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Aquinas's science-engaged theology

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Abstract

Science-engaged theology has emerged as a new way of conducting research within the vast field of science and religion, with the aim of, at least in one way of understanding it today, solving theological puzzles. In this article we suggest that an analysis of the diversity of approaches in which thirteenth-century philosopher and theologian Thomas Aquinas engaged theological questions with the best knowledge of the natural world available at the time allows twenty-first century science-engaged theologians to move forward the discussion about the different ways of engaging theology with the contemporary natural sciences.

Keywords: Science-engaged theology; Thomas Aquinas; Thomism; science and religion

Science-engaged theology has emerged as a new way of conducting research within the vast field of science and religion, with the aim of, at least in one way of understanding it today, solving theological puzzles (Perry and Leidenhag 2021). In this article we suggest that an analysis of the manner in which thirteenth-century philosopher and theologian Thomas Aquinas engaged theological questions with the best knowledge of the natural world available at the time,[1] allows twenty-first century science-engaged theologians to move forward the discussion about the different ways of engaging theology with the contemporary natural sciences.

Aquinas used the best knowledge of the natural world he had at hand to tackle specific theological questions as part of his grand theological project. We will show in this article that the ways in which he engaged theology with the natural sciences of his time is not univocal. Rather, these ways are diverse and complex, as will become apparent in the examples in the section below. Our argument will be that this diversity found in Thomas Aquinas serves as an historical exemplar of what is at stake in contemporary discussions on science-engaged theology. Aquinas's supple method can, therefore, support a fuller detailed exploration of what science-engaged theologians such as Perry and Leidenhag aspire to achieve.

With this goal in mind, a considerable part of this article will be devoted to particular examples of how Aquinas approached theological questions using the best knowledge of the natural world he had at hand. We will first present a question referring to the Incarnation of Christ and how Aquinas considers Aristotelian reproductive biology to reshape the question and answer it. We will then move to two questions regarding the interpretation of some passages of Genesis 1, for which Aquinas refers to Aristotelian

and Ptolemaic astronomy and geography, namely questions about the moment when the heavenly bodies were created and the location of the garden of Eden. Finally, we will present two cases of Greek epistemology that Aquinas sourced for answering particular moral and dogmatic theological questions. In the first, we will show how Greek epistemic studies on the foundations of astrology played a role in Aquinas's determination of the morality of divination. In the second, we will show how a Greek discussion on the epistemology of astronomy about the status of astronomical theoretical elements allowed Aquinas to approach the problem of the Trinity rationally. This detailed consideration of some cases in Aquinas's work will allow us to draw some important conclusions regarding the nature of contemporary projects in science-engaged theology.

Aquinas in action: five variations of science-engaged theology

As a thirteenth-century scholar, Thomas Aquinas embraced the philosophical and theological environment of his time and did not shield behind some false pretence of holding to the past to address the most pressing and determining problems that he and his contemporaries faced. While sourcing much of his thought from Augustine and the Fathers, he also embraced the then not so well-famed Aristotelian philosophy, which meant he was somewhat of a heterodox thinker for many of his colleagues.[2] He appropriated the most modern of ideas concerning nature and the natural world and, acknowledging their 'modernity', he addressed theological problems of his present and past. In a way, one may read what Aquinas was doing as engaging theology with the best knowledge of the natural world for attempting solutions for discrete theological problems. True, his overall theological project was for philosophical and theological wisdom, as Peter Harrison rightly points out, and in this, his pursuit was certainly different from contemporary theology. He was, in any case, solving theological problems: one only needs to take a look at the way in which his *Summa Theologiae* (*S.Th.*) is structured into questions and articles.

