THE IMPECCABLE CREDENTIALS OF AN UNTRAINED PHILOSOPHER: WILLEM JACOB 'S GRAVESANDE’S CAREER BEFORE HIS LEIDEN PROFESSORSHIP, 1688–1717

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The mathematician, physicist and philosopher W. J. ’s Gravesande is particularly known for his adherence to ‘Newtonian philosophy’. Currently, it is widely held that ’s Gravesande got his main inspiration for his scholarly calling from Newton himself, whom he met in 1715 during a first career as a lawyer; and that it was mainly Newton’s own intervention that ensured the appointment of the unqualified ’s Gravesande at Leiden University. I challenge these views by bringing together all currently known information about ’s Gravesande, including a number of as yet unused documents. I show that ’s Gravesande’s appointment resulted from a very carefully built up reputation in scholarly circles rather than from accidental meetings and patronage. ’s Gravesande had written several innovative papers and was in contact with both leading mathematicians and local political and patrician figures already before 1715. This article therefore explains the rationale behind his appointment in Leiden.

Keywords: Willem Jacob ’s Gravesande; career building; Leiden University

INTRODUCTION

Willem Jacob ’s Gravesande (1688–1742) is mostly known for his early efforts in disseminating ‘Newtonian philosophy’ to mainland Europe. As the literature tells us, ’s Gravesande was a young and promising lawyer and journalist when his life was completely turned around in the course of a diplomatic trip to London during 1715 and 1716. Part of a Dutch embassy concerned with settling the effects of the War of the Spanish Succession (1701–14), ’s Gravesande’s previously lurking interests in natural philosophy were to be awakened by discussions with, among others, Isaac Newton, the President of the Royal Society, and J. T. Desaguliers, its Curator of Experiments. ’s Gravesande was elected a Fellow of the Society in the same year and was appointed only two years later, in 1717, as Professor of Mathematics and Astronomy at Leiden.

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University through the mediation of Newton himself. In 1719 's Gravesande published the first part of his *Physices Elementa Mathematica, Experimentis Confirmata*, subtitled *Introductio ad Philosophiam Newtonionam*. With this book, which was to become the most important physics handbook of the first half of the eighteenth century, the conquest of ‘Newtonianism’ and empirical physics could commence.¹

This is of course a very curious story: a young, untrained and inexperienced man finds his way into the upper echelons of natural philosophy on a trip abroad and immediately wins a position in one of Europe’s most prestigious universities. Within a couple of years, he starts to change the course of the history of science. Needless to say, this narrative does little justice to the actual course of affairs when put in those words. Although factually true, it omits many crucial details. That this story still lingers on is because we have no reliable account of 's Gravesande’s life. The only biography ever written is that published in 1759 by Jean Allamand, his one-time servant, who would become his friend and, long after ’s Gravesande’s death, his successor at Leiden University.² Although historians have been suspicious of the credibility of Allamand’s story—a little unfairly, but for the right reasons—no significant attempt has ever been made to extend his short biography. One can find additional pieces of information about ’s Gravesande in several places, but apart from Ad Maas’s recent treatment in *Newton and the Netherlands*,³ little has been done with these pieces to criticize the narrative given above.

The success of this received account, I believe, must be attributed to its role in a naive but obstinate and widely popular understanding of ‘modern science’ as emanating from ‘the Scientific Revolution’, and Isaac Newton’s fulfilment of it in particular. According to this story, ’s Gravesande imported ‘Newtonianism’ to mainland Europe after his 1715 trip and used it to replace the outdated ‘Cartesianism’ still dominating the faculties of philosophy at Dutch universities. It has been shown before that this account of Cartesianism is just as lacking in nuance as its take on Newtonianism, and I need not repeat the arguments here.⁴ What I present here instead is a biographical sketch of ’s Gravesande’s life in the period before his professorship in Leiden. As a result of a lack of coherent accounts of that period, the rationality of ’s Gravesande’s appointment at the university has scarcely been discussed and never been explained. Yet, as Ad Maas has argued, the evidence available so far on ’s Gravesande would not have warranted his naming to such a prestigious institute as Leiden University at all. Because of that, Maas has provocatively proposed that ’s Gravesande’s appointment ‘was a sample of unadulterated nepotism’ displayed by one of the leaders of the London embassy of 1715, the patrician Arent Wassenaer van Duyvenvoorde.⁵

Given the present state of affairs, Maas’s conclusion seems certainly more credible than the myth of ’s Gravesande’s Newtonian conversion. However, as will become clear from the evidence collected in this article, Maas’s statement does not take ’s Gravesande’s own merits into account sufficiently. By bringing together all the available shreds of information, I will show here that ’s Gravesande was in fact a particularly suitable candidate for the vacant chair of mathematics and astronomy: even though he is primarily known as a physicist, he was not initially appointed to a chair in the corresponding discipline of philosophy. ’s Gravesande had written several innovative papers on different mathematical and technical topics before 1717, some of which were acclaimed by leading figures in the history of science. Besides those, his diplomatic abilities had already won ’s Gravesande a network of both leading international mathematicians and Dutch political and patrician figures. Together, these would have assured that ’s Gravesande’s name circulated at the Dutch universities.
and especially at Leiden, where the same patricians held sway on the university board. Moreover, we will see that ’s Gravesande had connections with the Leiden chair of mathematics long before he won it himself. Along the way, I will address ’s Gravesande’s alleged association with political and philosophical radicals, which, if in fact true, could certainly have impeded his appointment in Leiden.

**THE ’S GRAVESANDE FAMILY**

To understand ’s Gravesande’s early career, we first need to take a look at his descent. As is regularly noted, ’s Gravesande was born into a relatively upper-class family. Both ’s Gravesande’s father, Dirk (or Dirck) (1646–1716), and his grandfather Laurens (1605–86) were leading figures in the governance and administration of ’s-Hertogenbosch and its surrounding areas. Of the four sons of Dirk ’s Gravesande surviving beyond the age of 23 years, our Willem Jacob was the only one who would not become a member of the city council. Yet, although they were thus relatively well established, the ’s Gravesandes were not on a par with the *regenten* of the cities of Holland. The Dutch Republic had recaptured ’s-Hertogenbosch in 1629 during the Dutch Revolt, but treated it afterwards as occupied territory: the predominantly Roman Catholic southern provinces of the Dutch Republic were ruled by the legislature of the northern Calvinist provinces. The administration of the southern areas provided fine career options for expatriate Calvinist families such as the ’s Gravesandes but did not grant them access to the ruling assemblies of the Dutch Republic.

Nonetheless, the family seems to have been doing well financially. Dirk ’s Gravesande was ‘president-schepen’, the president magistrate of the city, for some years. In the absence of a mayor, which ’s-Hertogenbosch did not have between 1629 and the French Revolution, the ‘president-schepen’ was the leading figure in the city council. The family owned some property and land as well: in 1697 Dirk became the owner of a one-third part of the belongings of a former Roman Catholic convent. Among Dirk’s part were the dwellings of the fathers and the entire church as well as some smaller parts. The other two-thirds of the convent came into the hands of the family later, and were sold again in 1731 by Willem Jacob ’s Gravesande, his brothers and his uncle. Willem Jacob also inherited some other property, as is demonstrated by a notarial act of 1732 in which he transferred about 10 acres of fields in the vicinity of ’s-Hertogenbosch to one of his brothers.

