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The Importance of the Church Fathers for Early Modern Astronomy

This article deals with reservations several Church Fathers had to astronomy and the consequences that this had for early modern astronomy. In general, the Church Fathers criticised astronomy as vain curiosity that does Christians no good. I argue that when the early modern astronomers stressed the usefulness of their discipline, it was not an expression of a new utilitarian way of thinking, but an attempt to neutralise these theological objections by highlighting the religious, social and moral benefits of astronomy. The spirit of material utility for which modern science was reproached in the twentieth century originally emerged as a need to legitimise science against the objections of theology.

Key words: Lactantius, Augustine, Ambrosius, Basil of Caesarea, the Church Fathers, curiosity, Copernicus, Kepler, early modern astronomy

When we open early modern astronomical texts at the beginning we usually find a chapter dealing with the loftiness and dignity of astronomy. The uniqueness of astronomy was often celebrated in ceremonial orations and overviews of the history of the discipline. In all these texts, the practical importance of astronomy for the individual and society was highlighted as well as the importance of astronomy in strengthening piety by discovering God's order in the world. Why did early astronomers think it necessary to emphasise rhetorically and symbolically the usefulness, theological wholesomeness and religious value of books that were otherwise very technical in nature? What was the aim and purpose of highlighting the benefits of astronomy? Was it merely a manifestation of the Renaissance humanist's emphasis on the usefulness of knowledge – in contrast to the sterility of scholastic erudition? Some authors believe that early modern scientists emphasised the usefulness and benefits of astronomy to prevent astronomy from being associated with magic and other occult disciplines.¹

In this article, I would like to offer another explanation. I argue that the

1 Neal, K. 'The rhetoric of utility: avoiding occult association for mathematics through profitability and pleasure', *History of Science* (1997) 37, 151-177; Kassell, L. "All was this land full fill'd of faerie" or magic and the past in early modern England', *Journal of the History of Ideas* (2006) 67, 107-122; Popper, N. "Abraham, Planter of Mathematics": histories of mathematics and astrology in early modern Europe', *Journal of the History of Ideas* (2006) 67, 87-106; Goulding, R. *Defending Hypatia: Ramus, Savile and the Renaissance Rediscovery of Mathematical History*, Dordrecht: Springer (2010), pp. 1-33; Jardine, N. 'The birth of history and philosophy of science: Kepler's A defence of Tycho against Ursus', Cambridge: Cambridge University Press (1984), pp. 263-284.

texts on the usefulness and excellence of astronomy can be understood as a response to reservations about astronomy expressed by some of the Fathers of the Church. Today, the moral evaluation of science usually focuses on the *results* following from scientific research. From Greek Antiquity to the eighteenth century, however, the moral evaluation of knowledge related to the *motives* of theoretical investigation.² The common label for illegitimate motives was curiosity (*curiositas*). Hellenistic philosophers had already questioned the meaning of knowledge that did not bring any benefit or blessing to everyday life. Therefore, in the evaluation of theoretical knowledge, the idea often emerged among the Greek philosophers that knowledge was fully legitimate only if it could prove its importance for moral perfection, for achieving salvation or for the common good.³ Some Church Fathers later denounced as illegitimate and reprehensible all theoretical knowledge that could not be used for the edification of the Church, to achieve salvation or for the understanding of God. In patristic literature astronomy was often seen as an example of curious interest in unnecessary and unattainable matters.⁴ For the Church Fathers, astronomy symbolised three aspects of inappropriate curiosity: a) the futility of knowledge which does not contribute to salvation, b) the desire for knowledge which is inappropriate for man and is reserved to God alone, c) and the expression of human arrogance trying to limit God's omnipotence.⁵

In its three parts, the present study explains three kinds of reservation expressed by selected Church Fathers and attempts to outline how early modern astronomers responded to them. This study does not pretend to cover the entire patristic literature but focuses on theologians who were later mentioned by astronomers themselves: Lactantius, Augustine and the two commentators on Genesis, Basil and Ambrosius. Similarly, I have chosen only the most important figures of early modern astronomy such as Copernicus, Rheticus, Tycho Brahe, Kepler and the Jesuit astronomers. From a broader perspective, the objective of the paper is to show that the relationship of Christian theology to astronomical knowledge cannot be only one-sided and interpreted in a biased way as a foolish rejection of

2 cf. Daston, L. 'Die Lust an der Neugier in der frühneuzeitlichen Wissenschaft', in Krüger, K. (ed.) *Curiositas: Welterfahrung und ästhetische Neugierde in Mittelalter und früher Neuzeit*, Göttingen: Wallstein (2002), p. 151.

3 Hadot, P. *Philosophy as a Way of Life: Spiritual Exercises from Socrates to Foucault*, Oxford: Wiley-Blackwell (1995), pp. 21-24, 88-97.

4 cf. Oberman, H. *Contra vanam curiositatem: Ein Kapitel der Theologie zwischen Seelenwinkel und Weltall*, Zürich: Theologischer Verlag (1974); Bös, G. *Curiositas: Die Rezeption eines antiken Begriffes durch christliche Autoren bis Thomas von Aquin*, Paderborn: Schöningh (1995), pp. 85-129.

5 The history of theoretical curiosity was presented by Blumenberg, H. *The Legitimacy of Modern Age*, Wallace, R.M. (trans.), Cambridge, Mass.: MIT Press (1983), pp. 279-323.

scientific knowledge and the primacy of blind faith.⁶ This was the kind of reasoning typical of the positivist tradition at the turn of the nineteenth and twentieth centuries. Recent research⁷ has proved that the relationship of early Christianity and science should not be oversimplified. Developing this agenda, I try to highlight that we should pay attention not only to the religious reception of the astronomical theories – as the positivist research did – but also to the broader philosophical and theological context of that reception.

1. 'That which is above us is nothing to us': the futility of astronomy

The Church Fathers did not generally strive to formulate an authentic Christian cosmology following the Bible to replace Greek astronomy,⁸ and one of the reasons for this lack of interest was their firm conviction that the investigation of heavenly phenomena was useless and inappropriate.

Lactantius is usually mentioned in histories of astronomy because of his

6 See e.g. Draper, J.W. *History of the Conflict between Religion and Science*, New York: Appleton (8th edn., 1881), pp. 157-160; White, A. D. *A History of the Warfare of Science with Theology*, London / New York: Macmillan (1896), pp. 89-97, 114-120; Keltie, J.S. & Howart, O.J.R. *History of Geography*, London: Watts (1913), pp. 34-35; Dannemann, F. *Die Naturwissenschaften in ihrer Entwicklung und in ihrem Zusammenhange*, 4 vols. Leipzig: Wilhelm Engelmann (2nd edn., 1921), vol. I, pp. 288-289; Dijksterhuis, E. J. *The Mechanization of the World Picture*, Oxford: Clarendon Press (1961), pp. 92-93.

7 Lindberg, D.C. 'Science as handmaiden: Roger Bacon and the patristic tradition', *Isis* (1987) 78, 518-536; 'Science and the early church', in Lindberg, D.C. & Numbers, R.L. (eds.) *God and Nature: Historical Essays on the Encounter between Christianity and Science*, Berkeley / Los Angeles / London: University of California Press (1986), pp. 19-48; 'Early Christian attitudes toward nature', in Ferngren, G.B. (ed.) *The History of Science and Religion in the Western Tradition*, New York: Garland (2000), pp. 277-282; 'That the rise of Christianity was responsible for the demise of ancient science', in Numbers, R. (ed.) *Galileo Goes to Jail: and other myths about science and religion* (ref. 2), pp. 8-18; 'The fate of science in patristic and medieval Christendom', in Harrison, P. (ed.) *The Cambridge Companion to Science and Religion*, Cambridge: Cambridge University Press (2010), pp. 21-38.

8 There were minor exceptions – notorious is Cosmas Indicopleustes, see his *The Christian Topography*, McCrindle, J.W. (trans.), London: Hakluyt Society (1897), reprinted in *Cambridge Library Collection*, 2010). A very fine analysis of Cosmas' cosmology can be found in Krüger, R. *Eine Welt ohne Amerika*, Vol. 2: *Das Überleben des Erdkugelmodells in der Spätantike*, Berlin: Weidler (2000), 371-446; cf. Elweskiöld, B. *John Philoponus against Cosmas Indicopleustes: a Christian controversy on the structure of the world in the sixth-century Alexandria* Ph.D. thesis, Lund University (2005); Marcus, W. 'Typen altchristlicher Kosmologie in den Genesiskommentaren', *Philosophisches Jahrbuch der Görresgesellschaft* (1957) 65, 106-119; Scholten, C. *Antike Naturphilosophie und Christliche Kosmologie in der Schrift 'De officio mundi' des Johannes Philoponos*, Berlin / New York: De Gruyter (1996), pp. 272-295.

(often misinterpreted) rejection of the concept of the antipodes.⁹ Nevertheless, what is far more interesting for the history of astronomy is his reassessment of the function and meaning of the contemplation of the heavens in which he followed the Socratic condemnation of the investigation of nature.

