

CHRISTIAAN HUYGENS'S *COSMOTHEOROS*: ANTHROPOLOGICAL THEOLOGY AND THE MECHANIZATION OF NATURE

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Abstract. While it is known that a mechanized universe was adopted among scientists and philosophers during the seventeenth century and that it provided a new understanding of nature, we can see that for many scientists the universe was not entirely empirical. Rather, an automaton universe did entail theological and philosophical implications for figures such as Christiaan Huygens, who presents in his *Cosmotheoros* a theological anthropology mixed with astronomy and a speculative philosophy. In this paper, I defend that Huygens's *Cosmotheoros* not only could help us to properly understand and re-evaluate his figure, but also to have a complete view of the scientific mechanization of nature in the seventeenth Century.

Keywords: Christiaan Huygens, *Cosmotheoros*, automaton, mechanized universe, anthropological theology

1. Introduction

During the seventeenth century, especially after the establishment of Descartes' Mechanism, scientists and philosophers generally adopted the idea of the mechanized universe. This view states that the universe can be explained attending to its efficient causes and that every phenomenon can be accounted through the laws of motion. Therefore, in other words, the universe could be seen as an automaton, which works independently to human beings, and that is empirically self-sufficient.

It is clear that in this sense, Mechanism provided a new vision of the world, very different from the idea that the universe had both physical and transcendental parts, in contrast with other explanatory systems such as Aristotle's. Thanks to the development of astronomy (with the work of Galileo, Copernicus and Kepler, between others), as well as the philosophical understanding of nature, now the universe was made of matter and the distant celestial bodies were similar in nature to the Earth. This clearly provided a new perspective of the understanding of the universe itself, but also for the nature of human beings in relation with the rest of it.

The new angle provided by this idea was reflected in the beginning of the separation between empirical sciences and philosophy. However, although the general idea is that in this period scientists started to focus solely on science and philosophers on philosophy, the truth is more complex. Even the figures that are understood

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nowadays as pure scientists, such as Newton, wrote a huge amount of works on theology¹; while others reflected the philosophical implications that the new understanding of the automata universe had, such as Christiaan Huygens.

Christiaan Huygens is nowadays mainly remembered by his scientific advances, especially the creation of the pendulum clock and the discovery of Saturn's ring. While many of his contemporaries as Descartes or Pascal are also considered philosophers, this not seem to be the case of Huygens. Rather, he has been historically aligned with scientists such as Galileo or Copernicus, who were focused on a pure scientific praxis rather than on an interdisciplinary method². However, at the end of his life Huygens acknowledged in several occasions the preparation of a philosophical treatise that finally saw the light in 1698³. The *Cosmotheoros*, posthumously published, is a unique work in which philosophy, theology and astronomy are closely connected⁴.

This philosophical treatise contrasts with the majority of his corpus, mainly focused on his scientific outcome. This changed with the *Cosmotheoros*. In this work Huygens openly speculates about the existence of inhabitants created by God in other planets; how these planets are and what they have in their surfaces; whether these planets can be known through analogy with the Earth in a mechanized universe; how are animals and the inhabitants in these planes and their nature. The *Cosmotheoros*, moreover, cannot be seen as a minor work: it took him several years to finish it and he carefully left the final manuscript to his brother, to whom he commissioned its publication before his death in 1695.

In the light of this, and with the aim of explaining the view on the mechanized nature and the automaton universe in the seventeenth Century, is necessary to address the following questions: How the *Cosmotheoros* challenges the traditional interpretation of the universe of his work? How Huygens understood the connection between theology, philosophy and physics? What is the specific role of this anthropological theology in his scientific corpus?

2. The historiographical interpretation of Christiaan Huygens

As we can see, speculative works such as the *Cosmotheoros* not only help us to properly understand the interests of the seventeenth scientists, but also their understanding of the new vision of the automaton universe in contrast with the old views on nature. Therefore, to re-evaluate the figure of scientists such as Huygens will help us to establish their understanding of nature and, eventually, it will lead us to comprehend the differences between subject and object in the light of this new mechanization of nature.

In order to re-evaluate Huygens's figure, we should cast doubt on his historiographical interpretation. Was Huygens just a scientist, astronomer and mathematician as he is usually remembered nowadays⁵? As we will see, his case is complex. Various elements should be taken in consideration when evaluating his figure.