The importance of both ’s Gravesande’s social status and the fact that money was available should not be underestimated. Class differences could and certainly did play a role in scholarly matters around 1700; however, in the case of ’s Gravesande his respectable descent should have overcome problems with gaining credit in patrician and scientific circles. The money, ‘hard credit’, also had obvious benefits. First, ’s Gravesande was not in need of specific patronage to continue his research. Second, he was able to amassed large quantities of scientific instruments and supporting literature during his career. We know that after his death in 1742, ’s Gravesande’s cabinet of physical instruments was sold for 3981 guilders and 10 stuivers (20 stuivers being worth 1 guilder) to Leiden University, which can be estimated at roughly 40 000 euros in modern purchasing power. Similarly, the prices recorded on the auction catalogue of his library tell us that ’s Gravesande’s books were sold for more than 6000 guilders; his
maps, atlases, tools, mathematical instruments and a number of odd objects, including several guns, increased the profit of the auction to 6881 guilders and 1 stuiver.15

Even though ’s Gravesande’s salary increased steadily from 800 guilders per year in 1717 to 1800 guilders from 1734 onwards,16 we know that outside money must have been involved. First, ’s Gravesande illustrated many instruments in the first edition of his *Physicae Elementa*, which appeared in 1719.17 There is every reason to believe that the instruments had already been built and paid for at that time. Second, we know that in 1723, ’s Gravesande bought a magnificent house at the Rapenburg, Leiden’s foremost canal, for 5000 guilders,18 which he could hardly have afforded from his annual salary at the university.19 ’s Gravesande rebuilt part of the house in 1724 and thus rendered it in its modern form. After his death the renovated house was sold for 13 044 guilders by his widow. The property alone sold after ’s Gravesande death—his instruments, library and house—together amounted to 250 000 euros in modern purchasing power.20

Thus, it is evident that ’s Gravesande was well-to-do. Although this still needed to be proved, it is something that many commentators expected.21 Another very interesting detail about the ’s Gravesande family that has largely been passed over, however, is the fact that several of Willem Jacob’s direct ancestors showed considerable skill and interest in scholarly and engineering matters. From the biography of Allamand we know that ’s Gravesande was descended from the physician Johannes Heurnius (1543–1601), an innovator in medical and anatomical methods and one of the most famous figures in the early history of Leiden University.22 Much more interesting than this distant link, however, is the fact that ’s Gravesande’s mother was the daughter of one Nicolaas Blom, an engineer and overseer of fortifications,23 and that ’s Gravesande’s own father, Dirk, showed considerable interest in scientific matters himself. In 1690, for instance, when Willem Jacob was two years old, a ‘Dirck Schravesande’ applied on a national level for a patent for horizontal windmills, which could be used both on land and on water.24 Although I do not have definitive proof that this Dirck was the same person as Willem Jacob’s father, it is extremely likely that he was. The family name is not common, and Dirk had by then already entered far into scientific terrain. In the late 1680s, indeed, he had been corresponding with none other than the Huygens brothers on the topic of lens grinding.

The first appearance of Dirk in Christiaan Huygens’s *Oeuvres Complètes* is in March 1686, when Constantijn Jr tells his brother that he ‘has come to write to ’s Gravesande to have another 12 pieces of this glass made for me, as I told you before’.25 Obviously, the Huygens brothers already knew at this point who Dirk ’s Gravesande from ‘Bolduc’ (’s-Hertogenbosch) was. Constantijn wrote about these glasses, which he was still expecting, in another couple of letters to Christiaan26 before the lenses arrived and Christiaan was able to test them.27 Some other letters make mention of Dirk and his lenses in the meantime,28 but the one that definitely identifies Dirk as the father of our ’s Gravesande is a letter written on 7 October 1686, in which Christiaan tells Constantijn that ‘it has been four or five days since Messrs Sgravesande and Blom have come to see me and brought me again some samples of glass’.29 As we have seen, Dirk ’s Gravesande was married to a Blom, and the person he brought to Christiaan Huygens was almost certainly a family member, probably his father-in-law or a brother-in-law.30 Unfortunately for Dirk, Christiaan deemed his own lenses better than those of Bolduc. Yet he still believed that his contacts with ’s Gravesande might help him to test some of Constantijn’s lenses with long focal distances.31
Even though his lenses might not have been of the quality desired by the Huygens brothers, it seems beyond doubt that Dirk ’s Gravesande was both interested in optical and engineering matters and that he had some skill in those areas: Christiaan and Constantijn would certainly not have been awaiting the ‘Bolduc lenses’ eagerly if they had not deemed Dirk ’s Gravesande capable of doing interesting things. We can therefore assume that Willem Jacob ’s Gravesande received a solid education in these topics, one that would enable him to exploit his talents. Without providing a rationale for it, this is also what Allamand has claimed in a paragraph focusing on a mister Tourton, ’s Gravesande private teacher. Tourton plays the role of a master who cannot keep up with his juvenile student: according to Allamand, ’s Gravesande was so talented that Tourton had to study day and night to do so, and the headmaster of his school in ’s-Hertogenbosch asked ’s Gravesande to lecture on mathematics when the regular teacher was absent. Luckily, we no longer have to rely on these stories to affirm that ’s Gravesande was well prepared to study mathematical and physical topics when he left home in 1704 at the age of 15 years.

LAW, MORAL PHILOSOPHY AND JOURNALISM IN LEIDEN AND THE HAGUE

Little is known about ’s Gravesande’s student years. We know that he enrolled as a law student in 1704 and that he graduated three years later in 1707 on the very same day as his elder brother, Ewout, and his younger brother, Cornelis, who were both students of law as well. Ewout would follow in the footsteps of both their father and their eldest brother, Pieter, and become a ‘schepen’ of ’s-Hertogenbosch; Cornelis would be less fortunate: he died of unknown causes in 1714, at the age of 23 years. It seems that Willem Jacob had a quiet time during his studies: he concluded them rapidly and at a young age. According to legend, ’s Gravesande prepared and completed his first book-length study, the Essai de Perspective, during classes that did not interest him but that he showed up to in obedience to his father. However, as the Essai was only published in 1711, four years after his graduation, I think we can safely assume that this story is at best only partly true. The Essai, to which I will return in a moment, shows many signs of continued work and improvement, and it seems likely that ’s Gravesande kept working on the manuscript in the years after his studies in Leiden.