This way of approaching theological questions could be compared, with the above-mentioned differences, to what John Perry and Joanna Leidenhag have recently described as a new stream within academic theology, namely, *science-engaged theology*. In their article 'What is Science-Engaged Theology', they trace its heritage to Peter Harrison's critique of the field of 'science and religion' as such and suggest that this new approach should, instead of seeking grand comparisons between the sciences and the religions, 'study narrowly-focused theological questions that are already entangled with scientific theories and findings' (Perry and Leidenhag 2021, 247). For them, science-engaged theology is bold in asking empirical questions of contemporary science, which is conceived, thus, as a source for theological inquiry. To a certain extent, this is what Aquinas did when trying to solve different theological questions, sourcing for that purpose the best knowledge of the natural world he had at hand, namely the Aristotelian philosophy of nature. Consider, for instance, his discussions on the Eucharist and his use of the Aristotelian notions of substance and accidents, or his commentary on the *Hexameron* with the recurring illustrations of Aristotelian cosmology and geography, and the like.[3] All these can be thought of as bearing a resemblance to this science-engaged theology of which Perry and Leidenhag speak.

Perry and Leidenhag present Alvin Plantinga as summarizing the starting point for science-engaged theology. As they say, for Plantinga the world as God created it is full of contingencies. Therefore, 'we do not merely think about it in our armchairs, trying to infer from first principles how many teeth there are in a horse's mouth; instead, we take a look'.[4] For our authors, this statement 'could well serve as a motto' of science-engaged theology. Aquinas's metaphysics acknowledged that the world was full of contingencies as well; in fact, his ideas on providence required that there be contingent

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events in the world for it to be most perfect. This requirement makes evident the urge Aquinas felt regarding the study of the natural world for his own theology. In fact, this is a clear-cut case of study for Thomist theologians who want to engage positively with science: the doctrine of providence requires the world to have contingent events, events that can be discovered and theorized on by use of the natural sciences as we understand them today.

Peter Harrison has reflected on this new science-engaged theology, suggesting three challenges that it sets to avoid: 'a pattern of subservience in which science always trumps theology; an anti-science agenda that either rejects the legitimacy of science or denies that it has anything useful to offer theologians; an assertion of the total independence of science and theology that disavows any significant points of contact' (Harrison 2021, 476). Aquinas's science-engaged theology, as we describe him pursuing it in this article, could certainly avoid these pitfalls as well. It is usually the case that Aquinas's thought is typically confronted with the objection that, by posing itself at a different level of analysis (be it in the metaphysics of being or the hylomorphic philosophy of nature) it simply distances itself from any scientific discourse. In face of this recurrent objection, our reading of Aquinas's science-engaged theology, rather than over imposing a metaphysical or theological system on what the natural sciences have to say about nature, assumes that the natural sciences have something important to say for some discrete theological questions and themes. In what follows, we explore some cases found in Aquinas's work in the hope of finding a pattern, or at least some guidelines, on how to approach theological questions that have empirical bearings.

Aristotelian reproductive biology and the incarnation of Christ

One of the most interesting theological puzzles for which Aquinas draws from the available systematic knowledge of the natural world is that of the Incarnation of Christ in the person of Jesus of Nazareth. The most hotly debated topic during the first centuries of Christianity, namely, the claim that God had become man, is at the very centre of Aquinas's thought. Among the many theological problems he tackled surrounding this matter, he approached the question about the divine conception in the womb of the Virgin Mary with the tools provided by Aristotelian biology. In fact, Aquinas's use of Aristotle's doctrines served not only as an instrument to answer a discrete theological question, but also helped to shape that very question, and to present it as theologically relevant.

In *S.Th.* III, 31, 5, Aquinas asks whether the flesh of Christ was conceived of the Virgin's purest blood (*ex purissimis sanguinibus virginis*). Before taking on his reply, it is worth showing how his understanding of Aristotelian biology shaped the way he interpreted the very question he was asking. The Latin term *purissimis* was usually understood as referring to the spiritual sense of Mary being the purest of creatures. In this sense, Aquinas brings the authority of John Damascene in the *sed contra*, who claimed that 'the Son of God constructed for himself, from the chaste and purest blood of a virgin, a flesh animated by a rational soul'. The original Greek reads *ἐκ τῶν ἁγνῶν αἱμάτων*, with *ἁγονός-ή-όν* as the only adjective applied to blood.[5] This adjective can be translated both as *chaste* and *pure*, and it is an indication of how the question is posed within a spiritual context. In fact, the Damascene's following sentence reads: 'taking to Himself the first-fruits of the human clay, the very Word became person to the body' (John of Damascus 1899, 270), reinforcing the idea that he was writing in a spiritual sense.