First, that following the classical interpretation of Huygens, he was more interested on solving problems than on creating a unified explanatory system. But this could be wrong. There is an editorial problem that strengthen the idea of the savant being absolutely systematic (proposing and systematically solving problems), while we

can find proofs of his intellectual approach being mixed between disciplines at times. This is because of how the works of Huygens were published in the different volumes of *Oeuvres Complètes*⁶. As noted by Joella Yoder and Gianfranco Mormino, there is a decontextualisation of the activities put into practice by Huygens that makes impossible to properly rebuild Huygens's thought⁷. Sometimes, various pieces of work wrote by Huygens on the same sheet are dispersed in more than three volumes. Not only that, but also the edition does not point it out. Therefore is impossible to properly reconstruct Huygens's scientific praxis without going to the manuscripts themselves. What's more, the exegesis dispensed by the editors has have a paralysing effect on historians, as Mormino and Rupert Hall have pointed out⁸. Consequently, the idea of Huygens proposing and systematically solving problems could be wrong. Furthermore, we should add the opinion of his disciple Leibniz. After Huygens's death, in a letter to Remond of January 1714 Leibniz claimed Huygens did not had taste for metaphysics⁹. In Leibniz's opinion, in the phenomena of nature everything is done metaphysically and mechanically at the same time, but the source of mechanics is metaphysics. According to him, few people had bothered to unify both fields. Leibniz said that Descartes did it, but inadequately, since he failed at the description of the laws of motion. Because of that, Descartes is the antechamber of truth. Huygens, however, did bother with mechanics in a better way than Descartes, but he did not have taste in the field of metaphysics¹⁰, which seems to support the traditional interpretation of Huygens.

Second, another issue derived from the editorial problem of Huygens's *Oeuvres Complètes* is that the order of the edition does not match neither Huygens's original order nor the current order of his manuscripts. While Huygens prepared and arranged his manuscripts in anticipation of his death, due to several modifications during the following years by the keepers of the manuscripts (including the incorporation of family letters and wills)¹¹, it is very difficult to rebuild the scientific and philosophical project of Huygens, since the edition has only showed a biased image of him.

Third, Huygens's reluctance to publish his works during his life. This is shared with others contemporaries such as Leibniz. But in this case, Huygens not only refused to publish some of his works, but also he did not finish projects such as a book he had in mind to respond Newton's *Principia Mathematica*, which was never done¹². This factor prevents us from having a proper idea of his complete scientific vision.

Fourth, his scientific approach, including his explicit refusal to enter in metaphysical disquisitions when discussing with Leibniz. This is true, for example, when Leibniz asked Huygens his opinion on the remarks he did on Descartes's *Principles of Philosophy*¹³. Huygens, however, did discuss with Leibniz issues on mechanics such as the continuity of matter vs Atomism, the hardness of matter or the relativity of motion.

And fifth, the *Cosmotheoros*, a work that is absolutely different from what Huygens wrote until then. While the usual interpretation states that Huygens was interested mainly on mathematical and geometrical results, the methodology used on the *Cosmotheoros* is almost entirely speculative. It is not a coincidence that he called it

his “philosophical treatise”¹⁴. And it demonstrates that he was more interested on philosophy than it seemed, although his notion of philosophy seems to be focused on the application of a speculative method, divided here between natural philosophy and anthropological theology.

As we can see, there are some elements that seem to support the idea of Huygens being mainly a scientist interested only on immediate results, whereas there are others that seem to support the contrary:

- a) Elements that seem to deny the usual historiographical interpretation of Huygens:
 - An editorial problem that impede the reconstruction of Huygens’s scientific and philosophical project.
 - The existence of the *Cosmotheoros*, a speculative treatise in which he addresses issues on natural theology and natural philosophy. It shows the importance Huygens gave to religion, which was relegated to his personal life until then.
- b) Elements that seem to support the usual historiographical interpretation of Huygens:
 - An implicit lack of interest on philosophical-metaphysical issues during his corpus.
 - An explicit disinterest of mixing disciplines (e.g., he did not want to enter on theological issues when discussing on mechanics with Leibniz).
 - He only wrote one treatise that directly uses a speculative method.

Thus, we still have the problem of how to understand the figure of Huygens, and as we can see it is no easy task.