According to Lactantius, Socrates was wiser than other pagan philosophers because he understood that all the mysteries of the world (*arcana mundi*) could not be ascertained. So he humbly refrained from seeking knowledge of the world. Such a desire was not merely nonsensical, commented Lactantius, but even impious because it regularly entailed a curious penetration into the secrets of God's providence. Although in many things Socrates had acted foolishly, he should be praised for his epistemological restraint in the investigation of nature, which he used to express in the short proverb *quod supra nos nihil ad nos* – 'that which is above us is nothing to us'. Lactantius was quite aware of the ambiguity of that sentence, therefore he at once added that we could accept these words only if they meant indifference to the investigation of the heavens; not if they meant indifference to religion.¹⁰

The origins of the formula *quod* (or *quae*) *supra nos nihil ad nos* used by Lactantius are not quite clear. Obviously the sentence stems from that part of Socratic doxography concerning Socrates' disapproving relationship to the theoretical investigation of nature, particularly to the investigation of the heavens.¹¹ This pseudo-Socratic utterance should probably express a conviction attributed to Socrates that theoretical interest in heavenly phenomena is but a waste of time. The only legitimate knowledge is that which helps with the orientation of life and attaining beatitude – as we know from P. Hadot, this conviction was typical of many Greek philosophers.¹² In the history of European thought, this utterance attributed to Socrates was therefore interpreted as an instruction to neglect empirical knowledge and turn instead to the inner self and seek moral perfection.

9 See Lactantius, *Divinae Institutiones*, III, 24, 1, Brandt, S. (ed.), in *Corpus Scriptorum Ecclesiasticorum Latinorum* (hereafter *CSEL*), vol. 19, Wien: Tempsky (1890), p. 254; cf. Simek, R. *Heaven and Earth in the Middle Ages: the physical world before Columbus*, Woodbridge: Boydell (1996), p. 2; Russell, J. B. *Inventing the Flat Earth: Columbus and modern historians*, New York / London: Praeger (1991), pp. 1-5, 35 n; Mayaud, P.-N. *Le conflit entre l'Astronomie Nouvelle et l'Écriture Sainte aux XVIe et XVIIe siècles: un moment de l'histoire des idées*, 5 vols., Paris: Champion (2005), vol. I, 83-91; Dreyer, J. L. E. *A History of Astronomy from Thales to Kepler*, London: Dover (1953), pp. 207-220; Ritter, A. M. 'Christliche Kosmologie in der alten Kirche', in Hübner, J., Stamatescu, I.-O. & Weber, D. (eds.) *Theologie und Kosmologie: Geschichte und Erwartungen für das gegenwärtige Gespräch*, Tübingen: Mohr Siebeck (2004), pp. 99-112.

10 Lactantius, *Divinae Institutiones*, III, 20, 1-20, (*CSEL* 19, 246f.).

11 See Jüngel, E. 'Quae supra nos, nihil ad nos: Eine Kurzformel der Lehre vom verborgenen Gott – im Anschluss an Luther interpretiert', *Evangelische Theologie* (1972) 32, 197-240.

12 Hadot *op. cit.*, (3), pp. 21-24, 86.

Christianity accepted both the Socratic primacy of self-knowledge and the belief that the knowledge of nature is worthless and of no use in the pursuit of blessedness. Christian writers pointed out that the Bible itself (Is. 40:13; Job 38:4) admonishes man for his interest in the natural world and invites him to deal with something that is nearer than the heavenly bodies, with the nearest thing of all – namely, his own self.¹³

Lactantius uses the Socratic formula to devalue the unjustified and over-curious interest in things that man should rather ignore, because his life should not concentrate on the knowledge of nature. Instead man should seek spiritual understanding of the transcendental origins of the natural world:

Our heavenwards gaze is simply the will of God unobstructed. The birds can see the sky, and so can virtually all of dumb creation, but our special gift is to gaze at it standing upright, so that we can seek our faith there, and can contemplate god whose abode it is in our minds though we cannot with our eyes. (*ut deum ... animo contemplerur*).¹⁴

We should observe the heavens not because of their beauty and harmony. The perfection of the heavens is only a sign of their invisible Creator whom our souls should contemplate. 'We are not then born in order to see what has been made, but to gaze upon the maker of all things himself: to see him in the mind, that is.'¹⁵

According to Greek and Roman philosophers, the observation of the visible splendour of the heavens brings about the blessedness of the heavenly gods in human souls. Therefore, astronomy was considered the noblest form of theoretical activity.¹⁶ The writings of Lactantius, however, show that Christianity brought about an important change in the understanding of the observation of the heavens. Christians spiritualised the contemplative ideal of the observation of the sky and linked it to the Socratic ideal emphasising self-knowledge and ignoring the knowledge of nature. The result of such a synthesis was a devaluation of astronomy as a special theoretical activity. Unlike pagan gods, the Christian God does not dwell in the sky. He can only be found in the human soul. Gazing at the sky reveals only a curious interest in unnecessary things and at the same time

13 Brague, R. *Die Weisheit der Welt: Kosmos und Erfahrung im westlichen Denken*, München: C. H. Beck (2006), p. 104f.

14 Lactantius, *Divinae Institutiones*, II, 1, 17-18, (CSEL 19,98); Lactantius, *Divine Institutes*, Bowen, A. & Garnsey, P. (trans.), Liverpool: Liverpool University Press (2003), p. 120.

15 Lactantius, *Divinae Institutiones*, III, 9, 13, (CSEL 19,199f.); *Divine Institutes*, p. 182.

16 See e.g. *Ptolemy's Almagest*, Toomer, G.R. (trans.), Princeton: Princeton University Press (1998), pp. 35-37. The idea is of Stoic origin though; see Probst, P. 'Spectator coeli', in *Historisches Wörterbuch der Philosophie*, Ritter, J. & Gründer, K. (eds.), Basel / Stuttgart: Schwabe, vol. IX (1995), pp. 1350-1355; Blumenberg, H. 'Contemplator coeli', in Gerhardt, D. (ed.) *Orbis scriptus. Dmitrij Tschizewskij zum 70. Geburtstag*, München: Fink (1966), pp. 113-124; Brague *op. cit.*, (13), pp. 155-196.

it is a mark of neglecting things that are truly important. From this point of view, astronomy represents a useless and worthless activity. According to Braque, this is the reason why in patristic literature astronomy was so often identified with the 'wisdom of this world' in Paul's letter to the Corinthians (1 Cor. 1:20).¹⁷

The evidence for this devaluation of the interest in empirical heavens can be found in famous commentaries on Genesis. The first extant Greek text of this sort is a series of homilies by Basil of Caesarea called *Hexameron*. Among the Latin Fathers, the bishop of Milan, Ambrosius (333-397), wrote one of the earliest extant hexamerons in Latin. His *Hexameron* (or *Exameron*) is considerably influenced by Basil's treatise.¹⁸

Basil in his homilies on the creation of the world does not aim to present an authentic Christian cosmology. Like the other Fathers, he wants to defend the authority of Scripture against worldly wisdom and further he wants to bring his readers to a more genuine faith by depicting the beauty and order of creation. Referring to the Bible (Rom. 1:20), Basil says that interest in the visible world should lead to knowledge of its invisible Creator:¹⁹

Moreover, you will find that the world was not devised at random or to no purpose, but to contribute to some useful and to the great advantage of all beings, if it is truly a training place for rational souls and a school for attaining the knowledge of God, because through visible and perceptible objects it provides guidance to the mind for the contemplation of the invisible...²⁰

According to Basil, interest in nature is justified only when it is temporary and provisional, when it can be used for the edification of the church and when it brings men to knowledge of the Creator and to a virtuous life.²¹ For example, the world of animals and plants is used by Basil above all

17 Braque *op. cit.*, (13), pp. 197-233.

18 cf. Robbins, F. E. *The Hexaemeral Literature: a study of the Greek and Latin commentaries on Genesis*, Chicago: The University of Chicago Press (1912); Zahlten, J. *Creatio mundi. Darstellungen der sechs Schöpfungstage und naturwissenschaftliches Weltbild im Mittelalter*, Stuttgart: Klett-Cotta (1979), pp. 91-101; Henke, R. *Basilii und Ambrosius über das Sechstageswerks. Eine vergleichende Studie*, Basel: Schwabe (2000); Köckert, C. *Christliche Kosmologie und kaiserzeitliche Philosophie*, Tübingen: Mohr Siebeck (2009), pp. 312-420; Groh, D. *Schöpfung im Widerspruch: Deutungen der Natur und des Menschen von der Genesis bis zur Rezeption*, Frankfurt a. M.: Suhrkamp (2003), pp. 244-263.

19 Basil of Caesarea *Hexameron*, III, 10, Giet,S (ed.), in *Sources Chrétiennes* (hereafter SC), vol. 26, Paris (1968), p. 55.

20 Basil of Caesarea *Hexameron*, I, 6, (SC 26,11); Basil of Caesarea *On the Hexameron*, in Basil of Caesarea, *Exegetic Homilies (Fathers of the Church*, vol. 46), Clare Way, A. (trans.) Washington: Catholic University of America Press (1963), p. 31. cf. Ovitt, G. *The Restoration of Perfection: Labor and Technology in Medieval Culture*, New Brunswick / London: Rutgers University Press (1987), pp. 60-62.

