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## Newton and the Netherlands

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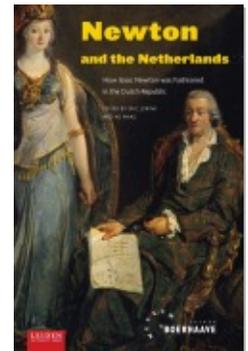
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# Defining the Supernatural

## *The Dutch Newtonians, the Bible and the Laws of Nature*

RIENK VERMIJ

‘Newtonianism’ is, as we all know, a problematic term.<sup>1</sup> Newton’s ideas were appropriated by different people in different ways and for different purposes, and not all concepts which came to be sold under Newton’s name actually stemmed from him. It is of little use to try to define a concept like ‘Newtonianism’ *a priori*, or based on our own preconceptions of the ‘real’ content or significance of Newton’s ideas. The study of Newtonianism should be a study of how far and why people at the time admired Newton, and what they felt his ideas meant, or should mean.

We can tackle the subject in both its wide and narrow senses. Newtonianism in a narrow sense can be equalled to the contemporary use of this or a similar term. ‘Newtonian philosophy’ was a term used by people at the time, so we may ask what exactly they meant by it. On the other hand, we can wonder why such concepts were attractive at all. If people invoked Newton, that was because his name came to be associated with a more general view of the world. Such a view would consist of many (in our view often disparate) elements, certainly not all of them directly originating with Newton, even if associated with his name. This Newtonianism in a wide sense is more difficult to define. Its identity is not fixed in a scientific or philosophical content, but is continuously reshaped by historical dynamics. In this essay, I will limit myself to the situation in the Dutch Republic, although some glances at the general European context will be found useful.

There appears to be by and large consensus about the main factors which in the Netherlands shaped ‘Newtonianism’ in its wide sense.

Newtonianism was on the one hand an answer to the confessional strife of the seventeenth century. It was hoped that Newton's ideas, or 'correct' scientific ideas generally, would serve as a rational foundation for both philosophical and religious truth, and thereby overcome doctrinal and confessional strife. On the other hand, it was an answer to, and an alternative for, the Cartesian philosophy which had dominated the second half of the seventeenth century. This Cartesianism was no longer acceptable for several reasons. Some of these were scientific, but for the large majority of people, the religious aspects of natural philosophy would weigh heavier. At the end of the seventeenth century, philosophical developments were upsetting established beliefs. Benedictus Spinoza (1632–1676) came forward with a philosophy which threatened the whole of religion. Newtonian philosophy made headway because it was seen as offering a decisive blow to the Spinozistic threat.<sup>2</sup>

In earlier work, I discussed the social dimensions of early Dutch Newtonianism, how it served as a way to obtain social and religious peace.<sup>3</sup> In this essay, though largely based on earlier research, I will concentrate on its more purely intellectual dimensions. It should be said from the outset that as a philosophy, Newtonianism is highly problematic. It consisted of various elements which appeared to cohere, but were not necessarily coherent. I will try to throw some light upon this complex by putting it in the context of contemporary debates. The formulation of a Newtonian philosophy cannot be explained just by the impact of Newton's writings, nor even as a reaction to René Descartes (1596–1650) and Spinoza. The relevance of Newton's work imposed itself only after 1713, when the second edition of the *Principia* was published. Spinoza's work had been around since 1670 and 1677. The Newtonian alternative was therefore formulated rather late. Indeed, there had been several earlier (failed) attempts to bring natural philosophy in agreement with the demands of religion. The Newtonians were well aware of these and the outcome of the earlier debates influenced their ideas as much as the specific things Newton had to say. In the end, the issue that mattered most was the authority of the Bible. Purely philosophical problems were secondary.

### **Dutch Newtonians: People and ideas**

First of all, let us have a short view on the people who, under our wide definition, we might label 'Newtonians'. This will also give us some idea of the various reasons why people admired Newton. Among

the first propagators of 'Newtonianism' were the scientific amateurs in the circle of Adriaan Verwer (c.1655–1717) in Amsterdam in the 1710s. Members included Lambert ten Kate (1674–1731) and Bernard Nieuwentijt (1654–1717). These people had been worried by Spinozism for a long time. Under the influence of some of Newton's friends, like David Gregory (1659–1708), they became aware of the apologetic potential of Newton's work and seized upon it as an orthodox form of natural philosophy to counter the Spinozistic threat. Their use of Newton's theories was selective and, from the point of view of modern science, defective. (On Ten Kate for instance, see the contribution by Dijksterhuis in this volume.) Newton had to fit in with their preconceived ideas. Bernard Nieuwentijt, the most influential member of the group, appears also the most lukewarm about Newton's theory of universal gravitation.<sup>4</sup>

Also in contact with Verwer and his friends was the journalist Jean Le Clerc (1657–1736), who discussed Newtonian ideas in his journals. A francophone who edited a French journal, he moved in different circles and he had his own contacts with England (he even read English). Le Clerc's aims as a journalist may have been slightly different from those of the Amsterdam amateurs, but his worries appear very similar. He presented Newton as a new philosopher who would counter the atheistic tendencies of his time. His extract of George Cheyne's *Principles of natural religion* (1715), which he presented as a specimen of Newton's philosophy, was later translated into Dutch by Ten Kate and published separately. Le Clerc again commended this edition in his journal. It appeared like a kind of systematic campaign.<sup>5</sup>

Probably the most prominent or conspicuous Dutch 'Newtonians' were the academic teachers who expressly claimed to be propagating Newton's theories in their lectures and textbooks. Among the first generation of Newtonian professors, the most influential were Willem Jacob's Gravesande (1688–1742), who obtained a chair at Leiden in 1717, and Petrus van Musschenbroek (1687–1747), who in succession was a professor at Duisburg (1719), Utrecht (1723) and Leiden (1739).<sup>6</sup> The professors' main aim was to explain natural philosophy to students, not to practice religious apologetics, but that is not to say that the latter was completely off their minds. The modern strict division between scientific, philosophical and religious knowledge did not exist at the time. Gravesande and Van Musschenbroek had been introduced to Newton's theories by English scientists, during trips to