As far as is known, ’s Gravesande received no significant training in either mathematics or philosophy during his studies in Leiden. He graduated with a dissertation in which he discussed the moral implications of suicide, the Dissertatio juridica inauguralis de autocheiria. Little attention has been paid to this work so far; although some historians have mentioned it, most of those who have passed over it as an oddity in ’s Gravesande’s oeuvre. This is far from the actual state of affairs. The title of the first chapter of De autocheiria reads, ‘First chapter, in which suicide is proven to be illicit, and the Stoic sentiment is refuted’, and indicates that this is a work on moral philosophy rather than the practice of law. ’s Gravesande continued to write on moral philosophy for his whole life. This was not simply a sideshow in a great career of a physicist: in 1734 ’s Gravesande became Professor of Philosophy in its totality and had to teach logic and morals as well as mathematics, physics and astronomy. His third and last oration dealt extensively with moral philosophy, and his highly successful Introductio ad Philosophiam of 1736 drew heavily on his earlier work on the topic. In fact, of the two volumes of his
posthumously published *Oeuvres*, the entire second volume deals with topics belonging to what we would call philosophy proper rather than physics or natural philosophy.37

Right after their studies, ’s Gravesande and his two brothers moved, according to Allamand, to The Hague ‘to apply themselves to the practice of law there’.38 Allamand’s biography after this jumps straight to 1713, when ’s Gravesande became one of the founding editors of the *Journal Littéraire*. Allamand gives some details but no informed account on what happened in the intervening six years, which is the main reason why there have so far only been speculations on ’s Gravesande’s doings in these years. In the last part of this article I will partly remedy this defect by discussing ’s Gravesande’s network and his mathematical endeavours in that period. First, however, I will briefly address the *Journal*, about which much more has already been written.

In his period in The Hague ’s Gravesande moved into literary and intellectual circles. It is not known exactly how and when this happened, but we can assume that ’s Gravesande gradually enlarged his network from his student years onwards. In 1713, still only 24 years old, he became part of the editorial board of the *Journal*, which he founded together with a group of friends—predominantly young—including several Huguenot refugees as well as the experienced journalist Justus van Effen and the literary polymath Prosper Marchand. In 1720 ’s Gravesande married Anne (or Anna) Sacrelaire, a cousin of Henri Alexandre, the secretary of the society.39 The *Journal*, which from its very beginning aroused much interest in the literary world, consisted mostly of lengthy book reviews, covering topics ranging from mathematics and law theory to news from the republic of letters and modern literature. Because the editors were committed to an ideal of impartiality, the reviews were presented anonymously: the editors shared responsibility for their content.40 Fortunately for us, some of the lengthier pieces can be identified as being ’s Gravesande’s, and some separate articles even bear his name.

The editors of the *Journal* have been linked to various allegedly radical, republican and masonic circles in the work of Margaret C. Jacob. According to Jacob, the *Journal* was published by a society descending directly from a secret group called *Les Chevaliers de la Jubilation*, which takes a central position in an international network of radicals that is the subject of her extremely stimulating *The radical enlightenment*.41 However, various authors have shown that the links under consideration do not stand the test of scrutiny: the so-called *Chevaliers* were far less radical than Jacob has claimed,42 and the link between that group and the editors of the *Journal* is not as close as she assumes it to be: her identification is based primarily on the simple fact that one person, Prosper Marchand, was a member of both groups. Yet, contrary to what Jacob argues, Marchand was not a founding editor of the *Journal* but joined the collective only later; this undermines her thesis that the group rendering the *Journal* was a direct successor of the *Chevaliers*.43 Moreover, Jacob fails to prove that Marchand was in fact as radical as she argues.44

I consider the evidence brought against Jacob’s thesis concerning the radicalism of these circles by the works of Gibbs, Berkvens-Stevelinck and Léonie Maass to be especially decisive. However, because Jacob’s claims about these groups, including ’s Gravesande’s involvement with them, continue to be repeated,45 I will say a few words here about her take on ’s Gravesande. Mostly by conjecture, Jacob places ’s Gravesande in a network of radicals, among whom were the freethinkers John Toland and Anthony Collins, whom he would have met via Prince Eugène de Savoy during the Spanish War of Succession; through them, Jacob links ’s Gravesande with English Whigs in general. As in many
other places, because of a lack of references it is not clear from Jacob’s account what her source is for this connection. To my knowledge Allamand’s biography is the only source that mentions ’s Gravesande’s contacts with Prince Eugène. Yet there is no hint whatsoever of extensive interaction between the two in Allamand’s piece: Allamand mentions only that Eugène knew personally of ’s Gravesande’s work in codebreaking—to which I will return below. Moreover, the contacts between Toland and Eugène have recently been questioned.46 On both links, those between ’s Gravesande and Eugène first and between Eugène and Toland second, there is too much uncertainty to assert that ’s Gravesande and Toland actually knew each other.47

Similar inaccuracies can be found, for instance, in Jacob’s claim that ’s Gravesande ‘embraced the Newtonian faith as mediated by the vehicle of Freemasonry’.48 As is well known, ’s Gravesande clashed especially with Samuel Clarke on the right understanding of Newtonianism and did not support ‘the Newtonian faith’.49 Neither is it true that ’s Gravesande’s ‘early and life-long association with freethinkers such as Marchand, Levier and Saint-Hyacinthe, rendered him a tolerant man and even opened him to the accusation . . . of spinozism.’50 What got ’s Gravesande accused of Spinozism were not his associations with freethinkers but rather the content of his 1736 Introductio ad Philosophiam,51 in which he espoused an idea of liberty directly opposed to that of many of the English Newtonians. His tolerance towards Saint-Hyacinthe, a deistic co-editor of the Journal, is not exactly beyond question either: as Allamand has recounted, ’s Gravesande and Saint-Hyacinthe clashed very early in the history of the journal on the question of whether ’s Gravesande was allowed to show his sympathies for a thoroughly apologetic Christian work he was reviewing. Only two years later, Saint-Hyacinthe was the first of the editors to leave the Journal.52 Jacob’s claim that ’s Gravesande ‘was, of course, one of the original “frères” in that literary society’ related to the journal similarly cannot be defended on the basis of the available documents.53

That there is very little reason to believe that ’s Gravesande was either a crypto-radical or a deist is furthermore indicated by two letters he published in the Journal himself, the first in the 1714 edition on the question of whether one was allowed to lie, and the second in 1718 on the philosophical definition of liberty. On the very first page of the former, which according to Allamand caught the attention of the famous professor of law Jean Barbeyrac, ’s Gravesande argued that he held a strict view on the question, and that he believed this was ‘in accordance with natural law and the morals of Jesus Christ’.54 On the basis of the fundamental liberty and equality of man, ’s Gravesande argued that man may never use speech to deceive or harm his neighbour. Withholding some things he allowed, but as long as one would speak, one should say nothing but the truth. Only when others first violated one’s rights and forced one to speak was this convention broken and one was allowed to tell lies.55

A similar rigour and appeal to the Christian God are evident in the second piece, the 1718 Lettre sur la Liberté. On the question of whether man’s actions were determined by his reason, ’s Gravesande argued that this must be so, because otherwise, one would have to deny ‘the divine foresight or prescience, but also the extent of God’s providence over most human actions’.56 Although the conclusion that ’s Gravesande reached in this second letter would prove to be controversial, his principles were categorically orthodox: predestination is of course one of the core tenets of Dutch Calvinism. Although it is not known exactly what beliefs ’s Gravesande subscribed to—he might have been a member of the Walloon Church57—there can be little doubt that he was committed to and inspired
by at least a basic form of Protestant Christianity, whether or not his contemporaries agreed with his views.