21 Basil of Caesarea *Hexameron*, I, 8, (SC 26,14 f.).

as a source of examples of virtuous behaviour. These examples can lead to moral enlightenment and in this way they can contribute to the salvation of the soul.²² For Basil, the wonder of nature is legitimate, 'though alone inadequate. The literal or phenomenal order and beauty of the world ... is worthy of its own right.... But this phenomenal order is always inducement to deeper exploration and inducement...'²³

Astronomy (or any explanation of heavenly phenomena) is treated by Basil in a different way. Throughout his interpretation of Genesis Basil carefully restricts himself to basic cosmological questions: the location of the Earth in the cosmos, the shape of the universe and the shape of the Earth. Basil concludes his extensive explanation of the Earth's location very briefly, but in a way typical of the Christian reception of astronomy. He recommends his listeners and readers not to search for these things. Men should not out of curiosity try to understand the incomprehensible. They should believe what Scripture says:

Therefore, we must say this to ourselves and to those asking us on what this immense and insupportable weight of the Earth is propped up: 'In the hand of God are all the ends of the Earth' (Ps. 95:4). This is safest for our own understanding and is most profitable for our hearers.²⁴

In the next section Basil describes again in detail the Greek theories explaining the stationary location of the Earth in the middle of the cosmos. Also, finally, he again questions the meaning of such considerations. If they seem probable to someone, they will certainly lead to admiration of the Creator of perfect cosmic order. However, it does not matter if the cause of the location of the Earth cannot be found because sincerity of faith is more important than the demonstration of reason.²⁵ Discussing in the same way the location of the Earth, Ambrose suggests that interest in cosmological problems is fruitless:

We can in many ways demonstrate this, if we observe that these elements are of advantage in the building of a church. But, since it is not profitable to be concerned with this, let us rather turn our attention

22 Basil of Caesarea *Hexaemeron*, IX, 3, (SC 26,150f.) cf. Harrison, P. *The Bible, Protestantism, and the Rise of Natural Science*, Cambridge: Cambridge University Press (1998), pp. 11-33.

23 Blowers, P. M. 'Entering "This Sublime and Blessed Amphitheatre": contemplation of nature and interpretation of the Bible in the Patristic period', in Meer, van der, J.M. & Mandelbrote, S. (eds.) *Nature and Scripture in the Abrahamic Religions: Up to 1700*, Leiden / Boston: Brill (2008), vol. I, pp. 147-176 (p. 157).

24 Basil of Caesarea *Hexaemeron*, I, 9, (SC 26,17); *On the Hexaemeron*, p. 16; cf. Bright, P. 'Nature and Scripture: The Two Witnesses to the Creator', in Meer, van der, J. M. & Mandelbrote, S. (eds.) *op. cit.*, (23), pp. 83-115.

25 Basil of Caesarea *Hexaemeron*, I, 10, (SC 26,18).

to those matters which may be fruitful for eternal life (*ad illa magis intendamus animum in quibus vitae sit profectus aeternae*).²⁶

In Basil's opinion, 'the wise of this world' worked out several theories concerning the nature and shape of the heavens. Even so, Basil's overview of the different Greek theories ends without giving a definitive answer. Understanding the nature of the heavens is not important for a Christian. On the contrary, the search for correct answers involves a Christian in the vain discussions of pagans:

But, let us allow them to refute each other, and let us stop talking about the substance, since we have been persuaded by Moses that 'God created the heavens and the Earth' (Gen. 1:1). Let us glorify the Master Craftsman for all that has been done wisely and skilfully; and from the beauty of the visible things let us form an idea of Him who is more than beautiful; and from the greatness of these perceptible and circumscribed bodies let us conceive of Him who is infinite and immense and who surpasses all understanding in the plenitude of His power.²⁷

Similarly, in the same context, Ambrose emphasises that a Christian should know only what is necessary. Necessary knowledge, then, is knowledge useful for salvation:

Let us leave these men to their contentions, men who contradict themselves by their mutual disputes. Sufficient for our salvation is not disputatious controversy but doctrine – not the cleverness of argumentation, but fidelity of the mind – that we may serve, not a creature, but our Creator.²⁸

The wise of this world in their effort to describe and measure the Earth and the heavens expose themselves to the pitfalls of demons, they lose the light of the Church and they do not see it any more.²⁹ Both theologians also reach similar conclusions regarding the shape of the Earth. They do not question the Greek findings about the spherical shape of the Earth, but they doubt that such questions have any meaning for a Christian.³⁰

26 Ambrose *Exameron*, I, 6, 20, Schenkl, C. (ed.), in *CSEL* vol. 32-1, Wien: Verlag der Österreichischen Akademie der Wissenschaften (1897), 16f.; St Ambrose *Hexameron, Paradise, and Cain and Abel*, Savage, J.J. (trans.) in *The Fathers of Church: new translation*, vol. 42, New York: Fathers of the Church, Inc. (1961), p. 10: cf. Ambrose *Expositio psalmi cxviii* 12, 20: *Sed non est cura sanctis axem caeli et elementorum spatia philosophico more numeros que describere – quid enim hoc prodest saluti? – , quia sancti spiritalibus semper intendunt et uitae aeternae profutura uel cognoscere gestiunt uel docere*.

27 Basil of Caesarea *Hexameron*, I, 11, (*SC* 26, 19 f.); *On the Hexameron*, *op. cit.*, (20), p. 19.

28 Ambrose *Exameron*, I, 6, 24, (*CSEL* 32-1,22); St Ambrose *Hexameron*, *op. cit.*, (26), p. 25.

29 Ambrose *Exameron*, V, 24, 86, (*CSEL* 32-1,200).

30 Basil of Caesarea *Hexameron*, IX, 1, (*SC* 26, 147); Ambrose *Exameron* VI,2,8 (*CSEL* 32-1,208); cf. Maurach, G. *Coelum Empyreum: Versuch einer Begriffsgeschichte*, Wiesbaden: Steiner (1968), pp. 25-35.

The astronomical investigation of the structure of the cosmos neither contributes to salvation nor brings reverence to the Creator. Therefore, such activity ought to be considered an illegitimate transgression of the borders that limit temporal interest in the structure of the cosmos during the terrestrial part of the soul's journey back to God. According to the authors of hexamerons, astronomy does not meet the criteria for knowledge that a Christian should be interested in.

Early modern astronomers were very well aware of the objections of the Church Fathers to exploring celestial phenomena and they naturally felt obliged to defend astronomy. In the introductions to astronomical works and in ceremonial orations about mathematical disciplines there often appeared brief sketches of the history of astronomy, claiming that God had given astronomy to Adam and the antediluvian patriarchs as a gift. Thus astronomy should be legitimised by reference to its divine origin and by its illustrious history dating back to the biblical patriarchs. In addition, these texts often mentioned *praestantia astronomiae* resulting from the nobility of its subject. In the spirit of Aristotelian and Stoic tradition, early modern astronomers still considered heaven a high and noble area that is closest to God and not affected by the volatile fluctuations of earthly affairs. Finally, readers were often reminded of the uniqueness of astronomy resulting from the certainty of its mathematical proofs.

In addition to these strategies, astronomers often emphasised the importance of astronomy for the knowledge of God and understanding His attributes. Such an emphasis can be found by astronomers with a theological education – as in the case of the Jesuit astronomers. One of the most famous, Christopher Clavius, in the introduction to his commentary on Sacrobosco's *De sphaera* (1570) writes that astronomy is a pathway to the Supreme God (*esse viam ac semitam ad sciendum Deum altissimum*).³¹ Another well-known Jesuit astronomer, Giovanni Battista Riccioli, in the introduction to his *Almagestum novum* (1651) reports on reservations to astronomy formulated by Augustine and Ambrosius, but at the same time he also states that astronomy is the most noble and royal science leading humans directly to the habitation of God (*qua intramus in ipsam Dei domum*).³² Similarly, another Jesuit astronomer, Franciscus Levera, spells out the objections raised by the Church Fathers, but finally recalls that astronomy not only leads directly to the knowledge of God (*ad Dei cognitionem directe conducit*), but also strengthens love of God and helps combat idolatry.³³

31 Clavius, C. *Commentarius in Sphaeram Ioannis Sacrobosco*, Romae: Zannetti (1606), p. 7.

32 Riccioli, G.B. *Almagestum novum*, Bononiae: Benatius (1651), pp. i-ii, vii.

33 Levera, F. *Prodromus universae astronomiae restitutae*, Romae: Bernabo (1663), pp. 45a-46a; cf. Biancani, G. *Clarorum mathematicorum chronologia*, in *Aristotelis loca mathematica*, Bononiae: Bochium (1615), (separated numbering of pages) pp. 19-27.

The importance of astronomy for the knowledge of God was emphasised by the Protestant astronomers as well – particularly in Germany due to the authority of Philipp Melanchthon who recommended the study of astronomy as a means of knowing God and introduced the Stoic ideal of man as a *contemplator coeli* into the body of Protestant education.³⁴ Accordingly, Melanchthon's son-in-law, mathematician Caspar Peucer, points out that astronomy elevates the human soul to the knowledge of God (*excitari igitur hoc studio mentes ad cognitionem Dei*).³⁵ Another famous German astronomer, Erasmus Reinhold, writes that those who condemn astronomy do not understand that mathematical disciplines are divine rays sent into the human mind and are unwavering testimonies to God and his providence.³⁶ According to Copernicus's Protestant pupil, Joachim Rheticus, humans are born to observe the sky because just a glance at the harmonious arrangement of lawful celestial movements reminds one of the existence and wisdom of the Creator.³⁷ In his speech *Oratio de disciplinis mathematicis* (1574), Tycho Brahe repeats the cherished theme of *contemplator coeli*. The beauty of the starry sky was made to be observed by humans who can thus better understand the majesty of God.

For what purpose would that wise and provident creator of the universe have fashioned laws of the motions of heavenly bodies so marvelous and so enduring, so diversified and yet so harmonious, if he had wished man, for whose sake chiefly he had created the visible world, to remain in ignorance of them. Rather he desired that these matters be diligently studied and investigated so that his majesty and his wisdom also might be seen and honoured by men. Therefore, after the true and appropriate recognition of God, who is revealed in the word he has given us, I consider nothing more fitting to the nature of man and more in harmony with the purpose for which man was created and placed on Earth, the centre of the universe, than that, looking out from his central position ... he may pass his life happily and ... recognising God as the creator in these his most wise and varied works, should honour, praise, and reverence him deservedly.³⁸

34 Kusakawa, S. *The Transformation of Natural Philosophy: The Case of Philip Melanchton*, Cambridge: Cambridge University Press (1995), pp. 127-131.