England, but there was also common ground with the above mentioned amateurs. 's Gravesande and Nieuwentijt maintained contacts well before the former went to England or became a professor. In 1715, Nieuwentijt referred to 's Gravesande when discussing an apologetical argument by John Arbuthnot (1667–1735) and presented 's Gravesande with a copy of the book wherein it was published. This book then was reviewed at great length in the *Journal littéraire de La Haye*, of which 's Gravesande was an editor.<sup>7</sup>

Somewhat different is the case of Jacob Odé (b. 1698), who in 1723 became a professor at Utrecht along with Van Musschenbroek. Odé had not been so privileged as to get first-hand knowledge of the new theories from English scientists. Whereas 's Gravesande and Van Musschenbroek aimed to completely restructure natural philosophy on the foundation of Newton's theories, Odé was more cautious in this respect. His use of Newton's theories remained more piecemeal, trying to harmonize old and new ideas. Still, he too saw good use for Newton's ideas and in the course of his career these gradually became more prominent in his writings. His recognition of their apologetical potential appears to have been an important stimulus.<sup>8</sup>

Even if all of these people had their own purposes and referred to different aspects of Newton's writings, they could still regard each other as participants in a common project. Broadly speaking, this project was defining the relation between God and nature in a way which answered both scientific and religious demands. Still, this 'project' did not comprehend a systematic or coherent philosophy. Rather, it was a complex of ideas which consisted of heterogeneous elements. Some ideas came from Newton's work, others were borrowed from the early English 'Newtonians', who of course were just as heterogeneous a group. Moreover, different people emphasised various elements more than others. We can list the most important of these elements.

The most obvious 'Newtonian' element is the inference from Newton's theory of universal gravitation that there are decidedly non-mechanical forces at work in the universe; and hence, that mechanical principles cannot explain everything. The argument was proposed first by Roger Cotes (1612–1716) in the preface to the second edition of Newton's *Principia* and much used abroad. In the Dutch Republic, the argument was particularly advanced by Le Clerc. We find an echo in Odé's textbook of 1727, where he defines gravity as a quality added to matter, impressed by the supreme Creator with the purpose that bodies will

strive towards the centre of the celestial bodies or be moved around them. This gravity is not natural but effected by the Divine will.<sup>9</sup>

Another important element is the argument from design, the idea that the world cannot have its origin in mere mechanical causes, but can only be explained by the actions of an all-wise, powerful and benevolent Creator. This is of course much older than Newton, but was reformulated by English apologists close to Newton. It became one of the most popular apologetic arguments of the eighteenth century and gave rise to a whole genre of apologetic literature, called physico-theology. In the Netherlands, Bernard Nieuwentijt was the most important representative. Lambert ten Kate also was among the pioneers with his translation of Cheyne. But the physico-theological argument was also looked upon favourably by professors, as Van Musschenbroek and Johannes Lulofs (1711–1768), a student of Van Musschenbroek and 's Gravesande's successor at Leiden.<sup>10</sup>

A third element is experimental philosophy, used to refute not only Cartesian speculations, but also Spinoza's geometrical way of reasoning. This idea too is older than Newtonianism. It can be claimed that it owes as much to Robert Boyle (1627–1691) as to Isaac Newton, though it nevertheless became part and parcel in the Newtonian argument. Experimental philosophy pervaded the eighteenth century. It not just propagated experimentation, but also denounced speculative philosophy. As such, it was not just a scientific method, but also a social strategy for defending orthodoxy and dealing with dissent. It was an essential element of the academic teaching of philosophy, in particular in the courses of 's Gravesande and Van Musschenbroek. But it was also used for apologetics. Here again, Nieuwentijt was the most important early propagator in the Dutch Republic.<sup>11</sup>

Finally, we should point to a (from our point of view) more purely philosophical element, the emphasis on theological voluntarism.<sup>12</sup> This in itself was no new stance. The question concerned is the relation between God and His creation. Voluntarists maintain that the world depends on God's will. That is, God could have created things differently, had He wanted so, and still may intervene at any moment. This position opposes the view that God wills only the best (which is *a priori* given) and is limited by his own decisions (which are eternal). Newton emphatically defended God's absolute freedom of action, in his 'General Scholium' and in the controversy with Gottfried Leibniz (1646–1716) which his follower Samuel Clarke (1675–1729) had fought in

his name. Voluntarism was much favoured in the eighteenth century as it countered the unwelcome consequences of Cartesian and mechanical philosophy and refuted the claims of materialistic philosophers. The philosopher who had most radically limited God's freedom in this way was, again, Spinoza. The Dutch Newtonians were well aware of his work and of the need to refute it, as will become clear in the next section.

### **Newtonianism as an answer to philosophical problems**

The novelty of 'Newtonianism' laid not so much in the disparate elements, many of which had been familiar for long, but in the cocktail. Newton's unique authority as scientist and mathematician was used to promote an apologetic, anti-mechanistic and anti-Cartesian worldview. But of course this would not have happened had the philosophical constellation not favoured it. The old Cartesian philosophy, which so far had offered the main legitimation for scientific research, had run into trouble, in particular because of Spinoza's work. Eighteenth-century 'Newtonianism' was in large part an attempt to create a viable philosophy of nature that on the one hand would account for all the scientific discoveries of the previous century, but on the other would avoid the problems of the mechanical philosophy.