One researcher who has dealt with this issue is Fabien Chareix in *La philosophie naturelle de Christiaan Huygens*. In it, Chareix’s claim is that the philosophy of Huygens is to be found in his mechanical philosophy¹⁵. However, this contrasts with the opinion of Leibniz himself who mainly discussed with Huygens mechanical problems such as the relativity of motion and atomism, but failed to recognize him as any kind of philosopher.

On his behalf, Fokko Jan Dijksterhuis claims in a review of *La philosophie naturelle de Christiaan Huygens* that Chareix’s vision is biased. His argument is that, in order to reconstruct the conceptual framework of Huygens’s natural inquiries, Chareix has selected a group of Huygens’s works on mechanics; but he does not justify the criteria of the selection¹⁶. For me, what most attracted my attention regarding “la philosophie naturelle de Christiaan Huygens” is that the *Cosmotheoros*, the only almost purely speculative work of Huygens, is not addressed. Fokko Jan Dijksterhuis finishes his critique stating that in his opinion, Huygens was mainly a mathematician, but a seventeenth century mathematician.

As we can see more than 300 years after Huygens’s death, we are still discussing on the nature of Huygens’s thought. In order to re-evaluate his figure and taking in consideration all the elements that come into play here, there are two main

sources by which we can reach a conclusion. First, his correspondences, since letters (especially in the seventeenth Century) usually reflect the sender's opinion on a number of topics. Huygens's letters are edited in *Oeuvres Complètes*¹⁷ and they were published chronologically. Therefore, they do not have the same problem that the individual works of Huygens have. Consequently, the letters seem to be a very good place to look for his scientific and philosophical project. However, as we have stated, in the correspondences he avoids entering in pure philosophical speculation, leaving these issues to be addressed at a later time. And second, the *Cosmotheoros*, since it is the only work where Huygens took a speculative approach. In the following section I will address the contents of the *Cosmotheoros* in order to evaluate its importance to understand Huygens' views on the mechanization of universe and the nature of the inhabitants of other worlds.

3. The *Cosmotheoros*

The *Cosmotheoros* is divided in two different books. The first one addresses the possibility of inhabitants living in other planets, while the second one addresses the stars and their distances. In both we can see how Huygens is reflecting the idea of an automaton universe, in the sense that after its creation by God the universe consists on matter in motion regulated by the natural laws, something that is shared with his former pupil Leibniz¹⁸. Huygens did not write this treatise for the general public, but for people with a scientific training. That's the reason why he wrote it in Latin rather than in French¹⁹. However, the *Cosmotheoros* exceeded all expectations within the general public and it was so successful that various translations into French or English appeared quickly²⁰.

a) The existence of other worlds and their similarity with the Earth

The first thing Huygens claims is that the conjectures present in the *Cosmotheoros* do not contradict the Holy Scriptures. Many would state that the Bible does only mention the existence of animals, plants and human beings apart from spiritual entities; it does not mention any other living being, let alone outside of the Earth. While this is true, for Huygens is evident that we do not know the details of all things created by God only through the Holy Scripture.

Had our ancestors stopped their research due to this hesitation, we would ignore today, for example, the form or magnitude of the Earth. Not only that, but also we would not even have discovered continents such as America. We can understand by these examples that God did not want us to know all things in nature in detail through the scriptures but through the use of reason. Therefore, our speculations about inhabitants in other worlds should not be stopped by the story related on the book of Genesis²¹.

What's more, nature was made by God for Him to be glorified and for the enjoyment of mankind. And we can see that the Genesis includes all kind of celestial bodies on the concept of "star" (apart from the sun and the moon) that cannot be seen by us. Consequently, because we cannot access nor observe many remote stars, planets and satellites, it is not strange to claim that there should be inhabitants in other planets that contemplate and admire the work of God²².

However, even though Huygens starts the *Cosmotheoros* claiming the compatibility of the book of Genesis with his speculations, he does not present any demonstration of the existence of God. For him, the book of nature itself is the proof of His existence, as several verses in the Bible state²³ and as other scientists believed. Neither he presents any cosmogony, that is, any explanation of why and how God created the world (as we can see at the end of the second book). Nevertheless, Huygens believes that it is impossible that organisms were created by chance. He thinks that every phenomenon is created by the collision of many infinitely hard small particles and that in the beginning there was a miraculous creation not caused by these collisions of particles²⁴.