35 Peucer, C. *Elementa doctrinae de circulis coelestibus*, Vitebergae: Lustius (1563), fol. 4r.

36 Reinholdus, E. *Prutenicae tabulae coelestium motuum*, Tubingae: Ulricum (1551), p. a3.

37 Rheticus, J. *Orationes duae prima de astronomia & geographia altera de physica*, Norimbergae: Petreius (1542), pp. A8r-v; cf. Danielson, D. *The first Copernican: Georg Joachim Rheticus and the rise of the Copernican revolution*, New York: Walker (2006).

38 Tycho Brahe 'On Mathematical Studies', Coon, R.H. (trans.) *Popular Astronomy* (1929) 37, pp. 311-320 (pp. 319f); cf. Tycho Brahe *De disciplinis mathematicis*, in Dreyer, J.L. (ed.) *Tychonis Brahe Dani opera omnia*, Copenhagen: Gyldendal (1913-1929), hereafter cited as *TBOO*, vol. I, p. 152.

Also, Kepler's teacher, Michael Mästlin, in his works repeatedly says that astronomy leads *ad gloriam nominis Dei*.³⁹ At the end of his *Mysterium Cosmographicum* (1596), Johannes Kepler strongly reminds his readers that the purpose of all astronomical research is 'knowledge, admiration and worship of the omniscient God' (*cognitio, admiratio et veneratio Sapientissimi Opificis*).⁴⁰ Kepler believed that God had created the world according to geometrical rules and the human spirit had been adapted to understanding this geometrical structure of the universe. Humans are naturally disposed to understand mathematical truths because, according to Kepler, God eternally geometrises – and man was created in his image.⁴¹ The knowledge of God from the study of nature is thus a possible way for humans to discover him in their hearts.

During the seventeenth century, emphasising the role of astronomy in understanding God became a standard part of astronomical writings and was used to demonstrate the religious importance of astronomy. Rejecting the objections of some of the Fathers and contemporary theologians, astronomers tried to prove that astronomy is a suitable activity for Christians because of its importance for salvation. This constant emphasis throughout the seventeenth century shows that, in this period, reservations about the meaningfulness of astronomical knowledge to the community and society were still rife. If this had not been the case, astronomers would not have felt the need to demonstrate the religious benefits of their discipline. In contrast, the authors of treatises on natural philosophy of that period did not feel such a need at all.⁴² The defensive strategy of legitimising astronomy became a positive and optimistic programme with the emergence of natural theology at the turn of seventeenth and eighteenth centuries. William Derham in his *Astrotheology* (1714) deliberately blurs the meaning of 'seeking things that are above' because, for him, the

39 Mästlin, M. *Observatio & Demonstratio Cometæ Aetherei*, Tübingae: Gruppenbachius (1578), Dedicatio, unnumbered page 4; *Epitome astronomiae*, Tübingae: Gruppenbachius (1588), fol. *3; cf. Methuen, C. *Kepler's Tübingen: Stimulus to a Theological Mathematics*, Aldershot: Ashgate (1998), pp. 171-177.

40 Kepler, J. *Mysterium Cosmographicum*, in von Dyck, W, Caspar, M. et al. *Kepler, J. Gesammelte Werke*, Munich: C. H. Beck (1938-99; hereafter KGW), vol. I., p. 79. As for theological presuppositions of Kepler, see Methuen, C. 'The Teachers of Johannes Kepler: theological Impulses to the story of the heavens', in *Sciences et Religions: De Copernic à Galilée (1540-1610)*, Rome: Ecole française de Rome (1999), pp. 183-203; Barker, P. & Goldstein, B.R. 'Theological Foundations of Kepler's Astronomy', *Osiris* (2001) 16, 88-113; Kusukawa, S. *The Transformation of Natural Philosophy: The Case of Philip Melanchton*, Cambridge: Cambridge University Press (1995), pp. 127-142; Hübner, J. *Die Theologie Johannes Keplers zwischen Orthodoxie und Naturwissenschaft*, Tübingen: Mohr (1975); Howell, K. J. *God's Two Books: Copernican Cosmology and Biblical Interpretation in Early Modern Science*, Notre Dame: University of Notre Dame Press (2002), pp. 10-139.

41 Kepler to Mästlin, 19 April 1597, Nr. 64, KGW vol. 13, p. 113.

42 cf. Rohault, J. *Traité de Physique*, Paris: Thierry (1671); Newton, I. *Principia mathematica philosophiae naturalis*, London: Innys (1726).

expression ‘things above’ means both exploring the ‘most distant Regions of the Universe’ and running ‘the Race which Christ hath set before us’.⁴³

2. The vice of curiosity

In his *Exameron*, Ambrosius, the bishop of Milan, accuses astronomy of arousing arrogance in people. Measuring the Earth and the universe is considered by Ambrose to be an expression of scientific conceit, daring to undertake a task which can be handled by God alone (with reference to Is. 40:12): ‘Who, then, ventures to put his knowledge on the same plane with God? Does man presume to offer in the way of knowledge what God has sealed with his own oracular and majestic pronouncements?’⁴⁴ The astronomer trying to measure the heavens and the Earth not only neglects the salvation of his soul but also commits blasphemy by demanding knowledge that God has reserved for himself. So the astronomers seek to penetrate mysteries that are not to be understood by men.

Augustine, in the fifth book of his *Confessions*, links astronomy to pride: ‘By the proud you are not found, not even if their curiosity and skill number the stars and the sand, measure the constellations, and trace the paths of the stars.’⁴⁵ There is a danger, too, that fulfilled predictions can give astronomers undue complacency. Augustine warns astronomers not to forget that their ability to gather knowledge was given to them and reminds them that they ought to remember the giver of this gift. Successful theoretical achievements bring astronomers conceited pride – but God cannot be found by the proud (*nec inveniris a superbis*).⁴⁶ For Augustine, astronomical predictions are an example of knowledge which is conscious neither of its transcendent origin, nor of the contingency of creation. Therefore, it forgets its dependence and limitedness. Since the practice of astronomy is tainted with curiosity and pride, astronomy becomes almost sinful in Augustine’s view. Although *curiositas* was never classified as a deadly sin, in one of his letters Augustine suggests that three kinds of vice, namely, the pleasure of the flesh, pride and curiosity, include all sins.⁴⁷

43 Derham, W. *Astro-theology: Or, A Demonstration of the Being and Attributes of God, from a Survey of the Heavens*, London: Innys – Manby (7th edn., 1738), p. 246.

44 Ambrose *Exameron*, VI, 2, 7, (CSEL 32-1,208): *Quis igitur aequalem sibi cum deo audet scientiam vindicare, ut quae deus maiestatis suae esse proprio signavit oraculo haec sibi homo ad cognitionem suppetere posse praesumat?* cf. Ambrose *Hexameron*, *op. cit.*, (26), p. 231.

45 Augustine *Confessiones*, V, 3, 3, Verheijen, L. (ed.), in *CCSL* 27, Turhnout: Brepols (1990), p. 58; Augustine *Confessions*, Chadwick, H. (trans.), Oxford: Oxford University Press (1992), p. 74. My account of Augustine’s conception of curiosity draws on Blumenberg, H. ‘Augustins Anteil an der Geschichte des Begriffs der theoretischen Neugierde’, *Revue des études augustiniennes* (1961) 7, 35-70; cf. Blumenberg, H. *op. cit.*, (5), pp. 239-308.

46 Augustine *Confessiones*, V, 3, 3-5, (CCSL 27, 58-59).

47 Augustine *Enarrationes in psalmos*, VIII, 13, Weidmann, C. (ed.), in *CCSL* 43-1A, Wien, Verlag der Österreichischen Akademie der Wissenschaften (2003), p. 182: *Haec autem tria genera vitiorum, id est voluptas carnis, et superbia, et curiositas, omnia peccata concludunt.*

‘Vain infatuation with nature ... is a primary ascetical vice and threat to the progress of spiritual life, according to Augustine’.⁴⁸

Besides, according to Augustine, astronomy contributes nothing to blessedness. Theoretical knowledge cannot be a goal in itself and for itself; it must be always oriented towards the achievement of blessedness. Blessedness can be found only in God, so the only justified knowledge is the knowledge showing the soul the way to God and uniting it with him.⁴⁹ In his *De doctrina christiana*, Augustine recommends his readers to keep in mind the apostolic pronouncement, ‘Knowledge puffeth up, but charity edifieth’ (1 Cor. 8:1).⁵⁰ Knowledge can become useful only through love. Without love of neighbour and of God science becomes diabolical.⁵¹ Greek mathematical astronomy cannot meet these requirements. Understanding heavenly phenomena is in no way beneficial to blessing and that is why it is mere curiosity. In his *Confessions*, Augustine admits the usefulness of astronomical findings and he even suggests that they helped to free him of Manichean heresy. Yet he then states: ‘The person who knows all those matters but is ignorant of you is unhappy. The person who knows you, even if ignorant of natural science, is happy.’⁵² A man not even knowing the constellation the Plough but loving and knowing his Creator may be better than a man ‘who measures the heaven and counts the stars and weighs the elements, but neglects you who have disposed everything “by measure and number and weight”’ (Wisd. 11:21).⁵³ The only kind of knowledge bringing blessing is wisdom (*sapientia*) which human beings cannot achieve by themselves because this knowledge has a supernatural origin in God’s grace. Worldly wisdom can bring blessing only indirectly when it does not cling to the created world but becomes a stepping stone on the long journey to God.⁵⁴

In Augustine’s writings, lack of interest in the natural world has been accompanied by instruction which widens the spirit of the Socratic formula, calling for a turn from nature to one’s own soul where God is to be found. Astronomical investigations (measuring the distances of heavenly

48 Blowers *op. cit.*, (23), pp. 147-176, p. 157.

49 Augustine *Confessiones*, X, 22, 32, (CCSL 27, 172); cf. Stiglmayr, E. *Der Wissenschaftsbegriff in der christlichen Philosophie I. Augustin: Verpflichtung zur Wahrheit*, Wien: Institut für Völkerkunde (1979), pp. 88-89.