The main problem concerned the relation between God and nature. Descartes had claimed that God acted by immutable and universal laws of nature. As a new and upsetting concept, these laws demanded a philosophical and theological justification. As John Henry has argued, this was the main reason for the emergence of what Amos Funkenstein described as 'secular theology', the seventeenth century field which discussed the relation between God and nature. This thinking referred to medieval scholastic tradition, but its lynchpin was Descartes' explanation of his laws. Descartes explained that the laws of nature were the direct expression of God's will. As God was eternal and immutable, so were the laws of nature. Any change in the universe had to be explained by laws which were immutable themselves.<sup>13</sup>

The problem with this idea was that Descartes' identification of the laws of nature with God's eternal will made it difficult to maintain that God could still sidestep the laws of nature. Spinoza drew the utmost conclusion and identified God and nature altogether. Hence, the laws of nature were strictly necessary. God, or nature, acted in an eternally unchanging way. Miracles and special providence had no place, neither in the order of nature, nor even in the divine order. As Edgar

Ziisel stated, 'Spinoza is the first author combining general metaphysical determinism with the modern concept of natural law'.<sup>14</sup> Spinoza thereby did away with the traditional concept of God as a transcendent governor of the world who cared for his creation, and he did so following the leading thoughts of Cartesian philosophy.

Descartes' interpretation of the laws of nature therefore led to consequences which were deemed unacceptable. This discredited the field of 'secular theology'. The project attempting to metaphysically bolster the laws of nature was therefore abandoned – one of the reasons, it would seem, for the turn to experimental philosophy. Eighteenth-century proponents of natural philosophy had to find other ways to justify their undertaking. Newtonian authors still regarded the laws of nature as a cornerstone of natural philosophy, but would no longer see them as a consequence of God's immutability. They would claim that the laws of nature were free, and by no means necessary, dispositions of God. The examples of British authors emphasizing this point (Newton, Cotes, etc.) are too familiar to be repeated here. This interpretation tallied nicely with the new emphasis on experimental philosophy, theological voluntarism and the argument from design.

Newtonian philosophy was embraced as a way to maintain an active Divine presence in a world which was increasingly seen in scientific terms. A definition of the laws of nature which left room for divine miracles was one of the major requirements. This is also true for the early Dutch Newtonians. Laws of nature play a very prominent role in the work of Nieuwentijt. The 27th chapter in his book *Het regt gebruik* bears the title: 'On some laws of nature'. As if that were not enough, the 28th is called: 'On some chemical laws of nature'. Taken together, these two chapters make up over a hundred pages.<sup>15</sup> In these chapters, Nieuwentijt aims to demonstrate that God 'acts not only rationally, not only incomprehensibly, but also according to his pleasure, not forced by any necessity, and freely'.<sup>16</sup> This latter argument is one of the main themes, not just of these two chapters, but of the book as a whole. Time and time again Nieuwentijt rejects the Spinozistic opinion that everything in nature is dependent upon necessary laws. If the laws of nature were necessary, he argues, they should always produce the same effects. The abundant variation of nature therefore argues for an all-powerful Creator.

Nieuwentijt gave many examples, be it not all of them convincing to a modern reader. The fact that fishes live under water shows that

a God and adorable wise and intelligent Being manifests itself in their formation; Who, having for other animals made the air so indispensable that without it they can hardly a minute survive, now, in creating these water animals, has demonstrated irrefutably that one can deduce their origin and nature only from a wisdom which arranges everything according to his pleasure, and not from any laws of nature which are necessary and therefore always operate in the same way.<sup>17</sup>

In the formation of the dragonfly, God

thought fit to make the eyes thereof immovable, which in bigger Creatures can be turned to all sides; showing thereby that he does everything according to his good pleasure, and will be bound to no Laws. An Atheist, who feels that everything happens by an unwitting necessity, should learn from this [...] that he who has made the eyes of animals is not limited to one and the same way in accomplishing something, but that this diversity in works shows not unclearly that his wisdom, making the very laws, has power to arrange things according to his good pleasure.<sup>18</sup>

Dutch academic textbooks also pay due attention to the character of the laws of nature. 's Gravesande introduced the laws of nature in a way which is clearly reminiscent of Descartes. However, the immutability of the laws of nature is no longer explained from God's majesty, which makes Him to work always in the same way, as earlier philosophers would have it. According to 's Gravesande, the immutability is a result of God's goodness. If the laws of nature were variable, human life would not be predictable. The food that was safe yesterday, might be dangerous today. It is only because of the fact that God has established fixed laws that man can exist in safety. By means of these laws, humans can draw conclusions about the world from analogy.<sup>19</sup> In other words, the laws of nature are the result of design. They are fixed because they thus serve better the purposes of the all-wise Architect; but God could change the laws any time if this would fit His purpose better.

Petrus van Musschenbroek in his textbook simply followed 's Gravesande. He expressly disavowed any speculation on the origin of the laws of nature, but stresses their voluntaristic character: 'God, accord-

ing to his omnipotence, could have established other laws as the ones we find now. True, we do not see the reasons, why he has chosen and established the like, because of the limits of our small understanding. But it should satisfy us to see that everything has been made and ordained very wisely'.<sup>20</sup>

### **The Bible in the new science**

The rise of Newtonianism can be described as a philosophical answer to philosophical problems. Still, this cannot be the whole story. For why would people be so worried about maintaining an idea of divine miracles? The idea of a passive, mechanical nature had become popular exactly because it reduced comets, earthquakes, monsters, and so on, which had often been explained as divine signs and warnings, to the status of mere natural phenomena without any special meaning. People had become wary of vitalistic or occult principles, sympathies or antipathies, omens and prodigies; they no longer saw the sphere of the magical or the divine to interpenetrate that of the natural, everyday world.

In the eighteenth century, this attitude would not change very much. The Newtonians were as little inclined as their Cartesian predecessors to regard comets or monsters as special Divine providences. They might have felt more free to speculate on the purposes God might have had in designing such phenomena (most often, they claimed they served the well-being of mankind), but the phenomena themselves should be explained from the known universal laws which governed the whole of nature. If this was so, one might well wonder why natural philosophers were so upset about Spinoza's dismissal of miracles. Many seventeenth-century protestant theologians held that the age of miracles was over anyway.