’S GRAVESANDE’S EARLY MATHEMATICAL CAREER AND DIPLOMATIC CONTACTS, CA. 1710–16

As discussed above, ’s Gravesande moved to The Hague after his studies in Leiden, supposedly to become a lawyer. It has often been assumed that he continued this business until 1717, when he was called to Leiden University. Although it seems certain that ’s Gravesande occasionally gave legal advice, I have serious doubts about whether this was his main profession for the entire period, especially for the later years. As I will show here, ’s Gravesande was occupied with many other things. In this section I will give a short overview of both ’s Gravesande’s network in higher politics and his mathematical writings in this period. For obvious reasons I cannot go into details and will instead focus on historical significance, especially where historical assessment is already available elsewhere.

So far I have found no information at all about the period 1707–10. I therefore do not know what ’s Gravesande was doing during these years, apart from completing the Essai de Perspective, which was published in 1711. With this little book on perspective, however, ’s Gravesande immediately set the standard for his later work. Kirsti Andersen, in her recent comprehensive study of mathematical perspective in the early modern period, lists ’s Gravesande’s work as one of the most important books in her story, and names ’s Gravesande himself as one of the five main characters in her work, together with such illustrious mathematicians as Simon Stevin and Brook Taylor. Another household name in the history of mathematics, Jean Bernoulli, contacted ’s Gravesande in March 1714 and praised him highly, saying ‘it is to be wished that you take the trouble to write on the other parts of optics with the same clarity and the same skill as you have done on perspective.’ Bernoulli might also have been the author of a very positive review of the Essai that appeared in the Leipzig journal Acta Eruditorum, as Andersen argues. The quality of the Essai is further illustrated by the fact that Taylor’s later work on perspective was significantly influenced by ’s Gravesande, that the book was popular is demonstrated by the appearance of a second edition as early as 1717.

I wish to draw attention to two remarkable aspects of the Essai de Perspective. The first is its dedication to Bruno van der Dussen, ‘pensionaris’ and mayor of Gouda, and one of the Dutch Republic’s most trusted diplomats and ambassadors in the first years of the eighteenth century. Like many of his family members, this Van der Dussen held important offices in Dutch water management, which of course indicates that he was interested in technical matters. Moreover, he was one of the major figures in the diplomatic endeavours to which the mission ’s Gravesande joined in 1715 belonged. As can be inferred from the dedication in the Essai, ’s Gravesande knew this top diplomat personally and might have served him at one point. It might very well be that ’s Gravesande had met one of Van der Dussen’s sons, who were about his age, in college: studying law at Leiden was the traditional training for patrician sons destined for the upper administrative echelons. The second point of interest in the Essai is the addition of a separate treatise on the camera obscura. In this treatise ’s Gravesande illustrated and described two different designs of the camera: a very elaborate chamber with a chair in it, and a portable machine. Both of these designs show a depth of detail that indicates strongly that ’s Gravesande had already
built these machines. If this is indeed the case, these machines, supposed to be tools for painters, are in fact the first instruments of ’s Gravesande’s design.65

As we have seen, the Essai provided ’s Gravesande with a valuable entry into the scholarly world. However, a couple of letters still exist that predate the Essai and show that ’s Gravesande was already an intermediary in scientific circles in 1710, in particular between William Burnet and Jean Bernoulli. To my knowledge these letters have never been referred to before. ’s Gravesande first appears in a letter from Burnet to Bernoulli in July 1710. As is well known, this Burnet was a son of the Anglican Bishop Gilbert Burnet, a confidant of stadtholder-king William III; William Burnet had studied with ’s Gravesande in Leiden, and in 1715 he proposed ’s Gravesande for Fellowship of the Royal Society.66 In 1710, in a letter to Bernoulli that discussed mainly mathematical topics, Burnet wrote that he would return to England soon but that Bernoulli could always reach him via ‘Mr. De Sgravesande, Avocat à la Haye’, who ‘has the most original genius for mathematics, but, as he is a lawyer, cannot give himself to it entirely. He has made beautiful discoveries in Perspective, whereof he will soon publish something, which I will send you right away.’67 From this letter we learn two things: first, that ’s Gravesande was still a lawyer in 1710, and second, that it was William Burnet, a former schoolmate, who introduced him not only to Newton and the Royal Society but also to Jean Bernoulli. Burnet, as will become increasingly clear here, was thus the essential figure in catapulting the unknown ’s Gravesande on to the mathematical scene.

The friendly correspondence between Burnet and Bernoulli was already well established at this point and concerned multiple issues. Besides the obvious mathematical subjects, one of these was Bernoulli’s refusal to accept a professorship at Leiden University, a question that involved Gerard Noodt, the renowned professor of law and consequently one of ’s Gravesande’s former teachers, and Jacob van Wassenaer Obdam, head of the board of the university. As Bernoulli himself explained, the offer was just not good enough (it was 1800 guilders per year at this point) to leave his present comfort in Basel, but Burnet tried to convince him either way.68 Another issue was the ‘injustice’ done by the Scottish mathematician John Craig in failing to acknowledge Bernoulli’s solutions to a particular problem, and later also those of Craig’s compatriot John Keill; Bernoulli reacted to Keill in particularly strong terms.69

Both of these issues spilled over in the brief early correspondence between ’s Gravesande and Bernoulli. In a first letter of September 1710 to Bernoulli, which ’s Gravesande sent to accompany another letter from Burnet to Bernoulli, ’s Gravesande wrote that he had come to talk to Obdam, who had told him that ‘what people say about Mr. Kiel are rumours without any foundation’. Besides trying thus to appease Bernoulli, ’s Gravesande added that after his talk to Obdam he still hoped that Bernoulli would come to Leiden.70 Bernoulli did not reply, and in January 1711 ’s Gravesande sent him another letter in which he, in the name of Obdam, repeated Leiden’s offer of 1800 guilders a year, and added that he himself would be very glad to see Bernoulli accept. Bernoulli replied in a very friendly manner to ’s Gravesande and thanked him for taking the trouble to act as an intermediary on his behalf, but made it very clear that he was not happy to get again the same offer he had already refused: Bernoulli wanted Obdam to offer at least 2500 guilders.71

Although the content of this correspondence may seem to be of little immediate interest, the fact that ’s Gravesande was in close contact with the most important figure on the board of Leiden University seven years before his own appointment is of course noteworthy. He subsequently kept in contact with both Burnet and the Bernoulli family;72 the latter
correspondence in particular became quite interesting. In 1712 ’s Gravesande had a lengthy correspondence with Nicolas Bernoulli, Jean’s nephew, on statistics. The occasion for this epistolary interaction was an article published in *Philosophical Transactions* by John Arbuthnot, who had crafted an argument for God’s providence out of a persistent imbalance between the number of boys and the number of girls born in London. ’s Gravesande agreed with Arbuthnot that this imbalance in the birth ratio demonstrated God’s providence, but improved Arbuthnot’s partly defective argument by calculating the chance of the numbers appearing as they did in great detail by using what we would now call binomial distribution. 73