50 Augustine *De doctrina christiana*, II, 41, 62, Martin, J. (ed.), in *CCSL*, vol. 32, Turnhout: Brepols (1962), p. 75.

51 cf. Lorenz, R. ‘Die Wissenschaftslehre Augustins’, *Zeitschrift für Kirchengeschichte* (1955/56) 67, 29-60, 213-251, esp. 245-246; cf. Marrou, H. I. *Augustin und das Ende der antiken Bildung*, Paderborn: Schöning (1995), p. 239.

52 Augustine *Confessiones*, V, 4, 7, (CCSL 27, 60); Augustine *Confessions*, *op. cit.*, (45), p. 75.

53 Augustine *Confessiones*, V, 4, 7 (CCSL 27,60); Augustine *Confessions*, *op. cit.* (45)p. 76.

54 Augustine *De Trinitate*, XII, 15, 25, Mountain, W.J. (ed.), in *CCSL*, vol. 50, Turnhout: Brepols (1968), p. 379; cf. *De Trinitate*, XII, 11, 16, (CCSL 50,370); *De Trinitate*, XII, 12, 17, (CCSL 50, 371f).

bodies or predicting their positions) repeatedly serve for Augustine as examples of unjustifiable curiosity joined with the inability to turn from the visible world to the inner self and to God.⁵⁵ Besides, astronomy presents a good example for Augustine, because it deals with the objects in an empirical sense most distant from man, that is, the stars and the heavens. In this way, an impressive contrast emerges to the thing nearest and most intimate: the soul. Sometimes Augustine seems to suggest his objections to astronomy mainly because of the closing message: instead of clinging to things too distant man should turn to his soul where God can be found.

Early modern philosophers and scientists countered accusations of curiosity with another category – usefulness.⁵⁶ Exploring nature is neither an end in itself nor a deplorable interest in unnecessary things because it provides multiple benefits. Francis Bacon programmatically legitimised interest in nature claiming that it is the recovery of power and sovereignty that man once possessed in Paradise. It is not ‘the pleasure of curiosity’ that is true end of knowledge – ‘it is a restitution and reinvesting (in great part) of man to the sovereignty and power ... which he had in his first state of creation’.⁵⁷ In a similar way to Bacon and the philosophers who followed him, astronomers tried to show that astronomy does not explore things without spiritual purpose but that it brings both individual and collective benefit. For example, in the spirit of the Renaissance humanism, Copernicus emphasises the role of astronomy in achieving blessedness.

Although all the good arts serve to draw man’s mind away from vices and lead it toward better things, this function can be more fully performed by this art (*i.e. astronomy*), which also provide extraordinary intellectual pleasure. For when a man is occupied with things which he sees established in the finest order and directed by divine management, will not the unremitting contemplation of them and a certain familiarity with them stimulate him to the best and to admiration for the Maker of everything, in whom are all happiness (*felicitas*) and every good?⁵⁸

These words act in response to Augustine’s reservations about astron-

55 e.g. Augustine *De vera religione*, 29, 52, Martin, J. (ed.), in *CCSL*, vol. 32, Turnhout: Brepols (1962), p. 221.

56 cf. Gaukroger, S. *The Emergence of a Scientific Culture: Science and the Shaping of Modernity*, 1210-1685, Oxford: Oxford University Press (2006), pp. 41-44.

57 Bacon, F. *Valerius Terminus*, in Spedding, J. (ed.) *The Works of Francis Bacon*, 14 vols. London 1857–74; reprinted Stuttgart: Frommann–Holzboog (1961–63), vol. III, p. 222; cf. esp. Harrison, P. ‘Curiosity, Forbidden Knowledge, and the Reformation of Natural Philosophy in Early Modern England’, *Isis* (2001) 92, 265-290; generally on the relationship of the Fall and human knowledge see Harrison, P. *The Fall of Man and the Foundations of Science*, Cambridge: Cambridge University Press (2007).

58 Copernicus, N. *On the revolutions*, in Dobrzycki, J. (ed.), Rosen, E. (trans. & comm.) *N. Copernicus: Complete works*, Warsaw / Cracow: Polish Scientific Publishers (1978), vol. 2, p. 7; cf. Copernicus, N. *De revolutionibus*, in Gansiniec, R. (ed.) *N. Copernicus, Opera omnia*, Varsaviae / Cracoviae: Officina publica libris scientificis adendis (1975), vol. 2, p. 7.

omy. This is not to say that Copernicus directly responded to Augustine's text but that he was aware of the need to legitimise astronomy by pointing out that it leads to happiness which ultimately can be found solely in God.

After emphasising the importance of astronomy for internal conversion to God, Copernicus only briefly mentions the benefit of astronomy to other disciplines, the Church and society.⁵⁹ His contemporaries and followers mentioned such benefits regularly and at times even at length. They tirelessly pointed out the importance of astronomy for the reckoning of time, for agriculture, medicine, poetry, mechanics, statics, geography, civil life, warfare, trade and so on.⁶⁰ Unlike philosophers, astronomers therefore did not defend the usefulness of their discipline by posing an absolute goal such as reversing the consequences of the expulsion from paradise. Instead, they stressed more pragmatically the practical usefulness of astronomical knowledge. The sinful ambition of astronomy to penetrate beyond the limits assigned to man was rejected by highlighting its rudimentary utility. Astronomy justified itself as inextricably belonging – almost as a condition – to other fields of human activity which had been not exposed to such an extensive theological arsenal. In this respect, condemnation of astronomy would have also led to rejection of all these disciplines, many of which were useful to the Church and to the missionary vocation of the Christian religion, as astronomers often reminded their audiences.

Johannes Kepler, who had originally wanted to become a priest, received an excellent theological education in Tübingen. It can therefore be reasonably assumed that he was aware of the theological objections to astronomy. Perhaps that is why at the beginning of the second part of his *Astronomia nova* (1609), Kepler points out that astronomy is not a kind of human caprice but human beings are directly called to astronomy. A divine voice inviting people to learn astronomy is imprinted in the world itself (*divinam vocem, quae discere jubeat hominem Astronomiam, in mundo ipso expressam*).⁶¹ For that reason, astronomy is not a curious and conceited penetration of unnecessary and useless secrets. God himself calls man to cognition of the world. In one of his letters, Kepler explains that when we discover the geometric structure of the world, we do not commit any kind of sin:

59 *ibid.*

60 Rheticus *op. cit.*, (37), pp. A6v-A7r; Levera *op. cit.*, (33), pp. 48-49; De Rheita, A. M. S. *Oculus Enoch et Eliae sive radius sidereomysticus*, Antverpiae: Verdussius (1645), p. 10; Des Challes, C. F. M. *Tractatus proemialis de progressu matheseos*, in Des Challes, C. F. M. *Cursus seu mundus mathematicus*, Lugduni: Anissonios et al. (1690), p. 75a-b; Hevelius, J. *Machina coelestis*, Gedani: Reiniger (1673), p. 4-5; Hortensius, M. 'The oration on the dignity and the usefulness of the mathematical sciences of Martinus Hortensius (Amsterdam, 1634): Text, translation and commentary', in Immhausen, A. & Rimmert, V.R. (eds. & trans.) *History of universities* (2006) xxi/1, 71-150, (pp. 111-121); Vossius, G. *De quattor artibus*, Amsteaedami: Blaeu (1650), pp. 121-126.

61 Kepler, J. *Astronomia nova*, KGW, vol. 3, p. 108.

These findings are within reach of the human mind. God wanted us to know them. When He had created us in His image He wanted us to get share of his own thoughts.... It is foolish to believe that we make a man God in this way (*hominem Deum faciamus*): intentions of God are unexplorable, not his corporeal works.⁶²

Justifying the legitimacy of astronomy, Kepler points out that by exploring the heavens, man is restored to his original mission – to be *imago dei*. Astronomy has no ambitions to penetrate the mysteries that God reserved for himself. Astronomy limits itself to exploring the corporeal physical world but this is just the kind of activity that enables humans to find God in their hearts.