What Huygens did introduce in the *Cosmotheoros* is a series of brief ideas on theodicy, stating that there is no prince of evil contrary to God: rather the devil is a fallen angel and therefore not as powerful as God, idea that it is also seen in the protestant tradition. In Huygens's opinion, misfortunes, wars and calamities take place because they help us to be alert, improve our defences, fight poverty and misery and invent diverse arts in order to examine nature²⁵ which is translated into glorifying God.

b) The contents of the other planets

Since physics cannot speak about distant planets, about what scientists cannot see, Huygens needs to use philosophical conjectures. He argues that by seeing the interior of a dog, we can know how all dogs are in their inside; therefore, if we see our Earth, and it is a planet, by knowing the Earth we can also know the basic elements and the nature of the other planets.

He applies the same logic to all celestial bodies. Referring to satellites Huygens states that by knowing the moon or the behaviour of Jupiter's satellites, could not we say that we know the nature of all satellites? In the same way, by studying the nature of one comet, we can acquire knowledge applicable to all comets. Therefore, by using our knowledge on the Earth we can make "excellent conjectures" about other bodies of the same family²⁶.

Since the Earth is so similar to these other planets in many ways, it is natural to speculate that they are not inferior to the Earth in any way, since they share a similar nature. They are not inferior in dignity nor in beauty, and they are not less decorated following Huygens's opinion²⁷. These planets actually have, in the words of Huygens, rocks, animals, plants and all kind of decorations as the Earth has. The animals are not less noble and the existence of plants is necessary in order to feed them.

One idea implicit in the *Cosmotheoros* is essential to understand the logic Huygens is following to build his arguments. The only reason why we would find inhabitants, animals or plants in other planets similar to the ones that we find in the Earth is the mechanization of nature. If there is no such mechanization, then there is no reason why we should find similar inhabitants, animals and plants in similar planets. And therefore, the Earth would be a special case in the universe. However, since we know the Earth is a planet just as any other in the universe, then there is no reason –even theological– for thinking that we live in a special place. Therefore, in a

mechanical or an automaton nature²⁸, in similar conditions we always find similar outputs.

Huygens states, therefore, that the Earth is no special between the planets. Although many could find on that statement a sign of the non-existence of God, Huygens clearly understands that it is exactly the opposite. The existence of inanimate bodies such as rocks or mountains, or the existence of all kind of living beings as animals and inhabitants are indication of the intelligence and providence of God not only on the Earth but on all the universe.

Huygens claims he has not found any philosophy, neither old nor modern, that had try to answer these issues²⁹. The fact that the distant planets have mountains, flatlands and other kind of landforms shows the veracity of the Copernican system in contraposition to the Aristotelian cosmology of perfect celestial bodies. Moreover, following this reasoning, the Earth is extremely similar to these planets. Therefore, if all planets, including the Earth, are so similar, it should not be irrational to admit that the rest of the planets should have inhabitants as well.

While it could be defended that to propose these kind of conjectures is useless since even us concede that we cannot understand them with certainty, states Huygens, then all studies on physics that try to establish the causes of phenomena should also be disapproved. It is the research not only on the main disciplines but also on the most hidden and difficult issues what brings the highest glory, which is to find true theories³⁰.

c) The science of the inhabitants of other worlds

Huygens brings his speculative method further. God could have made living beings in America very different from the ones coming from Europe. But that was not the case. There is no ontological difference between us. In the same way, the only difference between us, human beings, and the inhabitants of other planets, is not other thing that the distance they have with respect to the sun: inferior or superior to ours. They could be different in matter because of the difference of distances with respect to the sun, but not different in form. Huygens states that they live in society, they live in houses, and that they find pleasure in friendly conversations, love, performances and even jokes³¹. It is impressive that Huygens, at the end of the seventeenth century, is establishing that all human beings are equal, wherever they came; this idea itself was difficult to maintain in the seventeenth century, but because he is also opening this idea to inhabitants of other worlds, we can see how he really was ahead of his time.