That miracles were a sensitive topic was not because the miraculous still played a role in people's daily lives, but because miracles were mentioned quite prominently in the Bible. Denying the reality of miracles amounted to denying the truth of the biblical story and hence, it was felt, to undermining all religion. Actually, this was what made Spinoza's rejection of miracles so outrageous. His arguments seemed not much different from those of many other seventeenth-century philosophers. But whereas those philosophers had only spoken in terms of natural philosophy and had carefully left religion alone, Spinoza expressly applied his principles to the miracles in the Bible. For

the great majority of his contemporaries, this was definitely a bridge too far. People accepted gladly that their day-to-day world was 'disenchanted' and devoid of miracles. But at the same time they emphatically defended that the biblical miracles had been real.<sup>21</sup>

The debate on miracles and the laws of nature, which was a central question in the rise of 'Newtonianism', was really a debate about the authority of the Bible. This debate on biblical authority affected the formulation or defence of many other ideas as well. It is easy to regard physico-theology, experimental philosophy, and other elements of 'Newtonianism', as purely philosophical or intellectual positions, but in reality, such positions almost always served the purpose of salvaging a traditional interpretation of the Bible. Nieuwentijt is definite about this. About half of his book is devoted to defending a literal reading of the Bible. Experimental philosophy is for him not just an argument against philosophical speculation, but also for Biblical truth. The Bible is a book of facts and observations, written by an all-wise Author. According to experimental principles, one therefore has to accept its sayings at face value.<sup>22</sup>

In defending biblical truth, authors joined a long-standing debate. The rise of the new philosophy in the Dutch Republic had from the beginning been accompanied by fierce polemics on the religious consequences. Although these debates touched on all kinds of subjects, the authority of the Bible had been the crucial point. By 1656, a huge pamphlet war had erupted over the Copernican system, on the question whether the Earth moves or not. Cartesian theologians accepted the findings of modern philosophy and astronomy and maintained that the sentences of the Bible which appeared to state or imply the opposite, should be interpreted in a different way. In philosophical or cosmological matters, the Bible should be taken as representing the world as things appear to us, not as how they really are in a philosophical sense. Their traditionalist opponents, on the other hand, led by the Utrecht professor of theology Gisbertus Voetius (1589–1676), held that the Bible was the one and only source of real truth and regarded it as irreligious to modify its interpretation according to the secular sciences. Other debates of the period also came down to the question of biblical authority. The question whether animals are machines was initially waged in terms of the interpretation of biblical sentences.<sup>23</sup>

The debates of the 1650s and later ended in a stalemate, with an important part of the theologians accepting the accommodating Bible

interpretations, and another part denouncing it. It should be stressed that both parties kept to the Bible as a source of divine truth. Most theologians who defended accommodation were in theological matters followers of Johannes Cocceius (1603–1669), who gave the Bible a very central place in belief and spiritual life. The uneasy balance would not last, however. A principled attack on the sole authority of the Bible came in 1666 with Lodewijk Meyer's book *Philosophia S. Scripturae interpres*, wherein he argued that theology was subordinated to philosophy – biblical exegesis should direct itself to truth as established by sane reason. In 1670 was published Spinoza's *Tractatus theologico-politicus* with the infamous chapter 'On miracles'. These authors made clear that the stakes were much higher and casted doubt upon the earlier strategies which tried to defend the new philosophy while at the same time upholding the authority of the Bible.<sup>24</sup>

Consequently, it would be wrong to regard the debate about the principles of natural philosophy as one on purely philosophical questions. If there was a problem with the legitimation of Cartesian philosophy and the laws of nature, this was because there was a problem with accommodating these insights to the Bible.

### **The interpretation of the Bible at the end of the seventeenth century**

The question of how the Bible should be read in the light of the new philosophical and scientific insights was a heavily debated one in the last years of the seventeenth century, well before the rise of Newtonianism. This was not so much a debate between Spinozistic free-thinkers and the defenders of orthodoxy, although this opposition was heavily looming in the background. Nor was it a debate between Voetian literalists and Cartesian (or Cocceian) accommodators, although these parties still existed. Rather, it was a debate of accommodating and scientifically-minded theologians and philosophers among themselves. This implies that the first Dutch 'Newtonians' were not just reacting to Spinoza. They were aware of others who had tried to solve the problems raised by Spinoza in one way or another. And if they succeeded in finding a solution acceptable to most of their contemporaries, this was partly because during the earlier debates a consensus had formed upon which they could build.

In the Dutch Republic, the focal point for debates on the Bible and the new philosophy about 1700 was the work of the Dutch Reformed

minister, Balthasar Bekker (1634–1698). In his book *De betoverde weereld* (The World Bewitched), Bekker denied that the devil had any power in the physical world. He argued his case with both theological and philosophical arguments, but his main source of inspiration appears to have been Cartesian philosophy. To Bekker, the world was a material whole, governed by the laws of nature. Spiritual substances, either good or bad, simply had no place in this world.

The book caused an enormous outcry, not so much because Bekker denied the existence of witches or ghosts, which most educated people by this time had come to dismiss anyway, but because he denied as well that the Bible spoke of them. The Bible could not possibly teach things that were not true or not possible. So, Bekker felt that the passages wherein the Bible speaks of demonic possessions, angels, etc., could not be taken literally. Such passages had been accommodated to the understanding of the common people. The debate on the book was therefore largely a debate on the interpretation of the Bible.<sup>25</sup>

Bekker was not a Spinozist or atheist but a sincere Calvinist, who, however, took seriously the new view of nature and the world which had emerged in the preceding decades. His aim was not to undermine the Bible as God's word, but to salvage it. He used the same accommodating exegesis which had earlier been applied by Cartesian theologians to account for the motion of the Earth. In this case, however, his contemporaries did not swallow it – not just the conservative Voetians, who defended a strict literalism, rejected his position, but also the Cocceians, who supported an accommodationist reading of the Bible in the case of the motion of the Earth. Bekker's views were nearly universally rejected and would regain some credit among mainstream theologians only in the second half of the eighteenth century.<sup>26</sup>