In addition to the perpetual emphasis on the practical use and spiritual benefits of astronomy during the seventeenth century, an understanding of curiosity in a positive sense emerged. Some astronomers stopped stressing that astronomy was not a manifestation of curiosity and instead began to insist that a curious interest in celestial bodies had been purposely embedded in humans by God himself who wanted to be recognised by them. For example, Christian Huygens in his *Cosmotheoros* (1698) emphasised that the fact that God has not revealed all mysteries to humans does not mean that he has reserved all of them for himself. Penetrating unknown mysteries is not unwarranted curiosity. According to Huygens, no one has the authority to prescribe how far humans can push their investigations and to limit their diligence because no one knows with certainty the limits prescribed by God to human knowledge. If our ancestors had had similar scruples, humankind would not have known the shape and size of the Earth or the existence of America. Diligence and keenness of spirit were given to the humans in order to further the gradual understanding of nature and there is no reason why we should renounce our research.⁶³ Astronomical curiosity gradually began to be removed from the catalogue of sins. Instead, it was given the positive meaning of approaching God through the exploration of celestial movements. The whole process of legitimising curiosity had been symbolically closed in early Enlightenment natural theology. William Derham, in his *Physico-Theology* (1713), did not consider curiosity as illicit vice but one of God's gifts which encourages people to understand God's work – from that time on, ignoring this curiosity might lead to error:

The Creator doubtless did not bestow so much Curiosity, and exquisite Workmanship and Skill upon his Creatures, to be looked upon with

62 Kepler to Herwart, 9 and 10 April 1599, Nr. 117, *KGW*, vol. 13, p. 309.

63 Huygens, C. *Kosmotheoros*, in Huygens, C. *Oeuvres complètes*, Hague: Nijhoff (1888–1950), vol. 21, p. 687: *industriam mentisque acumen hominibus data esse, quibus paulatim rerum naturalium cognitionem consequerentur, neque esse cur conari desinamus & ulteriora inquirere.*

careless, incurious Eye, especially to have them flighted or contemned; but to be admired by the rational Part of the World, to magnify his own Power, wisdom and goodness, throughout all the World, and the Ages thereof. And therefore we may look upon it as a great Error, not to answer those Ends of the infinite Creator, but rather to oppose and affront them.⁶⁴

3. Astronomical knowledge and God's omnipotence

The objections of Church Fathers to astronomy which have been mentioned so far related to the meaning and purpose of astronomical knowledge but did not challenge its results. According to Ambrose and Augustine, more objections are to be found relating to astronomy's ability to predict the positions of heavenly bodies.

Like Basil, Ambrose deals with the question of the Earth's position in the cosmos in his commentary on Genesis. Beginning with the usual questioning of the usefulness of such investigation, Ambrose suggests that understanding the Earth's position is not beneficial for anything. It is sufficient to know what Scripture says (with reference to Job 26:7).⁶⁵ What is now interesting is the continuation of Ambrose's text where other theological objections to astronomy appear. The appropriateness of the study of the sky is no longer the most important question; his interest shifts to the supreme dominion of God over his creation. Ambrose suggests that although there are many cosmological systems, the unequivocal pronouncements of the Lord contradict them. He refers only to the biblical verses stressing the dependence of the created world on the lasting influence of God's power (Job 38:4-5, 8-11): 'Does not God clearly show that all things are established by His majesty, not by number, weight and measures? For the creature has not given the law; rather, he accepts it or abide by that which has been accepted.'⁶⁶

The topic of the Earth's position is then used by Ambrose to show the power of God over creation. The Earth is not in the middle of the cosmos because of the physical relationship of the material parts of the created world but because his infinite power suspends it in the centre. In the Bible (Ps. 103:5), God is said to be not merely an artist (*artifex*) but also an omnipotent being (*omnipotens*). The Earth is not suspended in the middle because God, as an artist, would have created a work able to run itself in structured order. What is most decisive for the order of the world is not

64 Derham, W. *Physico-Theology, or Demonstration of the Being and Attributes of God from his Works of Creation*, London: Innys (12th edn, 1754), p. 427.

65 Ambrose *Hexameron*, I, 6, 22, (CSEL 32-1,18).

66 *ibid.*; Ambrose *Hexameron*, *op. cit.*, (26), p. 21. *Nonne euidenter ostendit deus omnia maiestate sua consistere, non numero, pondere atque mensura? Neque enim creatura legem tribuit, sed accipit aut seruat acceptam.*

the regularity of nature but God's power (*potestas*) alone. God can at any moment decide that the regular course of natural events will no longer be respected. By the will of God, the Earth remains immovable in the centre of the cosmos, yet it is moved by the will of God as it is written: 'He looketh on the Earth, and it trembleth' (Ps. 104: 32). The dependence of the created world, however, leads Ambrose to question scientific knowledge:

However, I who am unable to comprehend the excellence of His majesty and His art do not entrust myself to theoretical weights and measures. Rather, I believe that all things depend on His will, which is the foundation of the universe and because of which the world endures up to present (*voluntas eius fundamentum sit universorum et propter eum adhuc mundus hic maneat*).⁶⁷

In Ambrose's discussion of the location of the Earth, we can clearly find the themes which will strongly influence the Christian relationship to astronomy and other sciences until the end of seventeenth century. Above all, the Christian emphasis on the ontological fragility of creation is strongly present here. Nature has no ability to persist in an ordered state by itself. Continuation of the natural world depends solely on the power and will of the Creator. Nature is incessantly dependent on the preserving influence of God's power and will which has decided – for the time being – to keep the order of creation. Laws directing different natural processes are not immanent in nature. They are imposed on nature from the outside and therefore they can be cancelled by their author at any moment. Such ontology has important consequences for scientific methodology. Ambrose explicitly denies the often quoted biblical evidence for the rationality of the created world according to which nature is created in accordance with mathematical relationships: 'thou hast ordered all things in measure and number and weight' (*Wis.* 11:20). In the Middle Ages and in the early modern period this biblical statement was very often used to justify mathematical disciplines and to support the idea that nature can be explained by mathematics. In Ambrose's view, such an approach is not possible. The full dependence of creation on the power and will of God relativises the concept of science daring to establish theories on the basis of alleged regularities of nature.

In the text that follows, indeed, Ambrose suggests that pagan scholars are wrong in thinking that it is possible to explain the created world by the laws discovered on the basis of empirical study. Everything is directed by the power of God, so scholars are mistaken when they focus on discovering the laws instead of on God who can at any moment violate the laws he gave his creation. Theory deduced from observation cannot limit God's omnipotence (with reference to Mark 14: 36: 'Nothing is impossible to

67 Ambrose *Exameron*, I, 6, 22, (*CSEL* 32-1,20); Ambrose *Hexameron*, *op. cit.*, (26), p. 23.

thee').⁶⁸ What is impossible from a scientific or philosophical point of view is not impossible for the absolute power. As an example, Ambrose uses astronomical phenomena. He maintains that astronomers and philosophers doubt the biblical words about the presence of water in the heavens (Genesis 1: 6-8). They rely on their knowledge of the laws of nature and boldly assert that there can be no water above the celestial vault because it would flow down on the sides of the spherical heavens. To this argument, Ambrose objects that it is not possible to measure and evaluate the created world according to human knowledge and human abilities. Above human knowledge towers God's unlimited power that created everything as he wished (*omnia quae voluit fecit*).⁶⁹ Located above nature, God is unlimited by anything. 'He gives orders to nature and does not comply with its power. He does not regard its measurements, nor does He examine its weight. His will is the measure of things and His word is the completion of the word.'⁷⁰ The absolute power need not respect the laws according to which human knowledge explains natural processes, presumptuously claiming them as truth. Therefore, for Ambrose, the astronomical explanations of the location of the Earth are not important at all.

Greek astronomical theory assumed that processes in the cosmos run regularly, eternally, inevitably and immutably. The concept of the cosmos persisting in an ordered way by itself was not acceptable to Christian theology and that is why astronomical topics became a favourite example for showing both the absolute dominion of God over his creation and the untrustworthiness of pagan science. Belief in the contingency of creation and the irreducibility of God's power was hard to reconcile with the concept of science seeking causes and laws of natural phenomena in order to make predictions. God can break the hitherto existing order of nature at any moment. He can make a miracle and thus invalidate the findings of worldly wisdom. Augustine also proves this idea with the help of astronomical phenomena. He points out that nothing was so well arranged by the Creator as the exactly ordered course of the stars (*cursus ordinatissimus*) directed by constant laws. Nevertheless, there is a report that Venus once changed its colour, form, size and even the order and laws of its course when it pleased God, who with sovereignty and supreme power rules all. Augustine insinuates that this intervention in the regular order of nature can also be understood as a humiliation of scientific pride originating in the presumed knowledge of natural laws on the basis of which science conceitedly dares to predict natural phenomena. By his intervention, suggests Augustine, God invalidated the tables of astronomers (*canones astrologorum*) who

68 Ambrose *Hexameron*, II, 2, 5, (CSEL 32-1,45).

69 *ibid.*, II, 3, 9, (CSEL 32-1,48); cf. *ibid.*, II, 1, 3, (CSEL 32-1,42).

70 *ibid.*, II, 2, 4, (CSEL 32-1,43); Ambrose *Hexameron*, 48, *op. cit.*, (26): *Iubentis est, non aestimantis, imperat naturae, non possibilitati obtemperat, non mensuras colligit, non pondus examinat. Voluntas eius mensura rerum est, sermo eius finis est operis.*

believe they can calculate the past and future positions of the stars.⁷¹

This mention of the constant possibility of supernatural intervention serves for Augustine as a point of departure for a stern admonition of astronomy and other branches of Greek science. According to Augustine, it is not possible to conclude from the carefully made observations of regular natural phenomena that they would be bound by those discovered regularities in any way. Human theory cannot prescribe the limits of absolute power. Whenever it pleases God, he can change natural processes in a way that may not be in accordance with scientific findings presuming the existence of inevitable regularities. Augustine thus reminds all seekers of natural knowledge who have ascertained some natural law from their observations of the sky that they should not seek to apply that law to God, as if he could not change it and turn it into something different from what they have observed.⁷² As the originator of the world, God has the right to change the nature of things he created as he pleases.⁷³ Therefore, nature cannot work as an embodiment of reliability upon which the human relationship to reality can be founded. Natural knowledge cannot serve as a reliable instrument for human orientation in the world because it is conditional and can be deprived of credibility whenever God pleases. From this point of view, the human desire to know the world seems to be but *vana curiositas*.

