Local traditions in the making of Dutch Newtonianism

Gerhard Wiesenfeldt

Early eighteenth-century Dutch natural philosophy is frequently characterised as Newtonian. The way Willem Jacob 's Gravesande and Petrus van Musschenbroek related their work to Isaac Newton and his ideas has been extensively studied. Far less, they have been studied in the perspective of older traditions of Dutch mathematics and philosophy. While they were themselves much more explicit in their acknowledgment of Newton than of any other philosophical reference points, this does not mean that Dutch academic traditions were not equally important in what can be understood as Dutch Newtonianism. In my talk, I will look at the relations between eighteenth-century Dutch Newtonianism and its predecessors. I will focus on the way the scope and the functions of natural philosophy were understood in the Dutch Republic. This will include the role of practical mathematics in the establishment of experimental philosophy, the appeal to the virtues of manual labour in the production of knowledge, as well as a discussion of the formation of the Dutch academic philosophical community against the background of the debates over Cartesianism and radical non-academic philosophies. My presentation will also look at the way eighteenth-century Dutch natural philosophers related themselves and Newtonian experimental philosophy to these traditions. My central argument will be that eighteenth-century Dutch experimental natural philosophers found that Newton's philosophy could easily be incorporated into the institutional and intellectual structures of philosophy in the Dutch Republic. Thus, one of the central motivations for reinterpreting Newton in Dutch philosophy during the eighteenth century lay in much older intellectual traditions.

Bio

Dr. Gerhard Wiesenfeldt is a lecturer in History and Philosophy of Science at the University of Melbourne and has held academic positions at the universities of Hamburg and Jena, as well as the Max Planck Institute for History of Science. He holds a degree in Physics and a PhD in History of Science, both from the University of Hamburg. He has published on Dutch natural philosophy, the relation between science and philosophy in Germany around 1800, the visual culture of experimental natural philosophy and on science fiction movies. He is the author of *Leerer Raum in Minervas Haus: Experimentelle Naturlehre and der Universität Leiden, 1675-1715* (Verlag für Geschichte der Naturwissenschaften und der Technik, 2002).

German traces in Dutch experimental philosophy

F. J. Dijksterhuis

In 1717 Daniel Gabriel Fahrenheit settled in Amsterdam as an instrument maker and public lecturer. He was welcomed by local amateurs who praised his skills and understanding. Fahrenheit brought the mix of instrument making, experiments and public lecturing that is typical of early Dutch *proefondervindelijke wijsbegeerte*. He brought it, however, over land from the East instead of across the North Sea, as might be expected. During the previous decade Fahrenheit had travelled through the Baltic and German lands developing philosophical, experimental, and instrument making expertise. Holland provided receptive ground, as a culture of experimental philosophy had been developing for some decades. The history of early Dutch experimental philosophy usually centres on the reception of English ideas. Fahrenheit is but one example showing that the story is a bit more rich and complicated. Although Newtonianism was hailed in the late 1710s by Dutch amateurs and philosophers, it was critically read and its teachings were appropriated to their own agendas. *Proefondervindelijke wijsbegeerte* developed by juxtaposing and mixing ideas, aspirations and practices from England, German lands, and local traditions. This paper discusses how this mix came about. The focus is on the influx of German ideas and practices, that has been largely neglected in historiography.

Bio

Fokko Jan Dijksterhuis is Associate Professor in the History of Science and Technology at the University of Twente. His main interest is in the cultural history of early modern science. He has published on 17th century optics, in particular on the work of Christiaan Huygens, and on the culture of mathematics in the Dutch Republic. Recently his focus shifted to the trans-disciplinary and transnational practices of knowledge cultivation in the eighteenth century.

Aspects of Petrus van Musschenbroek's appropriation of Newton's natural-philosophical methodology

Steffen Ducheyne

Petrus van Musschenbroek (1692-1762) is rightfully considered an important trailblazer in the diffusion of Newtonianism on the Continent. Together with W. J. 's Gravesande, he helped to establish teaching of Newton's natural philosophy within the university curriculum and the textbooks which he wrote were of vital importance in its spread and popularization. On the face of it, there are good reasons for portraying Musschenbroek as a 'Newtonian'. Musschenbroek spent time in England where he became acquainted with Newton, his natural philosophy, and his disciples. During his stay in England he came to accept the basics of Newton's natural philosophy and the theory of universal gravitation in particular, which he earlier rejected. In his *Elementa physicæ conscripta in usus academicos* (1734), for instance, he endorsed Newton's distinction between absolute and relative space and time and he affirmed the theory of universal gravitation and the doctrine of the heterogeneity of white light. After 's Gravesande's death in 1742, Musschenbroek was in full charge of teaching experimental and Newtonian philosophy at his *alma mater*.

My endeavour is to show that Musschenbroek developed a series of methodological views which diverged from Newton's views on the matter. Although it does make sense to speak of a modest Newtonian influence on Musschenbroek's methodological ideas, Newton's work was only one amongst several methodological sources and arguably perhaps not the most important one. First, I call attention to Musschenbroek's views on the aim of "physics" ("physica" in Latin; "natuurkunde" in Dutch). Second, I explore Musschenbroek's reception and understanding of Newton's *regulae philosophandi* in several of his works. Finally, I provide an outline of Musschenbroek's methodological views proper.