The campaign against Bekker's work played an important role in shaping the views on the proper relation between the Bible and science. A consensus emerged that the truth of the biblical narrative could not be measured by the yardstick of science or philosophy. Laws and miracles each had their proper sphere. The Newtonian authors obviously cannot have missed this major debate, which directly touched upon their main concerns. It is therefore striking that they remain almost completely silent upon the issue. Still, on a closer look, they do show awareness of the underlying problems. In his book *Gronden van zekerheid* (Foundations of certitude), Bernard Nieuwentijt, having refuted Spinoza's metaphysics at length, discussed the possibility of an 'exper-

imental metaphysics', a metaphysics based upon 'spiritual experiences'. Here, he left open the possibility of appearances. The true scientific method demanded that one should accept reports from trustworthy witnesses about spirits and appearances. Rejecting such testimonies showed just philosophical prejudice. Although Nieuwentijt does not mention Bekker's name, his argument speaks directly against his tenets.<sup>27</sup>

In the Dutch Republic, the debate on Bekker's book absorbed most of the energy spent on this kind of questions, but it was not the only debate of its kind. Another example is the book by the Haarlem physician Antoni van Dale (1638–1708) on the ancient pagan oracles. Van Dale claimed that all of these oracles had been the result of clever deceit by priests. This book too caused a furious response. Van Dale's readers were particularly offended by his 'debunking' of a particular biblical oracle, the story of the witch of Endor in 1 Samuel 28, who, on behalf of King Saul, conjured up the spirit of the dead prophet Samuel. This gave rise to a vehement dispute, again largely on the question how to read the Bible. Unavoidably, the issue was read often in the light of Bekker's book.<sup>28</sup>

Another debate concerned the book of the English cleric Thomas Burnet (c. 1635 – 1715), *Telluris theoria sacra* (The Sacred Theory of the Earth, 1681–1689). Herein, Burnet, among other things, gave a natural explanation of the biblical Flood. Whereas the Bekker debate dominated the Dutch intellectual scene at the end of the seventeenth century, it can be said that Burnet's book was the focus of very similar debates in England. In the Dutch Republic, Burnet's book was known and did play a role in the formation of a new consensus, but it was something of a side show. Still, it may be of interest to look into its role somewhat deeper. First of all, it indicates that the questions on natural science and the Bible were not just a local Dutch interest. The specifics were determined by local circumstances, but the underlying questions were more universal. Moreover, the debate is of interest as it put the question of laws of nature centre stage.

Basically, Burnet tried to bring the interpretation of the Bible into agreement with recent philosophical ideas (especially as propagated by Descartes) that the origin and constitution of the Earth, just as everything else in the universe, could be explained from the laws of nature. He gave a detailed account how the Earth had come into being 'according to the Laws established in Nature by the Divine Power and

Wisdom'.<sup>29</sup> But whereas Descartes left the creation story alone, Burnet wanted explicitly to harmonize his views with the Genesis narrative. The biblical Deluge had a special place in his story, as it explained the Earth's tilted axis and uneven surface. The original Earth had been smooth and even, but at a certain point, the Earth's crust had collapsed, unslashing the waters below and thus causing the Flood. This therefore had not been a special act of God, who had changed the course of nature in a supernatural way: it was the outcome of a chain of natural events, inevitable by the very constitution of the Earth. According to Burnet, most other planets too had undergone a similar deluge.<sup>30</sup>

Here again, Burnet's aim was not to undermine belief in divine providence, but to find a way to integrate sacred history into natural philosophy. What he envisions is a 'general system of Divine Providence'. For one thing, there is the traditional notion of Providence, which Burnet calls theological Providence, by which God directs the affairs of man: souls, religion, morals and the state of humankind. However, another part of the general system is natural Providence, by which God governs, by his fixed laws, the order of nature: 'the motions of Nature are indeed no less than human affairs subjugated to the care of Divine power'.<sup>31</sup> Burnet emphasizes that the two went hand in hand: the natural world was arranged so as to support the moral world. So, it is by this natural Providence that the Deluge, though the outcome of natural causes, happened at a time that it was most needed for moral purposes.<sup>32</sup> Burnet acknowledged that God can and does act outside the laws of nature, but that such miracles are a last resort: 'We must observe and consider, that The Course of Nature is truly the Will of God; and as I may say, his first Will; from which we are not to recede, but upon clear evidence and necessity'.<sup>33</sup>

Burnet's work was known among the philosophical and scientific amateurs at Amsterdam. The Amsterdam author Willem Goeree (1635–1711) used Burnet's theory extensively in his *Voor-bereidselen tot de bybelsche wysheid* of 1690.<sup>34</sup> In 1695–1696, a Dutch translation of Burnet's *Telluris theoria sacra*, as well as his later *Archaeologia philosophica*, was published. The translator is not mentioned but was in all probability the Amsterdam merchant Ameldonk Blok. Blok was an admirer of Spinoza and a friend of the German philosopher Ehrenfried Walter von Tschirnhaus (1651–1708). Tschirnhaus was much impressed by Burnet's book and it was he, it seems, who encouraged Blok to translate it. Blok undertook the work as a member of the lit-

erary society *Nil Volentibus Arduum* and he read several chapters in its meetings, according to the minutes.<sup>35</sup> Burnet found a few other defenders. Apart from Goeree, who in 1705 defended him against the charge of Spinozism, one could mention the naturalist Simon Schijnvoet (1652–1727). It is probably no coincidence that both Goeree and Schijnvoet counted among the few advocates of Bekker as well.<sup>36</sup>

