and Palm (1989), 243-75.

Maffioli, Cesare and Lodewijk Palm (1989) *Italian Scientists in the Low Countries in the 17th and 18th centuries*, Amsterdam, Rodopi.

Mandelbrote, Scott (2013) “Early modern natural theologies” in Russell Re Manning (ed.), *The Oxford Handbook of Natural Theology*, Oxford, Oxford University Press: 75-99.

Musschenbroek, Petrus van (ed.) (1731) *Tentamina experimentorum naturalium captorum in Academia del Cimento,* Lugduni Batavorum, Apud Joan. et Herman. Verbeek.

Nicolini, Fausto (1951) *Un grande educatore italiano. Celestino Galiani*, Napoli, F. Giannini e figli.

Pancino, Maria and Gian Antonio Salandin (1989) “Relazioni scientifiche fra Leida e Padova: Pieter van Musschenbroek (1692-1761) e Giovanni Poleni (1683-1761)” in *Incontri*, 4: 9-23.

Pater, Cornelis de (1979) *Petrus van Musschenbroek (1692-1761), een Newtoniaans natuuronderzoeker*, Utrecht, Rijksuniversiteit te *Utrecht.*

Pater, Cornelis de (ed.) (1988) Willem Jacob ’s Gravesande, Welzijn, wijsbegeerte en wetenschap Baarn, Ambo.

Pater, Cornelis de (1989) “The textbooks of ’s Gravesande and Musschenbroek in Italy”, in Maffioli and Palm (eds) (1989): 231-41.

Sullivan, R. (1982) *John Toland and the Deist Controversy: A Study in Adaptations*,

Cambridge, Mass., Harvard University Press.

Tervoort, Ad L. (2005) *The **Iter Italicum** and the **Northern Netherlands**. **Dutch Students** at **Italian Universities** and **Their Role** in the **Netherlands (1426-1575***), Leiden, Brill.

Venturi, Franco (1969) *Settecento riformatore*, Torino, Einaudi.

Voltaire (1738) *Elémens de la Philosophie de Newton, mis a la portée de tout le monde*, Amsterdam, Etienne Ledet & Compagnie.

Notes

[1] ‘Il mio primo maestro, Baccelliero di gran nome, con un po’ di materia prima, quattro forme sostanziali; certe qualità sostanziali pur elleno appese in aria, un’antipatia, una simpatia, quattro questioni chimeriche, poche distinzioncine, *modo cervellotico, concedo, aliter, nego: bibere et rebibere extinguit situm: pancialiter, nego, mascellariter, concedo*, vi so dire, che facea de’ mondi. Mo sentite dire a certi uomini massicci, a’ Galilei, a’ Torricelli, a’ Descartes, a’ Maupertuis, a’ Newton, a’ Keill, a’ Gravesandi, a’ Muschebrocò, agli Alamberti: *Non sappiamo*: non abbiamo degli sperimenti a sufficienza: si richiede più tempo: e li vedete come le chiocciole molti anni appena aver fatto un passo.’

[2] See Sullivan (1982).

[3] Bentley (1724).

[4] Clarke (1708).

[5] For extensive biographical information, see Pater (1979), ch. 2.

[6] See Pater (1979), ch. 3, in particular pp. 80-99.

[7] See Tervoort (2005); Alexander-Skipnes (ed) (2007).

[8] Gibbs (1971); Berkvens-Stevelinck et al. (eds) 1992; Cook (2007).

[9] See, for example: Lindeboom (1968); Lindeboom (1978); Luyendijk-Elshout (1983); Maffioli (1989); Pancino and Salandin (1989); Luyendijk-Elshout (1991).

[10] Nicolini (1951: 162-63); Casini (1978: 92-93); Gori (1972: 158-59).

[11] For biographical information, see **http://www.treccani.it/enciclopedia/antonio-genovesi_%28Dizionario-Biografico%29/**

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[12] See Pater (1989: 233). Moreover, in 1755 van Musschenbroek was associated to the Accademia delle Scienze in Bologna; see ibidem, note 7.

[13] For a reconstruction, see Finocchiaro (2005).

[14] It must be reminded that Copernicus’ *De revolutionibus orbium* had been placed on the Index when its content had been made accessible for a larger audience in Galilei’s lectures and in particular by Foscarini (1615).

[15] See Baldini (2000); Finocchiaro (2005: ch. 7).

[16] This work is referred to in Venturi (1969: 528); Badaloni, (1969: 277). For discussion, see Garin, (1969). Genovesi’s *Disputatio* was divided in three parts, dealing with Oriental philosophy (Hebrew, Chaldean, Persian, Indian, Ethiopian, Arabic, Egyptian, Phoenician, Thracian), the Greeks (Ionians, Pythagoras and followers, Plato, Peripatetics, Stoics, Elateans, Democritans), and modern philosophy (featuring Italian Renaissance, Descartes, Newton, Leibniz). Genovesi believed in the circularity of the history of philosophy and intertwined his discussion in the first two parts with numerous references to contemporary debates. This work was also spread through offprints and a revised edition appeared in 1763.

[17] Van Musschenbroek, *Elementa*, preface (unnumbered) to *De rebus coelestibus* (with separate page numeration).

[18] Van Musschenbroek (ed) (1731); see Gori (1972: 113, note 85).

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