In their correspondence on the topic, Bernoulli and ’s Gravesande discussed at length what statistical methods and concepts should be used to make sense of Arbuthnot’s data; as we learn from the first letter of the correspondence, they had also discussed this in person in The Hague when Bernoulli was en route to England, where he had also involved Burnet and Craig in the debate. 74 From this we can conclude that ’s Gravesande was becoming a participant in these mathematical circles around this time. His statistical treatment did, however, also arouse interest much closer to home. Bernard Nieuwentijt (1654–1718), the mayor of the city of Purmerend, whose ‘mathematical knowledge and skills were exceptional among his countrymen’, 75 included ’s Gravesande’s results in his 1715 *Het regt gebruik der werelt beschouwingen*. In this immensely popular work, Nieuwentijt set out to show that, in its right form, physics or natural philosophy would show the existence, providence and omnipresence of God; ‘the calculations, which the outstanding mathematician Mr. Willem Jan ’s Gravesande has made in a special way’, proved to be very useful for Nieuwentijt’s purpose. Nieuwentijt and ’s Gravesande referred to each other’s work another couple of times before Nieuwentijt’s death. 76

At some point in 1712 as well, we find another mathematical instrument designed by ’s Gravesande; as far as I am aware this was the first after the two camera obscuras. In his *Essai de Perspective* ’s Gravesande had added a chapter on sundials, and this is probably why Arent Wassenaer van Duyvenvoorde, again a prominent patrician, chose ’s Gravesande to design a horizontal sundial for his mansion’s garden. Although the chapter in the *Essai* definitely proved that ’s Gravesande mastered the subject, it was of little direct use in the design of the actual object because the chapter discussed how to form a vertical, inclined or declined sundial out of an already given horizontal one. 77 Nevertheless, the link with Duyvenvoorde proved to be of direct influence on the course of ’s Gravesande’s life. This Duyvenvoorde, as discussed in the introduction, was one of the leaders of the 1715–16 embassy to London to which ’s Gravesande acted as first secretary. Justus van Effen, mentioned above as a co-editor of the *Journal littéraire*, acted as second secretary to the embassy, perhaps on ’s Gravesande’s recommendation. Duyvenvoorde, in turn, allegedly recommended ’s Gravesande on the basis of Isaac Newton’s testimonial to Leiden University, where one of Duyvenvoorde’s relatives was a member of the board. 78

Although the Duyvenvoorde connection was obviously significant, we should not overestimate its importance. Between 1712 and 1715, ’s Gravesande had progressively enhanced his reputation. As arguably the most mathematically talented member of the *Journal*, there can be little doubt that it was ’s Gravesande who managed contacts with several renowned mathematicians. Among these were the aforementioned Keill and Christian Wolff, some of whose pieces were printed in the *Journal* in 1713 and 1714 pertaining to the priority dispute on the calculus between Newton and Leibniz. In particular Keill seems to have considered the *Journal* as a suitable vehicle for some
personal attacks. Wolff, in contrast, did not send more than one letter in reply: he probably had no interest in the kind of aggressive debate that Keill wanted to have; moreover, the *Journal* seems to have tended to side with Newton on these issues.\(^79\) This was much more openly the case on celestial dynamics. After a review of one of his books in which the reviewer of the *Journal* invoked Newton’s work, the Dutch natural philosopher Nicolaas Hartsoeker responded in some letters that Newton had not proven his claims in astronomy at all. These letters, together with answers from the editors, which we can reasonably assume to be ’s Gravesande’s, were printed in the 1713 and 1714 editions of the *Journal*. The consensus among mathematicians was to agree with the *Journal* that Hartsoeker’s arguments were flawed.\(^80\)

Besides these contacts with Keill, Wolff and Hartsoeker, ’s Gravesande also corresponded with Celestino Galiani, the foremost early ‘Newtonian’ of Italy between 1713–17, and he kept Galiani informed on Newton’s work in the later part of this period.\(^81\) ’s Gravesande’s first contact with Newton himself dates also from before his trip to London: in 1714 ’s Gravesande wrote a letter to Newton in which he offered his services, should Newton need anything done in the Netherlands. As Ad Maas has suggested, this might have been a ploy by ’s Gravesande to get in touch with Newton; Burnet and Keill, both ‘defenders’ of Newton, might have been involved in this manoeuvre as well.\(^82\) As we can also see from his correspondence with Jean Bernoulli, ’s Gravesande knew well how to flatter and befriend the mathematical giants of his time.

In 1714 ’s Gravesande also developed what has been called the first mathematical theory of the air pump,\(^83\) which was published under his name in the *Journal littéraire*.\(^84\) As becomes clear from the article and the practical details it contains, ’s Gravesande had at this point repeatedly worked with actual pumps: just as in his earlier description of the camera obscura, the article on the air pump was not a purely theoretical work. Besides the fact that the article proves that ’s Gravesande was developing his skills as instrument designer, it is noteworthy for two other reasons. The first is ’s Gravesande’s later cooperation with the instrument builder Jan van Musschenbroek. Together they went on to continue to develop air pumps; the article under consideration can be conceived as a starting point of their cooperation.\(^85\) The second point of interest is that the machine again put ’s Gravesande into contact with Nicolas Bernoulli, who in December 1715 praised ’s Gravesande’s mathematical treatment and used it as an opening to communicate a new theorem on logarithms of his own hand to ’s Gravesande.\(^86\) In the year before this, Nicolas’s uncle Jean Bernoulli, after reading the *Éssai de Perspective* and still remembering ’s Gravesande’s earlier kind words, had also considered ’s Gravesande worthy of being sent some of his mathematical work.\(^87\) Clearly, ’s Gravesande had become firmly entrenched in the world of mathematics by this time.

Besides the relations mentioned before, all relatively well documented, Allamand has written about two other occupations of ’s Gravesande about which I have not been able to find any independent evidence. For both of these, however, their very nature would not allow much information to be revealed. ’s Gravesande was allegedly asked to consult on matters of finance in 1711 by Treasurer-General Jacob Hop, another key diplomat of the Netherlands, and would have been involved in codebreaking during the War of the Spanish Succession, which ended in 1714. It is in this latter competence that ’s Gravesande would have come to the attention of Prince Eugène de Savoy, the legendary general of the Imperial Army.\(^88\) Given the connections discussed above, these stories are not in themselves incredible; in general there seems to be little direct indication that we should
distrust Allamand, and ’s Gravesande certainly had the mathematical skills required for both of these jobs. Yet we must remain cautious: the historian of cryptography Karl de Leeuw has searched extensively for proof of ’s Gravesande’s involvement in codebreaking, but has not been able to find any evidence for it.89

CONCLUSION

We have seen above that even before his trip to London, ’s Gravesande had written one outstanding book, the *Essai de Perspective*, and two very interesting mathematical tracts, one on air pumps and logarithms, and the other on statistics. We can also document that before 1715 he had been in contact with Jean Bernoulli, Nicolas Bernoulli, Burnet, Keill, Craig, Wolff, Newton, Galiani, Nieuwentijt and Hartsoeker. We can therefore conclude that he was quite well known in mathematical circles. At this point, ’s Gravesande had already designed two different camera obscuras, a sundial, and an air pump, and could count on the patronage of at least Van der Dussen, Obdam and Duyvenvoorde, mentioning only those with whom I have been able to document contacts. Meanwhile, ’s Gravesande continued to develop his moral philosophy. Considering that all of this was accomplished in just a couple of years, the list is quite impressive. ’s Gravesande’s well-known contacts in London would only have enhanced his budding reputation further.