It would seem that the book found admirers mainly among the radical fringe. The authors who after 1714 propagated a Newtonian philosophy decidedly rejected it. Nieuwentijt would abstain from open polemics and referred to Burnet's work only for geographical information. But he did criticize his ideas. One of the more conspicuous elements of Burnet's thought was his view of mountains as ugly and useless deformities, which therefore could not have been part of God's original creation. In his view, God had created the world as a perfectly round sphere and only the upheavals of the Deluge had brought mountains and oceans into being. Nieuwentijt on the other hand emphasized that mountains play an important part in water circulation around the globe, causing the clouds to bring rain, and thereby show the wisdom of the Creator's original design. Consequently, he refuted atheist philosophers who defended their materialist view on the hypothesis

that so many and such amazing great Bodies as the Mountains, are of no use at all; and who, if they had had the fashioning of the Globe of the Earth, according to their own Humours, they would have made it without them, and would have given it a perfect round Figure, without the least Inequalities.<sup>37</sup>

Some later authors expressly referred to Burnet. Jacob Odé refuted Burnet's work in his textbook on natural philosophy. He protested that Burnet's interpretation of the Flood went against the Bible.<sup>38</sup> A few years later, Johannes Lulofs, the later Leiden professor, defended a thesis under Odé wherein he referred to Nieuwentijt's explanation of the use of mountains in a disputation which had a decidedly physico-theological character. He expressly mentioned Burnet as the author to be refuted.<sup>39</sup> In general, eighteenth-century theories of the Earth would prefer to take the Genesis account literally, even if they would often describe it in scientific language. A major work in this respect

was *Physica sacra* by the Swiss scientist Johann Jacob Scheuchzer (1672–1733), a monumental overview of physical elements in the Bible. The lavishly illustrated, multi-volume work became quite popular and saw a Dutch translation as well.<sup>40</sup>

One might easily overlook the relevance of the earlier debates for the Newtonian position, as these were largely (and deliberately) ignored by the Newtonians themselves. The Newtonians claimed that their stance was the simple and logical outcome of the true scientific method. Experimental philosophy demanded that one would not indulge in theological or metaphysical subtleties. So, they made it appear as if there only was this debate between reasonable belief and atheistic folly. To them, this was the only thing that really mattered. Still, a closer look at the earlier debates may help us to understand their position. Nieuwentijt offers a case in point. In his books, he waged a campaign against ‘atheism’ (read Spinozism), which he tried as far as possible to dissociate from existing philosophical and theological debates. He made it a principle not to engage in debate with other mainstream Christians. He carefully refrained (unlike many Voetian theologians) from calling Cartesianism irreligious. Still, there is no doubt that Nieuwentijt rejected the claims of Cartesian philosophy, and that this partly shaped his ideas. Likewise, it appears obvious that the Dutch Newtonians followed the consensus which had formed over the interpretation of the Bible, that the Bible described supernatural events which could not be measured by the yardstick of natural philosophy, and that their apologetics was partly intended to give this a scientific basis.

### Conclusion

It has long been recognized that the eighteenth century saw a major effort to harmonize the new science with traditional religious insights. The new scientific worldview which had imposed itself in the seventeenth century was powerful and enticing. Still, people were not ready to reject all aspects of the old worldview. Uneasiness emerged where the new view of the world appeared to be contradicting vital elements of the old. Spinoza was such a disturbing character exactly because he pointed out such inconsistencies with unrelenting logic. What people wanted was a science which respected the traditional elements of religion they still valued.

Historians have so far mostly studied the more philosophical aspects

of this harmonizing efforts, like the argument from design or the question of materialism. But to contemporaries, the status of the Bible probably even mattered more. The Bible was the central element in Protestant religion and therewith a vital support of the social and moral order. For eighteenth-century philosophers, the Bible was a perfectly legitimate subject. Academic disputations discussed such 'physical' topics as the earthquake and darkness during the death of Christ, the manna in the desert, and so on. This was perfectly legitimate as long as the philosophers respected the biblical mysteries and by their use of scientific language legitimized the miraculous, rather than refuted it. Protests arose when science or philosophy tried to incorporate the sphere of the religious altogether. It was felt that there was a domain where the standards of the natural sciences could not be admitted. The Bible was no longer a book about the real world, but a guarantee for the existence of a realm beyond the world.

But, paradoxically, it was science which was used to define the boundaries of this supernatural realm. It was with scientific arguments that the wisdom of the Creator was demonstrated. It was Newton's science that taught that the world could not be explained from mere mechanical causes, but needed the design of a divine intelligence. A miracle was now foremost something that could not be explained scientifically, as occurring outside the laws of nature. This strict separation between a scientific and a religious sphere was a result of the new philosophy of the seventeenth century. In earlier times, the border between the natural and the supernatural had often been rather blurred.<sup>41</sup> In the eighteenth century, nature was explained in a strictly natural way, whereas religion was felt to be present only where such natural explanations did not hold. An unexpected consequence was that in the eighteenth century miracles and the miraculous, although (or rather, because) they were no longer deemed to play any part in actual life, played an increasingly important role in Christian apologetics.<sup>42</sup>

Apparently, the 'disenchantment of the world' concerned not so much the disappearance of the mystery altogether, but rather its restriction to its own separate domain. This domain was well separated from day-to-day existence, but considered real nevertheless. Cartesian philosophy had created a new view of nature. It remained up to the Newtonians to establish a corresponding idea of the supernatural.

## Notes

The author thanks Cornelia Lambert for linguistic improvements.