What does mean that the inhabitants are similar to us not necessarily in matter but in form? Huygens claims that they have reasoning as part of their beings. Therefore, they are not any kind of animals, but beings created by God that can use reasoning as we do in order to know and explain the world. If this was not the case, the Earth would have more quality than the other planets. But because we think the Copernican system is true, the Earth is a planet and therefore all planets should be similar. The same logic should be applied to animals, trees, herbs, metals, etc³².

However, it could be stated that the inhabitants of other planets could be exempt from all science. The main argument could be focused on the societies

Europeans found when they arrived at America for the first time, but we also find similar cases in other so-called barbarian nations in Africa and Asia. In Huygens's opinion, nevertheless, this is not only true of America and other nations: in Europe itself, not many people dedicate their lives to the sciences. Moreover, the true movement of the planets was just recently discovered, having passed many centuries since this discovery took place. Therefore, he claims that among the inhabitants of these planets there should be inhabitants to whom astronomical science is not unknown.

Additionally, we can see that within this presumption of an automaton or mechanized universe Huygens is reflecting the difference between subject and object. While Descartes thought that animals were mere automata, what he called the *animal-machine*³³, Huygens states that his vision of animals is incomprehensible, absurd and cruel, as their own behaviour shows³⁴. Therefore, we can infer that, according to Huygens, animals are not only mere machines but entities with their own will. In this sense, animals seem to be closer to human beings than to automata.

But what would be the difference between animals and the inhabitants of other worlds then? It is clear that human beings are not automata (even Descartes thought that although our bodies are machines we had a soul³⁵), and for Huygens the difference between animals and human beings is that humans have the capacity of contemplating nature and the works of God, which could be understood and appreciated through the development and application of the sciences³⁶. We can see that there is a clear theological component in Huygens's vision of the nature of human beings. But the case of the inhabitants in other worlds is similar since they seem to be situated within the divine plan of salvation and redemption³⁷. Therefore, in the *Cosmotheoros* we can see three different understandings: the universe as an automaton; the animal as a being with its own will but with no soul, reason or theological understanding; and the human beings, together with the inhabitants of other worlds, who can recognize God in themselves and in nature, therefore making a clear distinction between objects in nature and subjects.

4. Understanding Huygens and the automaton universe

The *Cosmotheoros* can help us to solve the problem of the interpretation of Huygens. Due to the speculative method used by him, it is necessary to take it into account in order to evaluate his figure. Anthropological theology and philosophical elements are key in this work, as we see in his views on the universe as an automaton in contrast with the nature of the inhabitants of other worlds. This fact tells us that both Huygens's figure and therefore the understanding of the universe in the seventeenth century is more complex than it seemed. If we, therefore, only take into consideration scientists' discussions on mechanics or on mathematics, we will have a biased view of their understanding of nature. Moreover, because the *Cosmotheoros* was the final work of Huygens, it shows us his thoughts after a whole life dedicated to science.

In principle, Dijksterhuis's opinion seems right: Huygens was a mathematician more than anything. A mathematician, as he says, from the seventeenth century. What that idea implies is not explained by him and it is necessary to do it. In

our opinion, what Huygens did was fundamentally an investigation of natural phenomena. In that investigation there are, however, not only mathematics, but also engineering and physics, optics and mechanics. He was an interdisciplinary scientist focused on discovering the functioning of nature. In that idea, every discipline has a role, even philosophy and anthropological theology, and it should be mentioned that not all Seventeenth-century mathematicians took all these disciplines into consideration when building their scientific projects. Therefore, Huygens's figure is special between them.

Nevertheless, there is something clear: there is no philosophy in Huygens as we understand it today. There is no metaphysics or epistemology, and even when Leibniz tries to make him discuss these issues, Huygens tries to avoid it. Even when he interchanged letters with Descartes, they mainly discussed issues on mechanics or mathematics, but not philosophical issues *per se*. In my opinion, Leibniz was right when he stated that metaphysics is the source of mechanics, and that Huygens never entered on this source. He was a scientist, but with a philosophical and theological background that allowed him to include his investigations in a framework not limited only to mathematics.

Was the interaction between theology and science necessary on Huygens's explanatory and scientific system? After analysing the *Cosmotheoros*, we have to respond affirmatively. In our opinion, it is impossible to separate Huygens's philosophical and theological speculations from his mathematical works, since they seem to form a unity in his scientific project as shown in the *Cosmotheoros*.