Aquinas's reply, however, shows how Aristotle's reproductive biology reconfigured the way in which he approached the question. As will become clear, Aquinas understood the term *purissimis sanguinibus* biologically rather than spiritually, as that blood out of which

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the flesh of a new human being was made, as Aristotle taught. For Aristotle, blood is the result of the soul concocting that is incorporated by nutrition. In that way the intake of nutrition is prepared by the living being so that it can become any part of the organism. Thus, blood is directed towards the entire body, and possesses a potentiality to become any part of it. When explaining human reproduction, Aristotle teaches that it is the coming together of both the male and female seeds. These seeds are formed as the ultimate stage of the concoction of blood, in which blood undergoes a final heightening of its potential for form (Aristotle 1952, 45–49). Women, because of their natural weakness, are not able to bring their seed to the final stage of concoction, so they are not able to reproduce by themselves. Men do not have the proper organs to take care of the offspring during their first stages of development. So, men and women need each other for reproduction: women provide their incomplete seed and bear the pregnancy, and men provide their more perfected seed. As Aquinas accepts, in this relationship the male seed acts on the female seed, prompting it to be organized as a new human being. Both these seeds are nothing more than blood concocted to the height of its possibilities (different in men and women) so as to be able to pass on the form to a new generation.

Because Christ was conceived without male seed, Aquinas points out in his reply to the question that 'it belongs to the supernatural mode of Christ's generation that the active principle of generation was the supernatural power of God'. Assuming this divine intervention, however, the passive principle of generation was the same as in any other human conception:

> it belongs to the natural mode of His generation, that the matter from which His body was conceived is similar to the matter which other women supply for the conception of their offspring. Now, this matter, according to the Philosopher (*De Gener. Animal.*), is the woman's blood, not any of her blood, but brought to a more perfect stage of secretion by the mother's generative power, so as to be apt for conception. (*S.Th.* III, 31, 5)

Hence, in presenting his own view on how God acted in the conception of Jesus of Nazareth, Aquinas also indicates his interpretation of the Damascene's text and of the question at stake. On the one hand, while the Holy Spirit was the active power, moving the female seed of Mary to become organized as a human being in Her womb, Mary provided the concocted blood (blood in the most perfect stage of secretion) and the proper organic environment for Jesus to develop. On the other hand, the Damascene's text takes on a new meaning; it is no longer interpreted to be referring, in a general way, to Mary, the purest of creatures, being the place and material source where and from which Christ's body was formed, but instead as a precise description of the way in which God acted on Mary's natural reproductive disposition. While originally the expression 'chaste/pure blood' was a reference to Mary's holiness and virginity, in Aquinas it is also a reference to the fact that the concocted blood on which God acted was, biologically speaking, that blood in which the proper virtue of blood, which is to nurture and become different parts of the organism, is at its highest.

Ultimately, Aristotle's biological teachings helped Aquinas to understand better one of Christianity's core beliefs, while at the same time reconfiguring a question which would not have been set up in that way had he not been working within such a biological framework.

Astronomy, geography and the interpretation of Genesis

It is not clear when Aquinas came into contact with Ptolemy's works. Although medieval education included astronomy as part of the *quadrivium*, the *Almagest* was well above the

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level any beginner would reach during that part of their basic education. So, it is likely that he became acquainted with them through the influence of Albert the Great. Whatever the case, in this section we will focus our attention on two examples of theological puzzles springing from Genesis 1 for which Aquinas uses some of the most sophisticated astronomical and mathematical texts of his time as tools to solve them.