- 1 For 'Newtonianism' in a European context, see J. Gascoigne, 'Ideas of nature: natural philosophy', in: R. Porter (ed.), *The Cambridge history of science*, Vol. IV, *Eighteenth-century science* (Cambridge 2003), pp. 285–304; M. Feingold, *The Newtonian moment. Isaac Newton and the making of modern culture* (New York, Oxford 2004); J. Israel, *Enlightenment contested: philosophy, modernity, and the emancipation of man, 1670–1752* (Oxford 2006), pp. 201–222; B.J.T. Dobbs and M.C. Jacob, *Newton and the culture of Newtonianism* (Atlantic Highlands, NJ 1995). A new volume on 'the reception of Isaac Newton in Europe' is presently being prepared by Helmut Pulte and Scott Mandelbrote.
- 2 E. Jorink, 'Honoring Sir Isaac, or, exorcising the ghost of Spinoza: some remarks on the success of Newton in the Dutch Republic', in: S. Ducheyne (ed.), *Future perspectives on Newton scholarship and the Newtonian legacy in eighteenth-century science and philosophy* (Brussel 2009), pp. 22–34; E.G.E. van der Wall, 'Newtonianism and religion in the Netherlands', *Studies in history and philosophy of science* 35 (2004), pp. 493–514, a contribution to a special issue on Newtonianism. Similar factors were at work elsewhere. For England, see in particular J. Gascoigne, 'From Bentley to the Victorians: the rise and fall of British Newtonian natural philosophy', *Science in context* 2 (1988), pp. 219–256.
- 3 R.H. Vermij, *Secularisering en natuurwetenschap in de zeventiende en achttiende eeuw: Bernard Nieuwentijt* (Amsterdam 1991).
- 4 R.H. Vermij, 'At the formation of the Newtonian philosophy: the case of the Amsterdam mathematical amateurs', *British journal for the history of science* 36 (2003), pp. 183–200.
- 5 Ibidem, pp. 197–199. M. Evers, 'Pro Newtone et religione: de receptie van Newton en de Engelse fysicotheologen in de *Bibliothèque Ancienne et Moderne* (1714–1727)', *Documentatieblad werkgroep achttiende eeuw* 20 (1988), pp. 247–267.
- 6 On the tradition of Newtonianism at Dutch universities, see Henri Krop, this volume. Further: C. de Pater, *Petrus van Musschenbroek (1692–1761), een newtoniaans natuuronderzoeker* (PhD thesis, Utrecht 1979); Willem Jacob 's Gravesande, *Welzijn, wijsbegeerte en wetenschap*, ed. C. de Pater (Baarn 1988); Ad Maas, this volume; R.H. Vermij, *The Calvinist Copernicans: the reception of the new astronomy in the Dutch Republic, 1575–1750* (Amsterdam 2002), pp. 335–341.
- 7 Vermij, *Secularisering en natuurwetenschap* (note 3), pp. 115–120. H. Bots, J.J.V.M. de Vet, 'De fysico-theologie in het Journal Littéraire. Haagse journalisten ten strijde tegen het ongelooft', *Documentatieblad werkgroep*

- achttiende eeuw 18 (1986), pp. 213–226.
- 8 Vermij, *Calvinist Copernicans* (note 6), pp. 344–347; R.H. Vermij, ‘Johannes Lulofs als vertegenwoordiger van het newtonianisme in de Republiek’, *Gewina* 22 (1999), pp. 136–150, on 140–141.
  - 9 The classical study on this argument is H. Metzger, *Attraction universelle et religion naturelle chez quelques commentateurs anglais de Newton*, 3 vols (Paris 1938). For Le Clerc, see the literature mentioned in footnote 5. Jacob Odé, *Principia philosophia naturalis in usum scholarum privatarum conscripta, et captui studiosae juventutis accomodata* I (Utrecht 1727), p. 61.
  - 10 On Dutch physico-theology, see in particular R.H. Vermij, *Secularisering en natuurwetenschap* (note 3); J. Bots, *Tussen Descartes en Darwin. Geloof en natuurwetenschap in de achttiende eeuw in Nederland* (Assen 1972). The connection between physico-theology and Newtonian philosophy in England has been emphasized in N.C. Gillespie, ‘Natural history, natural theology and social order: John Ray and the “Newtonian ideology”’, *Journal for the history of biology* 20 (1987), pp. 1–49.
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  - 12 On the question of voluntarism and science, see especially J. Henry, ‘Voluntarist theology at the origins of modern science: a response to Peter Harrison’, *History of science* 47 (2009), pp. 79–113. See also P. Harrison, ‘Voluntarism and the origin of modern science: a reply to John Henry’, *History of science* 47 (2009), pp. 223–231.
  - 13 J. Henry, ‘Metaphysics and the origins of modern science: Descartes and the importance of laws of nature’, *Early science and medicine* 9 (2004), pp. 73–114; esp. pp. 96–97. The article also conveniently summarizes the earlier historiography on the laws of nature. See also L. Daston and M. Stolleis (eds), *Natural law and laws of nature in early modern Europe: jurisprudence, theology, moral and natural philosophy* (Aldershot 2008); R.H. Vermij, ‘Een nieuw concept: de wetten der natuur’, in: F. Egmond, E. Jorink and R.H. Vermij (eds), *Kometen, monsters, muilezels. het veranderende natuurbeeld en de natuurwetenschap in de zeventiende eeuw* (Haarlem 1999), pp. 105–120; F. Steinle, ‘The amalgamation of a concept – laws of nature in the new sciences’, in: F. Weinert (ed.), *Laws of nature: essays on the philosophical, scientific and historical dimensions* (Berlin, New York 1995), pp. 316–368; L. Daston, ‘Wunder, Naturgesetze und die wissenschaftliche Revolution des 17. Jahrhunderts’, *Jahrbuch der Akademie der Wissenschaften in Göttingen* (1991), pp. 99–122.
  - 14 E. Zilsel, ‘The genesis of the concept of physical law’, in: D. Raven and W. Krohn (eds), *The social origins of modern science* (Dordrecht, Boston, London 2000), pp. 96–122, on 116.
  - 15 B. Nieuwentijt, *Het regt gebruik der wereltbeschouwingen, ter overtuiging van ongodisten en ongelovigen* (Amsterdam 1715), pp. 752–826 and 827–854. In John Chamberlayne’s (abridged) translation, *The religious philos-*