Considering the names of those interested in his work, as well as the fact that mathematics was at a low point in the Netherlands,90 we cannot but conclude that ’s Gravesande was one of the most important, if not simply the leading, Dutch mathematician in the period leading up to his call to Leiden. Therefore, pace Maas, I believe that there is nothing strange in his appointment at the university: ’s Gravesande was both extremely well qualified and well connected. I would therefore even claim that the university could only have passed him over for someone of the calibre of a Jean Bernoulli, who, as we have seen here, had little interest in going to Leiden except on much better terms. It is a distinct possibility that ’s Gravesande and his main contacts, Burnet in particular, were drawing ’s Gravesande gradually closer to discussions on the Leiden chair of mathematics on purpose, especially in his early correspondence with Bernoulli on the professorship. As Willem Otterspeer has described in his history of Leiden University, negotiations and intermediaries were of utmost importance in the procedures that led to the appointment of professors around the turn of the eighteenth century, as were contacts with both the curators of the university and backing from the Republic of Letters.91 Needless to say, ’s Gravesande was in a very good position on all of these accounts; if his attempts were meant to get him the chair, he was very successful in his ploy.

The evidence collected here shows also that it is time to dismiss the story of ’s Gravesande’s meeting with Newton as the single decisive moment in his career. Without in any way wishing to claim here that Newton did not have an enormous influence on ’s Gravesande’s later work and development, I wish to stress that we must not overlook the fact that ’s Gravesande was already in the process of becoming an international heavyweight before his 1715 trip to London. Even though it might be against the conventions of historians to speculate on what might otherwise have happened, I shall conclude this article by doing exactly so: it is my belief that ’s Gravesande would eventually have become a professor of mathematics even if he had never met Isaac Newton. The specific timing of his call might be due to Newton’s
intervention, but ’s Gravesande had no need of that intervention to be perfectly eligible for the chair: he had done the hard work himself.

ACKNOWLEDGEMENTS

This article would not have been written without the help of Ad Maas and Tiemen Cocquyt, who share my enthusiasm for ’s Gravesande. Both Tiemen and Ad have made important contributions to my research by identifying previously unused documents and pieces of evidence, for which I wish to express my gratitude. Part of this research was carried out during a stay in Museum Boerhaave. I thank the museum and its staff for offering me their generous help and supplies. This article has benefited from comments of Bram van Besouw, Steffen Ducheyne, Ad Maas and the editor of Notes and Records. Research for this article was made possible by funding of the Research Foundation Flanders (project G002913).

NOTES


2 This article was first published in 1759; I will, however, refer to page numbers in the more accessible Oeuvres of ’s Gravesande; see J. N. S. Allamand, Oeuvres Philosophiques et Mathématiques de Mr. G. J. ’sGravesande (2 volumes) (Rey, Amsterdam, 1774), vol. 1, pp. ix–lix.


4 See, for instance, Wiep van Bunge, ‘Dutch Cartesian empiricism and the advent of Newtonianism’, in Cartesian empiricisms (ed. Minhea Dobre and Tammy Nyden), pp. 89–104 (Springer, Dordrecht, 2013). Interestingly, ’s Gravesande himself ardently distinguished his ‘Newtonian’ physics from overly speculative (i.e. Cartesian) natural philosophies in the preface to his Physics Elementa: see G. J. ’s Gravesande, Physics Elementa Mathematica, Experimentis Confirmata. Sive Introductio ad Philosophiam Newtonianam (Van der Aa, Lugduni Batavorum, 1720), Praefatio. This, however, should first and foremost be understood as an attempt to win his audience’s favour by juxtaposing his own empirical method with an excessive representation of its adversary. Thus, ’s Gravesande himself cast his work as ‘anti-dogmatic Newtonianism’.


7 See also Koenen, *op. cit.* (note 6), p. 267. The ’s Gravesandes originated from the area around Delft in Holland. Although we might expect one, the genealogies mentioned above do not give a link to the city of ’s-Gravezande, which lies about 20 km to the west of Delft.

8 Van der Wijck, *op. cit.* (note 6), p. 130.

9 For an introduction to the institutional history of ’s-Hertogenbosch see Jozef Hoekx and Valentijn Paquay, *Inventaris van het archief van de stad ’s-Hertogenbosch, 1262–1810* (Stadsarchief ’s-Hertogenbosch, ’s-Hertogenbosch, 2004). This publication gives the inventory of the archive of the city between 1262 and 1810. Dirck ’s Gravesande is frequently mentioned throughout the volume, especially as treasurer. The same goes for his three sons, Willem Jacob’s brothers, but, surprisingly, not for the latter’s grandfather Laurens.


11 Archive of notary Hendrick Wilmers, 1732, no. 91. This item can be found in the archive ‘Erfgoed Leiden en omstreken’, in ‘Archiefblok nr. 0506, Rubriek CLX, filegrp. 1865–1890; Inventaris nr. 1877’, pp. 411–412. (Available online via [https://www.erfgoedleiden.nl](https://www.erfgoedleiden.nl); accessed 4 January 2016.) The document mentions a ‘weylant groot vier mergen’, where a ‘mergen’ or ‘morgen’ is slightly less than a modern hectare. I thank Tim Huisman for help in deciphering this document.

12 These issues were of course problematic in the Royal Society, where figures such as Hooke and Desaguliers were ‘experimental servants’ of the regular Fellows, the ‘gentleman philosophers’, according to Stephen Pumfrey, ‘Who did the work? Experimental philosophers and public demonstrators in Augustan England’, *Br. J. Hist. Sci.* 28, 131–156 (1995), at p. 134. ’s Gravesande’s status seems to have been entirely different.


14 I have used the calculator of the International Institute for Social History, an institute of the Royal Netherlands Academy of Arts and Sciences ([http://www.iisg.nl/hpw/calculate-nl.php](http://www.iisg.nl/hpw/calculate-nl.php); accessed 5 January 2016). According to the calculator, 3981 guilders in 1742 had the same purchasing power as 42 620 euros in 2013. This is of course only a rough indication.


16 Molhuysen, *op. cit.* (note 13), vol. 4, pp. 295, 321 and 371; *ibid.*, vol. 5, pp. 94 and 141.

17 ’s Gravesande, *Physics, op. cit.* (note 3). Although the title page gives the date as 1720, the book had in fact already appeared in 1719; even the English translation of Desaguliers had appeared in December of that year: see Jeffrey R. Wigelsworth, ‘Competing to popularize Newtonian philosophy: John Theophilus Desaguliers and the preservation of reputation’, *Isis* 94, 435–455 (2003), at p. 437.