Therefore, even though Huygens was a scientist, he had a world view in which philosophy and natural theology had an important role in order to understand and to explain nature. This is something that has been largely ignored by scholars. In this sense, we find that Huygens is between two different worlds: the classical and the modern one. Aristotle and the Aristotelian tradition are examples of the former, while in the latter this interdisciplinary approach started to decline.

Huygens shares something very important with his pupil Leibniz: the religious significance of the study of nature. Specifically, Huygens gives this theological meaning to all his scientific praxis³⁸, and it has philosophical connotations. Precisely this background facilitates the interaction of disciplines when making science, something that perhaps has been ignored in the contemporary scientific praxis.

For Huygens therefore, mathematics does not end in mathematics, as well as natural theology does not end in natural theology. As the *Cosmotheoros* shows, every discipline in Huygens point out to other disciplines that complete his philosophical understanding of nature.

To understand Huygens as a mathematician, physicist or maybe a philosopher, is just result of our contemporary world vision, in which every discipline usually works separated from each other. In Huygens, however, there is a continuity between them. More than a mathematician or a philosopher of nature, we could understand him as an interdisciplinary figure. And the name of "observer of the cosmos", as the title of the *Cosmotheoros* seems to suggest, would fit as a description of Huygens's praxis.

Therefore, we can see how the view of the mechanized universe, working as an automaton, not only did not stop Huygens' transcendental views on nature but rather encourage him to develop them. Thanks to this understanding, he wrote the only large work in his life in which he addressed philosophical and theological issues (while he wrote short essays that dealt with the issue of God and other philosophical themes, such as *De rationi imper viis*³⁹, *De Gloria*⁴⁰, *De morte*⁴¹, *Pensees meslees*⁴² or *Que penser de Dieu*⁴³, only the *Cosmotheoros* was prepared for publication). Thus, Huygens is an example of how scientists in the seventeenth century, even those that seemed to be focused on "practical issues", were more complex than it seemed, and not only were interested in philosophy and theology, but also developed works that addressed these issues in the light of the new angle of mechanism.

5. Conclusions

There are several problems that we encounter when evaluating the figure of Huygens, which will lead us to understanding his views on the mechanized universe and the new understanding of nature in the seventeenth century. First, the classical interpretation of Huygens, which states he was more interested in solving problems than in creating a unified explanatory system. Second, the impossibility of rebuilding his scientific and philosophical project based on the collection of manuscripts and the *Oeuvres Complètes*. Third, Huygens's reluctance to publish his works during his life. Fourth, his fundamentally scientific approach, including his explicit refusal to enter in metaphysical disquisitions. And fifth, the *Cosmotheoros*, a work that is absolutely different from what Huygens did until then.

How to understand him then? After analysing the *Cosmotheoros*, I think we have strong reasons to believe that he was an interdisciplinary figure more than anything. We find that in his *Cosmotheoros* Huygens is reflecting his ideas on the difference between an automaton and a subject; the difference between human beings, animals and the inhabitants in other worlds, all of them being differentiated from machines or automata; and finally, the functioning of an automaton universe based on matter in motion regulated by the natural laws.

He is, as Fokko Jan Dijksterhuis says, a mathematician. However, he was not just a mathematician per se, but a scientist with a philosophical and theological background that guide his mechanical, speculative and even scientific disquisitions. In this sense Huygens is differentiated from the rest of "pure" mathematicians of his era.

Without that special background, we could not have had Huygens' scientific corpus, and a proof of it is that in the *Cosmotheoros* the theological speculations had priority in order to explain the universe and everything that is contained there.

This re-evaluation of Huygens' figure could be applied to other figures of the seventeenth century as well in order to examine how scientists and philosophers viewed the automaton universe. As we can see, the mechanized and empirical universe, which works as an automaton, did not entail the end of philosophical and theological implications. Rather, it encouraged scientists and philosophers to explain those implications within the new vision of nature. The possibility of inhabitants living in other worlds, for example, was one of them, but as we can see Huygens' speculative approach when addressing this automaton universe also helped him to clarify the

differences between the object (the universe itself) and the subject (animals, human beings and inhabitants of other worlds), as well as the ontological differences between those subjects.