- opher, or, the right use of contemplating the works of the Creator (London 1718), these are the 26th and 27th chapters, pp. 471–533 and 533–548 respectively.
- 16 Nieuwentijt, *Regt gebruik* (note 15), p. 777. My translation, as not included in Chamberlayne's (note 15); cf. pp. 486–487.
  - 17 Nieuwentijt, *Regt gebruik* (note 15), p. 549. My translation, as not included in Chamberlayne's (note 15); cf. p. 658.
  - 18 Nieuwentijt, *Regt gebruik* (note 15), p. 563. Partly translated in idem, *Religious philosopher* (note 15), p. 679.
  - 19 See 's Gravesande, *Welzijn, wijsbegeerte en wetenschap* (note 6), pp. 41–42.
  - 20 P. van Musschenbroek, *Beginselen der natuurkunde beschreven ten dienste der landgenooten* (Leiden 1736), p. 7 (my translation).
  - 21 J. Israel, *Radical Enlightenment: philosophy and the making of modernity, 1650–1750* (Oxford 2001), pp. 218–229 and 242–246.
  - 22 See also R.H. Vermij, 'Nature in defence of Scripture: physico-theology and experimental philosophy in the work of Bernard Nieuwentijt', in: K. van Berkel and A. Vanderjagt (eds), *The book of nature in early modern and modern history* (Leuven etc. 2006), pp. 83–96.
  - 23 Vermij, *Calvinist Copernicans* (note 6), pp. 239–331. W. van Bunge, *From Stevin to Spinoza: an essay on philosophy in the seventeenth-century Dutch Republic* (Leiden 2001), pp. 74–93. See also R. Vermij, 'The debate on the motion of the Earth in the Dutch Republic in the 1650s', in: J.M. van der Meer and S. Mandelbrot (eds), *Nature and Scripture in the Abrahamic religions: up to 1700*, 2 vols (Leiden, Boston 2008), vol. 2, pp. 605–625. On the place of the theory of the animal-machine in the debate, see R. Vermij, 'Dieren als machines: een stok om de hond te slaan', *Groniek* 126 (September 1994), pp. 50–63.
  - 24 Israel, *Radical Enlightenment* (note 21), pp. 197–217; Van Bunge, *From Stevin to Spinoza* (note 23), pp. 94–122.
  - 25 W. van Bunge, 'Balthasar Bekker's Cartesian hermeneutics and the challenge of Spinozism', *British journal for the history of philosophy* 1 (1993), pp. 55–79; Israel, *Radical Enlightenment* (note 21), 375–405; J. Israel, 'The Bekker controversies as a turning point in the history of Dutch culture and thought', *Dutch crossing* 20–21 (winter 1996), pp. 5–21; G.J. Stronks, 'De betekenis van "De betoverde wereld" van Balthasar Bekker', in: M. Gijswijt-Hofstra and W. Frijhoff (eds), *Nederland betoverd. toverij en hekserij van de veertiende tot in de twintigste eeuw* (Amsterdam 1987), pp. 207–211.
  - 26 J.W. Buisman, 'Bekkers wraak. Balthasar Bekker (1634–1698), de accommodatietheorie en Nederlandse protestantse theologen 1750–1800', *Documentatieblad werkgroep achttiende eeuw* 30 (1998), pp. 97–111.
  - 27 B. Nieuwentijt, *Gronden van zekerheid* (Amsterdam 1720), pp. 403–405. Cf. Vermij, *Secularisering en natuurwetenschap* (note 3), p. 122.

- 28 M. Evers, 'Die "Orakel" von Antonius van Dale (1638–1708): eine Streitschrift', *Lias* 8 (1981), pp. 225–267. For the witch of Endor, see pp. 229–233. Van Dale was here influenced by Reginald Scott. On the witch of Endor in biblical exegesis, see also F. Laplanche, 'Dieu ou diable? Nécromancie et théologie, de Calvin à Dom Calmet', in: G. Demerson and B. Dompnier (eds), *Les signes de Dieu aux XVIIe et XVIIIe siècles* (Clermont-Ferrand 1993), pp. 57–63. On the disputes over Van Dale's book, see Israel, *Radical Enlightenment* (note 21), pp. 359–374.
- 29 Th. Burnet, *The sacred theory of the Earth*, ed. B. Willey (London-Fontwell 1965), p. 54. Willey follows the second English edition (1690–1691). The English version is Burnet's own, but he has reworked it from the Latin original.
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- 31 Th. Burnet, *Telluris theoria sacra originem et mutationes generales orbis nostri [...] complectens* (Amsterdam 1694), p. 247.
- 32 Ibidem, p. 31 and Burnet, *Sacred theory of the Earth* (note 29), p. 89.
- 33 Burnet, *Sacred theory of the Earth* (note 29), p. 221.
- 34 [W. Goeree], *Voor-bereidselen tot de bybelsche wysheid, en gebruik der heilige en kerkelijke historien*, 2 vols (Amsterdam 1690), vol. 2, passim.
- 35 R.H. Vermij, 'Le spinozisme en Hollande: le cercle de Tschirnhaus', *Cahiers Spinoza* 6 (1991), pp. 145–168, on 161.
- 36 G.M. van de Roemer, *De geschikte natuur. Theorieën over natuur en kunst in de verzameling van zeldzaamheden van Simon Schijnvoet (1652–1727)* (PhD thesis, University of Amsterdam 2005), pp. 147–150.
- 37 Nieuwentijt, *Regt gebruik* (note 15), p. 415 (Beschouwing 20, section 44). Chamberlayne's translation (note 15), vol. 1, p. 495.
- 38 Odé, *Principia philosophia naturalis* (note 9), vol. 2, pp. 39–42. See also the long discussion of Descartes' cosmogony, ibidem, vol. 1, pp. 13–18.
- 39 J. Lulofs, auctor and respondens, *Disputatio philosophica de causis, propter quas zona torrida est habitabilis* (disp. Utrecht, 1729 Nov. 9), p. 18 (par. 10).
- 40 M. Kempe, *Wissenschaft, Theologie, Aufklärung. Johann Jakob Scheuchzer (1672–1733) und die Sintfluttheorie* (Epfendorf 2003); I. Müsch, *Geheiligte Naturwissenschaft. Die Kupferbibel des Johann Jakob Scheuchzer* (Göttingen 2000).

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