18 Th. H. Lunsingh Scheurleer, C. Willemijn Fock and A. J. van Dissel, *Het Rapenburg: Geschiedenis van een Leidse gracht, deel IVa: Leeuwenhorst* (Rijksuniversiteit Leiden, 1989), p. 144. The text here gives 50 000 guilders, but this is an obvious error because the house was sold two years earlier for 4700 guilders. See also p. 157, where it is stated that the previous owner made a profit of 300 guilders on selling it to ’s Gravesande.
This is especially the case given the fact that Leiden University had difficulties in paying their professors in these years. See Otterspeer, *op. cit.* (note 1), p. 71.

Lunsingh Scheurleer *et al.*, *op. cit.* (note 18), p. 144; I have used the same calculator as above (note 14).

See, for instance, the comments by P. L. Rijke, ‘Levensschets van Willem Jacob ’s Gravesande’, *Album der natuur*, 65–88 (1879), at p. 66.


See G. Doorman, *Octrooien voor uitvindingen in de Nederlanden uit de 16e-18e eeuw* (Martinus Nijhoff, ‘s-Gravenhage, 1940), p. 251, item G 535, which talks about ‘Orisontale Molens’. The rendering of the name in this form does not alter the pronunciation. Allamand, *op. cit.* (note 2), vol. 1, p. x, note D, states that Dirk was interested in scholarly matters but does not give any details.


Constantijn Huygens to Christiaan Huygens, 4, 6 and 18 April 1686, in *ibid.*, pp. 50, 51 and 54.

Christiaan Huygens to Constantijn Huygens, 26 April 1686, in *ibid.*, pp. 76–77.

Christiaan Huygens to Constantijn Huygens, 12 August, 16 and 26 September and 1 October 1686, in *ibid.*, pp. 85, 93, 98 and 100.

Christiaan Huygens to Constantijn Huygens, 7 October 1686, in *ibid.*, pp. 104–105. ‘Il y a 4 ou 5 jours que les S.rs Sgravesande et Blom me vinrent voir et m’apporterent encor quelques echantillons de verre.’

Furthermore, no other ‘Messrs ’ s Gravesande’ lived in ’s-Hertogenbosch at this time, as far as I can establish. Dirk’s father—the first ’s Gravesande to move to the city—and Dirk’s brothers had died before this time, and his own children and surviving nephews were still under age in 1686. See Van der Wijck, *op. cit.* (note 7), pp. 128–130.


Allamand, *op. cit.* (note 2), vol. 1, p. x, note E.

Molhuysen, *op. cit.* (note 13), vol. 4, p. 247*.

Van der Wijck, *op. cit.* (note 7), pp. 130–133.

The legend comes from Allamand, *op. cit.* (note 2), vol. 1, p. xi, note F, who, however, also indicates that ’s Gravesande continued to improve the manuscript after his studies.


See the collected works in Allamand, *op. cit.* (note 2), vol. 2. ’s Gravesande’s *Introductio ad Philosophiam; Metaphysicam et Logican continens* (Verbeek, Leidae, 1736), went through at least 16 editions in five different languages. For a list see De Pater, *op. cit.* (note 1), pp. 152–153. The only discussion of ’s Gravesande’s study and its importance for his later work is in Giambattista Gori, *La fondazione dell’esperienza in ’s Gravesande* (La Nuova Italia Editrice, Firenze, 1972), pp. 65–67 [in Italian].

Allamand, *op. cit.* (note 2), vol. 1, pp. xi–xii, ‘pour s’y appliquer à la pratique du Bareau’.

Maas, op. cit. (note 3), not to be confused with Maass, gives a very interesting interpretation of how this ‘impartiality’ fits in with ’s Gravesande’s scientific work.

Margaret C. Jacob, *The radical Enlightenment: pantheists, freemasons and republicans* (Cornerstone, Lafayette, LA, 2006 [1981]). I refer to page numbers in the second edition. Apart from the addition of a short preface at the expense of the bibliographical essay, there are only minor differences between the two editions.

See in particular Christiane Berkvens-Stevelinck, ‘Les Chevaliers de la Jubilation: maçonnérie ou libertinage? À propos de quelques publications de Margareth C. Jacob’, *Quaerendo* 13, 50–73 and 124–148 (1983), and G. C. Gibbs, ‘The radical Enlightenment’, *Br. J. Hist. Sci.* 17, 67–81 (1984). Both these authors have scrutinized parts of the corpus used by Jacob, have pointed to errors in interpretation and transcription in key pieces of evidence, and have shown that these texts in their original form do not support her thesis. As Gibbs concludes (p. 79): ‘so far as those whom [Jacob] designates as the principals of the radical enlightenment are concerned, the case for regarding them as a Masonic coterie of political, religious and social radicals... not only has not been proved, it scarcely exists.’ I am aware of Jacob’s reply to Berkvens-Stevelinck in Margaret C. Jacob, ‘The Knights of Jubilation—masonic and libertine: a reply’, *Quaerendo* 14, 63–75 (1984); a close reading shows that very few of the points Jacob makes there can withstand the combined criticisms mentioned above.

Maas, op. cit. (note 39), pp. 39–50, has done most to uncover the possible relations between the Chevaliers and the editors of the Journal. She distinguishes between those two groups and still another literary Assemblée. The links between the Assemblée and the Journal seem quite close, but neither of them is directly related to the Chevaliers according to Maas. On Marchand’s later joining the editors see Berkvens-Stevelinck, op. cit. (note 42), p. 137.

See Berkvens-Stevelinck, op. cit. (note 42) in general, and Gibbs, op. cit. (note 42), pp. 76–77 in particular, where Gibbs gives and reinterprets an extract from Marchand’s will that is key to Jacob’s identification of Marchand as a crypto-radical.


Toland’s works do not appear in ’s Gravesande’s library, cited above (note 15). Because there is a special category of ‘forbidden books’, containing works of Spinoza and La Peyrère, we cannot explain this by the fact that Toland’s work was too dangerous to be listed.

Jacob, op. cit. (note 41), p. 154.

See, for instance, Jonathan I. Israel, *Enlightenment contested: philosophy, modernity, and the emancipation of man 1670–1752* (Oxford University Press, 2006), pp. 215–222. Israel argues that ’s Gravesande deviated from the British Newtonians on their metaphysics, and their physico-theology in particular. Israel makes a much more interesting case for at least some strands of radical thought in ’s Gravesande’s work. There are some inaccuracies in Israel’s description of ’s Gravesande, but as Israel makes sufficiently clear, ’s Gravesande was not part of the radical wing of the Enlightenment. As the texts and controversies pertaining to
these issues are from the 1720s and 1730s, they fall out of the scope of this article. I shall discuss them elsewhere.

50 Jacob, *op. cit.* (note 41), p. 155.


53 Jacob, *op. cit.* (note 41), p. 225. The only document that links ’s Gravesande to the Assemblée mentioned above is a letter in which the Assemblée asks his legal advice; see Maass, *op. cit.* (note 39), p. 40. Maass believes that she does not have enough evidence to claim that ’s Gravesande was part of this society. The letter in question can be found in the archive of Leiden University Library, ‘Collectie Prosper Marchand: Marchand 1-portefeuille, Varia, folio 13’, and dates from 1717. Because of the fact that this document is from such a late date, it provides little information on ’s Gravesande’s earlier involvement with the Assemblée. I thank Steffen Ducheyne for sending me an electronic version of this document.