The conflict between the idea of the cosmos and belief in the infinite God's power is not an isolated episode in the history of Christianity's relationship with science. It is only an initial – but not preliminary – expression of the fatal discrepancy between scientific and philosophical belief in the ordered course of nature and the theological idea of God's omnipotence.

While older positivistic historiography emphasised the absolute independence, or even hostility of early modern science to Christian theology, more recent research has shown that the Christian emphasis on the irreducibility of God's power (under the label of 'voluntarism') played an important role in the constitution of modern science.⁷⁴ In particular, it has pointed to the relationship between voluntarism and early modern mecha-

71 Augustine *De civitate dei*, XXI, 8, 2, (CCSL 48,771); cf. Augustine *De Genesi ad litteram*, VI, 16, 27, (CSEL 28-1,190 f.).

72 Augustine *De civitate dei*, XXI, 8, 4, (CCSL 48,773).

73 *ibid.*, XXI, 8, 5, (CCSL 48,771): *Sicut ergo non fuit impossibile Deo, quas voluit instituere, sic ei non est impossibile, in quidquid voluerit, quas instituit, mutare naturas.*

74 Good overview of the topic with vast bibliography can be found in discussion of P. Harrison and J. Henry: Harrison, P. 'Voluntarism in early modern science', *History of Science* (2002) 40, 63-89; Henry, J. 'Voluntarist theology at the origins of modern science: a response to Peter Harrison', *History of Science* (2009) 47, 79-113; Harrison, P. 'Voluntarism and the origins of modern science: a reply to John Henry', *History of Science* (2009) 47, 223-231; for historians of science neglect theory of the influence of 'voluntarism' on the emergence of early modern science which was presented by German philosopher Hans Blumenberg in his *Die Legitimität der Neuzeit*, see Blumenberg *op. cit.*, (5), pp. 125-226.

nism.⁷⁵ These debates concerned mainly the representatives of natural philosophy (Descartes, Boyle, Newton) but little attention has been paid to the way astronomers responded to the argument that an omnipotent God is not bound by the regulations of human knowledge.

At the end of Galileo's famous *Dialogue* is the famous passage that recalls God's sovereignty in relation to human desire for knowledge:

I know what you would answer if both of you are asked whether God with His infinite power and wisdom could give to the element water the back and forth motion we see in it by some means other than by moving the containing basin; I say you will answer that He would have the power and the knowledge to do this in many ways, some of them even inconceivable by our intellect. Thus, I immediately conclude that in view of this it would be excessively bold if someone should want to limit and compel divine power and wisdom to a particular fancy of his.⁷⁶

It is believed that these sentences express the personal belief of Pope Urban VIII who Galileo had met several times and with whom he had discussed the content of the envisaged work. It is difficult to estimate the extent to which Galileo just wanted symbolically to oblige the Pope by putting his argument into mouth of Simplicio at the end of the *Dialogue*. Nevertheless, its use shows that the emphasis on the omnipotence of God over against claims of the new science regarding world order was well known at the time. Galileo, through the mouth of his speaker Salviati, bows before this argument: 'we are not about to discover how his hands built it (i.e. the world)' but 'to acknowledge His greatness'.⁷⁷

Perhaps Galileo expressed his scepticism as a precaution and as a symbolic concession to ecclesiastical authorities. On the other hand, the passage shows very satisfactorily what the postulate of an omnipotent God meant for science in the early modern period – the inability to recognise the truth about the world. If everything depends on God's power, which may at any time change the course of creation, the human ability to obtain true knowledge of world order is constantly threatened. In the world of a voluntarist God, humans are dependent only on either speculative hypotheses or the empirical collection of isolated facts. These were two solutions adopted by many representatives of mechanism in the seventeenth

75 Hutchison, K. 'Supernaturalism and the Mechanical Philosophy', *History of Science* (1983) 21, pp. 397-333; Funkenstein, A. *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century*, Princeton: Princeton University Press (1986), pp. 317-322; Osler, M. J. *Divine Will and the Mechanical Philosophy: Gassendi and Descartes on Contingence and Necessity in the Created World*, Cambridge: Cambridge University Press (1994); Meinel, C. 'Okulte und exakte Wissenschaften', in Buck, A. (ed.) *Die okkulten Wissenschaften der Renaissance*, Wiesbaden: Otto Harrassowitz (1992), pp. 21-43.

76 Finocchiaro, M.A. (ed. & introd.) *Galilei, G. The Essential Galileo*, Indianapolis/Cambridge: Hackett (2008), p. 270.

77 *ibid.*, 270-271.

century: the first option was held on the continent by Cartesians,⁷⁸ the second by fellows of the Royal Society.⁷⁹ But then again, even before the emergence of mechanism, astronomers – probably for the last time in the history of science – developed a strategy that should protect the security and accuracy of astronomical knowledge against the objection of showing disrespect to God’s omnipotence.

As shown in detail by H. Blumenberg, the mainstay of Copernican astronomers against the idea of contingency embodied in God’s omnipotence was rationalistic anthropocentrism.⁸⁰ The Copernican astronomers faced the contingency of reality and necessarily hypothetical human knowledge constantly dependent on the absolute power with the pious and Platonic idea of a well-ordered cosmos created by a benevolent God for humans. According to Copernicus, the teleology of the cosmos does not manifest itself in a structure where the Earth stood in the middle and man stood on its surface as the favoured and divinely chosen *contemplator universi*.⁸¹ Reality does not have a teleological structure in the sense that the world would relate to man physically – in other words, that things naturally offer themselves to human senses and use. The anthropocentric character of the cosmos lies in the fact that the world opens up to the cognitive claims of human reason:

Where man is domiciled in the universe, cosmologically and topographically, becomes a matter of indifference. It can no longer be related to his comprehension of himself ... For him (i. e. Copernicus) the fact that the world was created for man does not guarantee primarily the security of his life, but rather the performance of his reason in relation to the whole – a guarantee that becomes critical in the classical borderline case of astronomy. The senses have lost their Paradise, not reason.⁸²

In this context, confidence in reason is possible only when the rational rules also apply to the creator of the natural world which reason turns to. A prerequisite for a rational universe is discernible limits posed to the absolutely free will of God and his omnipotence. God cannot be a factor of

78 The relationship between the idea of God’s omnipotence and hypothetical reasoning was convincingly shown in Clark, D. *Occult Powers and Hypotheses: Cartesian Natural Philosophy under Louis XIV*, Oxford: Oxford University Press (1989).

79 McGuire, J. E. ‘Boyle’s Conception of Nature’, *Journal of the History of Ideas* (1972) 33, 523-542; Steinle, F. ‘Negotiating experiment, reason and theology: the concept of law of nature in the early Royal Society’, in Detel, W. & Zittel, C. (eds.) *Wissensideale und Wissenskulturen in der frühen Neuzeit*, Berlin: Akademie-Verlag (2002), pp. 197-211; Dear, P. *Revolutionizing the Sciences: European Knowledge and Its Ambitions, 1500-1700*, London: Palgrave (2001), 140.

80 Blumenberg, H. *The Genesis of the Copernican World*, Wallace, R.M. (trans.) Cambridge, Mass.: The MIT Press (1987), pp. 169-229.

81 cf. Brague, R. ‘Geozentrismus als Demütigung des Menschen’, *Internationale Zeitschrift für Philosophie* (1994) 1, 2-25.

82 Blumenberg, H. *op. cit.*, (80), pp. 202-203.

uncertainty. Copernicus therefore in one breath speaks of anthropocentrism and of a dependable God:

I began to be annoyed that the movements of the world machine, created for our sake (*propter nos*) by the best and most systematic Artisan of all, were not understood with greater certainty by the philosophers, who otherwise examined so precisely the most insignificant trifles of this world.⁸³

Articulating a thesis according to which the world was created *propter nos*, Copernicus wants to say that the world is open to human rational scrutiny. Copernicus rejected the physical teleological anthropocentrism of the classical philosophical tradition in favour of rational anthropocentrism, according to which the world is a divinely managed best order.

Copernicus could reject the geocentric model without hesitation because the exclusivity of man is expressed in his reason, not in his privileged place. In Copernican thinking, the idea of anthropocentrism guarantees in particular the truth of rational knowledge. A cognitive setback is not possible because a benevolent God seeks to disclose the truth to humans of how the world was created. The cosmos is not arranged to serve the comfortable life of humans but to respond to the human need for truth. The nobility of astronomy consists not so much in its capacity to explain all phenomena but above all in the ability to eliminate all forms of cosmic arrangement that are not in accordance with the criteria of human rationality.⁸⁴ Copernicus is convinced that he reformed astronomy so that it truly revealed the harmony of the world order: 'In this arrangement, therefore, we discover a marvellous symmetry of the universe, and an established harmonious linkage between the motion of the spheres and their size, such as can be found in no other way.'⁸⁵ If reason reveals the cosmic order, which meets the demands of human rationality, simplicity, harmony and symmetry, then anthropocentrism guarantees that the world is really like this. An arrangement in which it is not possible to find traces of intelligent design is illusory or inhuman and contrary to the will of God, who made reality accessible to the human mind having created the world according to rational criteria. When humans succeed in finding a design that shows signs of internal rationality, then they discover the true system of the world – its true and rational form granted by God.

Johannes Kepler was also aware that the idea of divine omnipotence entails inaccessibility to human reason. In connection with the discovery of a

83 Copernicus *On the revolutions*, *op. cit.*, (58), vol. 2, p. 4; cf. Copernicus *De revolutionibus*, *op. cit.*, (58), vol. 2, p. 4.