The first puzzle comes up when Aquinas discusses in *S.Th.* I, 70, 1, the convenience of the order of Creation, in particular whether it was convenient for God to create the Sun, the Moon, and the stars on the fourth day (Gen. 1:14–19). The third objection he presents against this order is that those celestial bodies are fixed in the firmament (*posuit ea in firmamento*). Now, there is another case in the Genesis story in which something is fixed to another, and that is the case of the plants, which are fixed to the earth. But, when Genesis tells us that plants were created, it says that they were created just after the separation of the earth from the waters, during the same third day. So, it seems that the luminaries should have been created just after the creation of the firmament, on the second day.

Aquinas's answer is twofold. As we show below, his approach to Ptolemaic astronomy was cautious, not for astronomical reasons, but for physical ones. This caution did not preclude him from using Ptolemaic hypotheses to explain or discern difficult passages. In this puzzle, after presenting the firmament/earth and luminaries/plants analogy in the objection, he suggests that there is another way of understanding the term *posuit* in the sacred text. Quoting John Chrysostom, Aquinas offers a different analogy, that between the firmament and Paradise, and the luminaries and Man. Just as God, in different days, created first Paradise and then Man, so did he create the firmament and then the luminaries, also in different days. To justify this new analogy, he claims that the luminaries resemble more the Man/Paradise relationship than the plants/earth one, because they are not fixed as plants are to the earth, but more like Man was to Paradise. Indeed, Ptolemy proposes that although the luminaries are located in the spheres of the firmament, they have their own movement, as Man did in Paradise. He is most certainly referring to – albeit not mentioning it – the anomalistic motion of the planets in their epicycles, which is present in each and every Ptolemaic model of what Aquinas called luminaries.[6] In this reading, the Sun, the Moon and the stars can be considered to have been put within the firmament, as Man was in Paradise, but not fixed to it, as plants were on earth. So, Ptolemy's epicyclic astronomy provides Aquinas with a suitable tool to interpret the relationship between the luminaries and the firmament, in which the luminaries are not completely fixed to the firmament, but instead are merely 'located' within it. Aquinas was aware that this was an advantage that Ptolemy had over Aristotle, to whom he refers in the second part of his explanation, devoted not only to save the sacred text, but also to save its compatibility with Aristotle's cosmology.

In this second part, Aquinas says that, for Aristotle, the luminaries are properly fixed to the spheres. But the spheres are not seen, and thus the planets are perceived to move by themselves. Nevertheless, in this context Aristotle's hypothesis presents a view more akin to the firmament/earth and luminaries/plants analogy. To allow for an Aristotelian interpretation, Aquinas adds that:

> The objection, however, falls to the ground if we regard the firmament made on the second day as having a natural distinction from that in which the stars are placed, even though the distinction is not apparent to the senses . . . For although to the senses there appears but one firmament; if we admit a higher and a lower firmament, the lower will be that which was made on the second day, and on the fourth the stars were fixed in the higher firmament. (*S.Th.* I, 70, 1, ad 3)

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Although one should not assume that the idea of two separate firmaments was suggested as an *ad hoc* hypothesis to save the Aristotelian interpretation,[7] it is clear that, after showing the convenience of Ptolemy's hypothesis to interpret Scripture, Aquinas wants to stress his preference for Aristotle's general astronomical scheme. We will come back to this later.