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- ⁴ We find similar works in the history of science, such as Kepler and his *Somnium*. However, what makes Huygens' *Cosmotheoros* unique is his scientific approach, in contrast with the *Somnia*, which is a fictional work.
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- ¹⁷ Huygens, Ch., (1888–1950), vols. 1 to 10.
- ¹⁸ We can see many examples of Huygens's vision of a mechanical universe in his correspondence with Leibniz. For example, when debating Newton's gravitational theory: Leibniz, G. W., (1923ff.), series III, vol. 4, 461.
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- ²¹ Huygens, Ch., (1888–1950), vol. 21, 686.
- ²² Huygens, Ch., (1888–1950), vol. 21, 686.
- ²³ Psalms 8:3, 69:34, 96:11-12, 102:25, as well as Romans 1:20.
- ²⁴ Huygens, Ch., (1888–1950), vol. 21, 664-665.
- ²⁵ Huygens, Ch., (1888–1950), vol. 21, 715.
- ²⁶ Huygens, Ch., (1888–1950), vol. 21, 689.
- ²⁷ Huygens, Ch., (1888–1950), vol. 21, 698.
- ²⁸ Huygens represents the universe as an automaton in Huygens, Ch., (1888–1950), vol. 21, 689-690; and also in one of the appendices, in page 825: “Vous avez vu cette beauté et simplicité du système dans l'automate ou j'ay représenté les orbés et le mouvement des Planetes par un fort petit nombre de roües lesquelles roues il auroit bien falu multiplier si j'eusse voulu suivre Ptolemée ou mesme Tycho Brahé. Je vous mettray ici en 2 figures ce que represente la face de devant de ma machine a fin que vous ayez l'Idée du monde presente pendant que vous lirez ce que j'en diray”.
- ²⁹ Huygens, Ch., (1888–1950), vol. 21, 680.
- ³⁰ Huygens, Ch., (1888–1950), vol. 21, 688.
- ³¹ Huygens, Ch., (1888–1950), vol. 21, 746ff.
- ³² “Si mon jugement me trompe en cette rencontre, j'avoue être incapable d'estimer la valeur des choses” Huygens, Ch., (1888–1950), vol. 21, 714.
- ³³ Descartes, R., *Oeuvres de Descartes* (Paris: Cerf, 1897–1913), VI, 56.
- ³⁴ Huygens, Ch., (1888–1950), vol. 21, 730: “Il m'est incompréhensible que quelqu'un puisse se rendre à leur sentiment absurde et cruel; surtout en considérant que les bêtes elles-mêmes donnent à entendre le contraire tant par leur voix et par leur fuite devant les coups que généralement par toute leur manière de se comporter”.
- ³⁵ “These men will be composed, as we are, of a soul and a body. First I must describe the body on its own; then the soul, again on its own; and finally I must show how these two natures would have to be joined and united in order to constitute men who resemble us”, Descartes, R., (1897–1913), XI, 119.
- ³⁶ Huygens, Ch., (1888–1950), vol. 21, 730.
- ³⁷ According to Huygens they are ontologically very similar to human beings, and they are created by God (Huygens, Ch., (1888–1950), vol. 21, 702; 712 and 770). They also have developed different sciences (Huygens, Ch., (1888–1950), vol. 21, 732), which is the tool Huygens states human beings use to contemplate and glorify God (Huygens, Ch., (1888–1950), vol. 21, 730 and 736). Therefore, it can be inferred that they are within the God's plan of salvation.
- ³⁸ As Erik Jorink states, the ideas on how to interpret the “book of nature” were changing in the modern era in the Netherlands. He explains, for example, that this was also biologist and microscopist Jan Swammerdam's approach: “a pious scientist such as Swammerdam saw the order and structure of the creation as an *autonomous* revelation of God: it was the ‘Bible of God's wonders’ from which in principle everyone could grasp his essence”, Jorink, E., *Reading the Book of Nature in the Dutch Golden Age, 1575–1715* (Leiden: Brill, 2010), 406.
- ³⁹ Huygens, Ch., (1888–1950), vol. 21, 513-516.
- ⁴⁰ Huygens, Ch., (1888–1950), vol. 21, 517-521.
- ⁴¹ Huygens, Ch., (1888–1950), vol. 21, 522-523.
- ⁴² Huygens, Ch., (1888–1950), vol. 21, 345-371.
- ⁴³ Huygens, Ch., (1888–1950), vol. 21, 339-343.