84 cf. Bechler, Z. *Newton's Physics and the Conceptual Structure of the Scientific Revolution*, Dordrecht / Boston / London: Kluwer (1991), pp. 75-93.

85 Copernicus *On the revolutions*, *op. cit.*, (58) p. 22; Copernicus *De revolutionibus*, *op. cit.*, (58), p. 21.

new star in 1604, Kepler writes that the astronomical interpretation of the phenomenon is meaningless if some people refer to *potentia Dei absoluta*. If we leave the boundaries of nature (*si naturae terminos excesserimus*), we cannot say anything of importance any more.⁸⁶ For Kepler, a celestial phenomenon cannot be a manifestation of divine arbitrariness. God did not create the world according to his whim, '*nihil enim sine ratione optima facit*',⁸⁷ and 'does not want anything what would not be reasonable'.⁸⁸ Like Copernicus before him, Kepler guarantees a cognisable natural order by limiting God's omnipotence by rational principles. Strongly influenced by neoplatonism, hermeticism and Pythagorism, he turns to the exemplarist version of the interpretation of creation in justifying the inner rationality of the world. The world is created perfect, according to harmonic ratios – according to an archetype, which is the essence of God (*ex Archetypo Mundi, qui est ipsa essentia divina*).⁸⁹

According to Kepler, God does not act arbitrarily – his omnipotence is controlled by his essence consisting of geometric ideas. They are co-eternal with the Creator and form the basis for the creation of the world: *geometriae rationes Deo coaeternae sunt*.⁹⁰ The world is not a random cut-out of all the options available to the absolute creative power of God: it is the best and most beautiful world.⁹¹ Its harmony, beauty and rationality lie in the fact that it is actualised geometry. According to Kepler, God eternally performs geometry.⁹² Instead of a voluntarist God, *deus absconditus* preferred by Augustine, by medieval nominalists and by some of the Reformation theologians, Copernicans put forth a Platonic kind of piety which bounds the power of God by rational principles. This was understandable, because only in this way could they declare that their astronomy reflected the real structure of the universe.

In early modern astronomy, however, the Copernican strategy did not win. Anthropocentrism was rejected along with all forms of teleology of

86 Kepler *De stella nova*, KGW, vol. 1, p. 252.

87 Kepler's Letter to Mästlin, 3 October 1595, KGW, vol. 13, p. 35.

88 Kepler *Mysterium cosmographicum*, KGW, vol. 1, p. 38: ... *nihil velit ille, nisi summa cum ratione*...

89 Kepler *Harmonices mundi*, KGW, vol. 6, p. 360; cf. *Mysterium cosmographicum*, KGW, vol. 1, p. 24: ... *idaea sit rei prioris ... Patet quod his legibus quas Deus ipse sua bonitate sibi praescribit, nullius rei Idaeam pro constituendo mundo suscipere potuerit, quam suae ipsius essentiae*. cf. Barker, P. 'Kepler's Epistemology', In Di Liscia, D. A., Kessler, E. & Methuen, C. (eds.) *Method and Order in Renaissance Philosophy of Nature: The Aristotle Commentary Tradition*, Aldershot: Ashgate (1997), pp. 355-368.

90 Kepler *Epitome astronomiae copernicanae*, KGW, vol. 7, p. 267.

91 Kepler *Mysterium cosmographicum*, KGW, vol. 1, p. 23.

92 Kepler *Harmonices mundi*, KGW, vol. 6, p. 299: '*Non aberat ... ab archetypo suo Creator, geometriae fons ipsissimus, et, ut Plato scripsit, aeternam exercens geometriam*.'

nature in the campaign against Aristotelian philosophy.⁹³ On the other hand, many scientists have tried to combine the idea of God's free will with the development of new science. In this period, various special phenomena were seen as popular examples of God's omnipotence.⁹⁴ Comets or new stars (1572, 1604) were such phenomena in astronomy. Tycho Brahe considered the new star of 1572 to be a divine phenomenon, violating the order of nature introduced by God himself. Divine majesty acts absolutely freely, without being bound by any ties of nature. Whenever he wants, he can stop the water in the rivers and turn the paths of stars.⁹⁵ However, Tycho was quite aware that God's absolute power excludes the possibility of true knowledge. Tycho admits knowing nothing about the origin of the new star and its causes and focuses merely on its mathematical description (*solum ea quae ad Mathematicam considerationem spectant excutiam*).⁹⁶ The cognitive interest of the astronomer is associated with regularity, as Augustine feared it would be. Violation of the natural order is a fact of reified omnipotence, which can be accurately described by means of mathematics, but not understood, explained, or predicted. Omnipotence requires a mere collecting of what is empirically given.

In his *Oratio de disciplinis mathematicis*, Tycho explains that God is not bound by secondary causes. He is a free and perfect agent who is not bound by any laws of nature (*nullis naturae astrictus legibus*), but still he decided freely to keep the world order established by himself until the end of days. 'Even though God could directly cause anything ... it pleases him in his inscrutable wisdom ... to let everything what happens properly (*ordinarie*) come from him mediately (*mediate*). ... Therefore, if God does almost everything mediately, it does not mean that he could not act immediately (*immediate*), but that he does not want to.'⁹⁷ Tycho obviously works here with a well-known distinction between *potentia ordinata* and *potentia absoluta*, which was typical in medieval and contemporary theology. The purpose of emphasising the government of *potentia ordinata* is not to guarantee human confidence in the regularly ordered cosmos but something else. Emphasising the idea of God acting mediately and not immediately serves Tycho in the defence of astrology. It is not impious,

93 Osler, M. J. 'Whose Ends? Teleology in Early Modern Philosophy', *Osiris* (2001) 16, 151–168; Daston, L. 'Historische Überlegungen zum Antropomorphismus und zur Objektivität in den Wissenschaften', in Küppers, B.O. (ed.) *Die Einheit der Wirklichkeit: zum Wissenschaftsverständnis der Gegenwart*, München: Fink (2000), pp. 27–44.

94 Daston, L. & Park, K. *Wonders and the Order of Nature, 1150–1750*, New York: Zone Books (2001), pp. 173–251.

95 Tycho Brahe *De nova stella, TBOO*, vol. 1, p. 19: 'admirandum hoc esse Ostentum, praeter omnem naturae ordinem, a seipso in initio constitutum... Divina enim maiestas liberrime agit, nec ullis obstricta est Naturae vinculis, sed cum vult, sistit aquam fluviis & vertit sidera retro.' cf. *ibid.*, pp. 30, 34.

96 *ibid.* p. 19.

97 Tycho Brahe *De disciplinis mathematicis, TBOO*, vol. 1, p. 154.

according to Tycho, to say that the stars are *causae secundae* by which means God acts on the Earthly world.⁹⁸ Regularity of the world and restriction of God's omnipotence only serve to guarantee the possibility of astronomical predictions, not secure human cognitive claims.

Attempts to reconcile God's omnipotence and the human need of regularly ordered nature appeared in various philosophical and scientific disciplines throughout the seventeenth century. In the case of astronomy, natural theology again brought (supposedly) a final neutralisation of theological objections. According to Derham, the infinite and incomprehensible power of God manifests itself in the vastness of the infinite cosmos by perpetuating the scientific progress:

Because it is far the most magnificent of any; and worthy of an infinite Creator; whose Power and Wisdom as they are without bounds and measure, so may in all probability exert themselves in the Creation of many System as well as one. And as Myriads of Systems are more for the Glory of God, and more demonstrate his Attributes...⁹⁹

The expression of God's power is no longer used to limit human desire for knowledge. On the contrary, exploring the infinite universe is appropriate because it leads to a humble awareness of the power and wisdom of the Creator. Infinity is no longer a mark of incomprehensibility. It challenges humans to come closer to God.

Conclusion

Thanks to recent research, we know that the relationship between science and religion in the early modern period was intricate and irreducible to simple models of conflict, separation, or harmony. Especially thanks to work of Peter Harrison, we know that early modern science in fact did need religion for it to be accepted as a legitimate intellectual and social activity:

Arguments from design were deployed in the first instance to demonstrate the religious usefulness and social utility of a set of otherwise intellectually marginal scientific practices. In other words, it was science that needed religion. The deployment of arguments for God's existence based on the natural sciences was the key strategy of a programme of legitimation, and one that proved to be remarkably successful in securing social status for the new sciences.¹⁰⁰

I agree with Harrison that early modern science *had* to prove its signifi-

98 *ibid.*

99 Derham *op. cit.*, (43), p. xlii.

100 Harrison, P. 'Religion, the Royal Society, and the Rise of Science', *Theology and Science* (2008) 6, 255-271, pp. 264f.

cance for religion and society (thoroughly confessional at that time). And I think that the 'rhetoric of utility' typical for early modern science was not an expression of new pragmatic values, but an expression of religious stance. Nevertheless, what we still lack is more a thorough analysis of why early modern scientists had to defend themselves and legitimise their activities. We now know very well the answers given by early modern scientists – but it seems to me that we do not always understand the religious questions, doubts and objections these answers were responding to. Many early modern scientists had a far deeper theological education than today's historians of science who often compare the religiously coloured propositions of scientists only with the content of the Bible. (A kind of Protestant heritage, perhaps?) It is anachronistic to consider these religious answers as responses to the questions raised by present-day historians and scientists. In my analysis, I have tried to find some of the questions belonging to some of the answers of the early modern scientists. But we need far more thorough analysis of theological texts concerning the knowledge of nature from both early Christian and the early modern period. Classical patristic sources and period theological tractates should be re-read in accordance with the recent methodological trends in the historiography of science which have abandoned positivistic and simplistic polarised models of the relationship between science and religion.

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