Bio

Steffen Ducheyne is Research Professor at the Centre for Logic and Philosophy of Science at the Free University of Brussels (VUB). He has published widely in the history and philosophy of science and he is the author of "*The main Business of Natural Philosophy*:" *Isaac Newton's Natural-Philosophical Methodology* (Springer, 2012). He has just published a two-part study of W. J. 's Gravesande's Newtonianism in *Centaurus*.

Probability, moral certainty and evidence in Willem 's Gravesande's natural philosophy

Anne-Lise Rey

Willem J. 's Gravesande delivered his *Discourse on Evidence* as he was leaving the position of *Rector magnificus* at Leiden in 1724. He began his speech by making a distinction between mathematical evidence and moral evidence. This distinction led him to define moral certitude. This talk is concerned with the difference between certainty and evidence in 's Gravesande's epistemology. In order to show how 's Gravesande reworked Descartes' division between moral certainty and probability on the one hand and Locke's division between certainty and probability on the other, I will offer a detailed discussion of his *Introductio ad philosophiam* (in particular Chapters 12-16). I shall argue that he rearranged the categories developed by Descartes and Locke in order to guarantee the possibility of a certainty of moral evidence and to consider it as being autonomous from mathematical evidence.

My objective is to show that 's Gravesande's natural philosophy brought about a double shift. First, it encompassed a replacement of the empiricist credo said to typify the modernity of eighteenth-century science. In this context, I will consider the diverse ways of articulating conjectures and experiments in order to characterize the outline of 's Gravesande's new epistemology which is to be understood as a 'rationalization of experience'. His epistemology brought about a shift of focus on the certainty of experimental. Secondly and related to this, I will show that his new epistemology brought about a shift in the meaning of 'moral evidence'. Moral evidence is used by 's Gravesande as a means to identify degrees of certainty that are not necessarily based upon the probable and which are not to be considered subordinate to mathematical evidence. If we focus on these two shifts, we will be in a position to understand how 's Gravesande attempted to argue that we can be sure of the sort of knowledge we obtain by performing experiments – or so I will argue.

Bio

Since 2004 Anne-Lise Rey is Maître de conferences en histoire des sciences et épistémologie at the Université de Lille I. She works on the history and philosophy of seventeenth- and eighteenth-century dynamics. She has published on Newton, Leibniz and du Châtelet and she has edited several special issues in journals and multi-authored books. She is currently editing the correspondence between Leibniz and De Volder, which will appear with Vrin.

Experiment's journey at Leiden: From compromise to justified scientific method

Tammy Nyden

The seventeenth and early eighteenth centuries witnessed the shift from Aristotelian natural philosophy to the New Science, first represented by Cartesian physics and then that of Newton. These changes are often characterized as a scientific revolution, when science was divorced from theology and 'cured' of metaphysics, when experiment replaced metaphysics as the foundation of science. The University of Leiden played a key role in the early acceptance and spread of experimental physics throughout Europe. But its story is different than many would suspect. Experiment at Leiden did not exorcise theological and metaphysical concerns from physics, saving it from Scholastic and Cartesian natural science. On the contrary, it was the Cartesian Burchard De Volder and the Aristotelian Wolferd Senguerd who first championed experiment. Furthermore, theological and metaphysical concerns were rhetorically used to justify the use of experiment by Aristotelians, Cartesians, *and* the early Newtonians.

This paper will trace rhetorical and philosophical justifications of experiment at Leiden from 1675 to 1736. We begin with De Volder's creation of the Physics Theatre. From there we examine writings by De Volder and Senguerd that shed light on their pedagogy and philosophy of science during the thirty years that they both taught in those facilities. Next we look at Boerhaave's 1715 oration on the certainty of physics and finally at 's Gravesande's 1736 philosophy textbook, *Introductio ad philosophiam, metaphysicam et logicam continens.* Throughout this journey, the epistemological and methodological roles of experiment will gradually change, but one thing that remains surprisingly consistent is the role theological and metaphysical concerns relating to certainty will play in its justification.

Bio

Tammy Nyden is Associate Professor at the Philosophy Department at Grinnell College. She has published on De Volder, 's Gravesande, Descartes and Spinoza. She is the author of *Spinoza's Radical Cartesian Mind* (Continuum, 2007) and a co-editor of *Cartesian Empiricisms* (Springer, 2013).

The truth in a layer of clay: A replication of 's Gravesande's *vis viva* experiment

Ad Maas and Tiemen Cocquyt

In 1722 the Leiden professor Willem Jacob 's Gravesande dropped brass spheres of different weights, from different heights in a layer of clay and measured the depths of the impressions. He concluded that the 'force' contained by the accelerating spheres was proportional to the square of their velocities. This apparently simple experiment had large implications. 's Gravesande's result contradicted the view of his own master Isaac Newton, who contended that the 'force' (we would now say kinetic energy) was proportional to the velocity. For Newton and his followers far-reaching metaphysical en religious consequences were at stake and 's Gravesande was considered a betrayer and was even accused of being a 'Spinozist'.

In our presentation we will demonstrate a replication of 's Gravesande's experiment. Could he really have observed what he claimed to have seen? Did he himself perhaps have other motives than purely scientific ones and what were these? And what role did 's Gravesande's results play in the aftermath of the *vis viva* controversy?

Bio

Ad Maas and Tiemen Cocquyt are both curators of natural sciences at the Boerhaave Museum in Leiden. They have first-hand experience with re-enacting important experiments in the history of physics and they have studied 's Gravesande's experiments in great detail. Ad Maas has recently edited (together with Eric Jorink) *Newton and the Netherlands: How Isaac Newton was fashioned in the Dutch Republic* (Leiden University Press, 2012).