The second puzzle is one to which we referred in the introduction, regarding the earthly location of the garden of Eden, which Aquinas faces in *S.Th.* I, 102, 1. His proposal that the garden might have been located in a region that was, at least up to his times, unexplored, was supported by his knowledge that there were places of the Earth that were to some extent isolated by different natural obstacles. The three obstacles he names correspond to the three limits that Ptolemy proposed in his *Geography*. Although it is not clear whether the text of the *Geography* was available to Aquinas, it is certain that there were many contemporary works that were based on the information given there (Berggren and Jones 2000, 50–52). In any case, one need not assume a direct Ptolemaic influence here, since the basic information was already contained in Aristotle. In his *Meteorologica* II, 13, 350a 14–22 – a book to which Aquinas wrote a commentary – Aristotle says: 'the largest rivers flow, as we said, from the highest mountains . . . We find that most rivers in Asia and the largest of them flow from the mountain range called Parnassus, which is commonly regarded as the highest mountain towards the eastern dawn.'[8] Regarding the western limit at the sea, Aristotle's references can be found both in *De Caelo* II, 14, 298a 5–15 and, again, the *Meteorologica* II, 5, 362b 25–30. In both places Aristotle indicates that it is the westernmost point of the *oikumenē*, after which we find the sea. This sea is a continuous body that ends on the eastern shores of India. Finally, Aristotle's description of the geographic zones or *klimata* – which would become canonical in Greek geography – indicates that the regions between the tropics and the Arctic and Antarctic circles are the only ones that are inhabitable (*Meteor.* ii, 5, 362a 32–362b 9). The region between the tropics is not suitable for men due to the heat caused by its proximity to the sun, namely, the high angle with which solar rays fall on the terrain.

So, if one follows Aquinas's reasoning, the garden of Eden must have been either on the southern hemisphere, in the inhabitable zone between the tropic of Capricorn and the Antarctic circle, or in India, between the eastern foothills of the Hindu Kush-Himalaya and the (presumed) Indian eastern shores of the Atlantic.

The epistemic foundations of astrology and the religious status of divination

This and the following section will present how Aquinas sourced notions in epistemology of the natural sciences to solve two theological puzzles, one in moral theology and one in dogmatic theology. The first one refers to the moral legitimacy of astrology, as opposed to a morally illegitimate *ars divinatoria*. In *S.Th.* II–II, 95, 1, co., Aquinas asks whether divination is a sin, and indicates that if someone foretells the future through the study of its present causes, then they are not engaging in the practice of *divination*, although they may very well be practising astrology:

> The future may be foreknown in two ways: first in its causes, second in itself . . . Some [causes] produce their effects of necessity and always; and such like future effects can be foreknown and foretold with certainty, from considering their causes, even as astrologers foretell a coming eclipse. Other causes produce their effects, not of necessity and always, but for the most part, yet they rarely fail, and from such causes their future effects can be foreknown, not with certainty, but by a kind of conjecture, even as astrologers by considering the stars can foreknow and foretell things concerning rains and droughts, and physicians, concerning health and death. . . it is not called

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> divination, if a man foretells things that happen of necessity, or in the majority of instances, for the like can be foreknown by human reason.

The activities Aquinas assigns to the *astrologi* encompass practices that we would today associate with mathematical astronomers (prediction of eclipses), meteorologists (prediction of rains and droughts), or astrologers (the influence of the celestial bodies on bodily health), although it can be argued that because modern medicine naturally studies the influence of the weather on human health, the medicinal aspect of medieval *astrologia* still echoes today in some way.

Aquinas distinguishes two kinds of celestial causes: those that necessitate their effects, and those that do not but still produce them in a regular manner. And the examples he gives for each are very eloquent. While the first kind is exemplified by the prediction of an eclipse, that is, a celestial phenomenon, the examples for the second kind are all earthly ones: weather and human health. This distinction maps exactly onto one that Ptolemy makes right at the beginning of his *Tetrabiblos* I, 1:

> Of the means of prediction through astronomy, O Syrus, two are the most important and valid. One, which is first both in order and in effectiveness, is that whereby we apprehend the aspects of the movements of the sun, moon, and stars in relation to each other and to the earth, as they occur from time to time; the second is that in which by means of the natural character of these aspects themselves we investigate the changes which they bring about in that which they surround. The first of these . . . has been expounded to you as best we could in its own treatise [i.e. the *Almagest*] by the method of demonstration. We shall now give an account of the second and less-sufficient method in a properly philosophical way, so that one whose aim is the truth might never compare its perceptions with the sureness of the first, unvarying science . . . nor yet refrain from such investigation as is within the bounds of possibility, when it is so evident that most events of a general nature draw their causes from the enveloping heavens.[9]