54 G. J. ’s Gravesande (anonymously), ‘Lettre à M. . . . sur le Mensonge’, *J. Litt.* 5, 254–270 (1714), at p. 254: ‘mon sentiment, qui me paroit conforme au Droit Naturel, & à la Morale de Jesus Christ.’ This letter is dated 17 August 1711 (see p. 270). The letter is anonymous, but I believe that Allamand’s claim that it is ’s Gravesande’s is warranted (Allamand, *op. cit.* (note 2), vol. 1, p. xiii). It displays both ’s Gravesande’s style and the peculiar axiomatic method he used in most of his philosophical writings, for instance the *Introductio, op. cit.* (note 37).


56 G. J. ’s Gravesande (anonymously), ‘Lettre envoyée au Libraire qui imprime ce Journal’, *J. Litt.* 10, 234–239 (1718), at p. 236: ‘leurs Adversaires, en nient cela, sont obligés de nier non seulement la certitude des Decrets de Dieu, & la prévision ou préscience divine, mais aussi l’étendue de la providence de Dieu sur la plupart des actions humains.’ In Allamand, *op. cit.* (note 2), vol. 2, pp. 216–218, this letter is reprinted, but the first part with a reference to a ‘livre Anglais’ is removed. This reference turns out to be to Anthony Collins’s deistic *A Philosophical Inquiry Concerning Human Liberty* (London, 1717), and this association is without a doubt the reason that Allamand expurgated the letter. However, as ’s Gravesande stated, he had not yet seen the book. Besides that, and notwithstanding the fact that his views on liberty remained close to those of Collins, whom he never mentioned by name as far as I know, ’s Gravesande would continue to argue that this understanding of liberty was compatible with Christianity in his later work. See, for instance, his *Introductio, op. cit.* (note 37). I will discuss these matters elsewhere in more detail.

57 Both his children were baptized in the Walloon Church; see the ‘doop-, trouw- en begraafregister 1696 – 1 mei 1748, Vrouwenkerk Leiden’, sheets 111 and 116 (https://www.erfgoedleiden.nl; accessed 7 January 2016). Incidentally, the ruins of the Vrouwenkerk are right in front of the Boerhaave Museum, where ’s Gravesande’s collection of scientific instruments is on display.

58 As I recently found out, Rijke (*op. cit.* (note 21), p. 66) shares my doubts. This question might possibly be settled by consulting the archives in The Hague.


60 Jean Bernoulli to ’s Gravesande, 20 March 1714: ‘Il seroit à souhaiter que Vous prissiez la peine d’ecrire sur les autres parties de l’Optique avec la meme netteté et avec la meme adresse que Vous l’avez fait sur la perspective.’ All letters from and to the Bernoullis referred to in this article can be found in ‘Basler Edition der Bernoulli-Briefwechsel’, edited by Fritz Nagel and Sulamith Gehr in cooperation with the library of Basel University. These letters can be found online via http://www.ub.unibas.ch/bernoulli/index.php/Hauptseite (accessed 8 January 2016).
63 The second edition was published in Rotterdam by Gaspar Fritsch in 1717. This must have happened before ’s Gravesande’s appointment in Leiden in the same year, because the title page describes him only as ‘docteur en droit, et membre de la société royale d’Angleterre’. On the title page of the first edition he is described only as ‘docteur en droit’; see G. J. ’s Gravesande, *Essai de Perspective* (Troyel, La Haye, 1711).
65 See the ‘Usage de la chambre obscure pour le dessein’, added to ’s Gravesande’s *Essai, op. cit.* (note 63), with separate numbering.
67 William Burnet to Jean Bernoulli, 8 July 1710: ‘Je croy de passer bien tot en Angleterre, mon adresse sera toujours à Mons. De Sgravesande, Avocat à la Haye, pour rendre à M. Burnet l’aïné. Celui que je viens de vous nommer est un des jeunes hommes que je connois qui a le plus de genie original pour les mathematiques, mais comme il est avocat, il ne pourra pas s’y donner entierement. Il a fait de belles decouvertes dans la Perspective, dont il imprimeria bientot quelque chose, que je vous envoyerois aussitot par quelque amy.’
68 Jean Bernoulli to William Burnet, 9 April 1710; see also the undated letter of Burnet to which this is a reply, and William Burnet to Jean Bernoulli, 13 May 1710. In this last letter Burnet notes that he is ‘à la Haye chez Mr. S’Gravensande avocat in de Nord end’, where ’s Gravesande therefore must have been living at this point.
69 See, for instance, Jean Bernoulli to William Burnet, 9 April 1710 and 3 August 1710. Keill and Bernoulli would soon become two of the main players in the nasty priority dispute between Newton and Leibniz concerning the calculus. On this dispute see A. Rupert Hall, *Philosophers at war: the quarrel between Newton and Leibniz* (Cambridge University Press, 1980).
70 Willem Jacob ’s Gravesande to Jean Bernoulli, 19 September 1710: ‘ce qu’on dit de Mr. S’Gravensande avocat in de Nord end’, where ’s Gravesande therefore must have been living at this point.
71 Willem Jacob ’s Gravesande to Jean Bernoulli, 6 January 1711; Jean Bernoulli to Willem Jacob ’s Gravesande, 16 January 1711.
72 For Burnet see, for instance, the ‘Lettre sur l’Utilité des Mathematiques’, in Allamand, *op. cit.* (note 2), vol. 1, pp. 313–317, in which ’s Gravesande defended mathematics against some deriding comments made by Jean Le Clerc in his *Bibliothe`que Choise* in 1709. This letter was addressed to a ‘Monsieur B.’ of the Royal Society, which we can safely assume to have been the same William Burnet.


Bernard Nieuwentijt, Het regt gebruik der werelt beschouwingen (Pauli, Amsterdam, 1715), p. 310: ‘de uiterrekening, die den uitmunten de Wis-kundige de Hr. en Mr. Willem Jan ’s Gravesande op een bysondere wyse daar over heeft gelieven te maken’. See Ducheyne and Van Besouw, op. cit. (note 73) and references therein for more on Nieuwentijt. Hr. was the Dutch equivalent of Mr.; the Dutch title Mr., in contrast, was specifically used for law graduates.


On this correspondence see, for instance, Gori, op. cit. (note 37), pp. 78, and Maass, op. cit. (note 39), pp. 189–196.


On this cooperation see Van Helden, op. cit. (note 83); I do not support all of Van Helden’s conclusions about the nature of the cooperation.


Jean Bernoulli to Willem Jacob ’s Gravesande, 20 March 1714: ‘Les marques d’affection que Vous m’avez temognées autrefois dans l’affaire de la vocation de Leyde ont été trop sensibles pour n’en être pas touché.... Voicy donc Monsieur un petit livre de ma composition.’ See also the quotation in note 60 from the same letter.

Allamand, op. cit. (note 2), vol. 1, p. lviii.


Vanpaemel, op. cit. (note 75), pp. 206–207.

Otterspeer, op. cit. (note 1); see pp. 72–79.