Thus, for Ptolemy there was in fact an important difference to be marked regarding the different types of predictions one could make from celestial motions and phenomena: the first, which corresponds to mathematical astronomy, is invested with the certainty that comes both from the object, which is unchanging, and the instrument, which is mathematics. The second one, astrology properly, is subject to the variability of earthly matters, and is just conjectural and approximate. As Ptolemy says, one should not assume that astrology is as certain as astronomy, but neither should one lose hope that there is usefulness in astrology because even if astrologers do not always hit the mark, 'we do not discredit the art of the pilot for its many errors' (I, 2).[10] After the initial justificatory introduction, Ptolemy goes on to show how astrology is helpful in precisely both the dominions Aquinas refers to: weather, with its farming and seafaring implications, and medicine.

Given Aquinas's acquaintance with this book (the *Quadripartitum* is mentioned three times in his works)[11] it is hard not to see Ptolemy's influence in Aquinas's evaluation of the moral status of astrological practice. That Aquinas read Ptolemy's epistemological texts with care is evidenced by the fact that he quotes the epistemological prologue of the *Almagest* three times in his *Super De Trinitate*, always as additional support for the Aristotelian tripartite division of philosophy.[12]

As we saw, Aquinas considers that astrological predictions, inasmuch as they are the result of the study of celestial dispositions, are *physical causes* of earthly events. As such, they are part of the normal use of human reason and cannot be condemned as *divinatory superstition* (*S.Th.* II–II, 95, 2, co.).[13] In this, he is following the Aristotelian approach

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to astrology, which is also present in Ptolemy. Aquinas explicitly rejects the view that celestial phenomena are *non-causal signs* of future events. For him earthly events are either causally linked to celestial events, or they are not. Causally linked events are either necessary or happen in most cases, and both of these are within the realm of acceptable astrological predictions. But accidental events or human action are not to be predicted via the study of the stars, since there is no causal link between the two types of phenomena. In the case of accidental events, such things have no proper cause. And in the case of human actions subjected to free will because, although the celestial bodies have an indirect influence on the human soul through their direct influence on the human body, given the spiritual nature of the soul there is always space for the person to choose independently of the celestial influence.[14] Thus, if one engages in astrological predictions about these kinds of events with no causal relations to the stars, then one is committing a sin by opening the door to demonic intrusions (*sic operatio daemonis se immiscetci*, in *S.Th.* II–II, 95, 5, co.), and is stepping beyond the dominion of science. Thus, appealing to an epistemic analysis, Aquinas is able to solve a question in moral theology.

It is difficult to see, however, where in practice lay the limit between earthly phenomena that was causally related to celestial phenomena and those that were not. Ptolemy, after indicating that astrology is useful 'regarding events of a general nature', goes on to talk about astrological influences on marriages and the convenience of making foreign journeys! One would think that Aquinas was more restrained as to what kinds of event were to be properly understood as falling under the rational umbrella of astrology. While in general this assumed restrain seems to be at work, there is an intriguing example at the core of the Nativity story. When discussing the heavenly nature of the star of the Magi in *S.Th.* III, 36, 7, obj. 3, Aquinas seems to source a non-causal explanation: 'stars which are not in the heavens but in the air are called comets, which do not appear at the birth of kings, but rather are signs of their approaching death. But this star was a sign of the King's birth . . . Therefore, it seems that it was a star from the heavens.' Aquinas replies by suggesting that the star from Matthew's gospel was neither a comet nor a fixed star, but a 'newly created star, not in the heavens, but in the air near the earth, and that its movement varied according to God's will'. His answer is clearly meant to be taken as a conjecture, and the tone is not categorical at all. But interestingly, in the answer to the previous objection he says that 'the star . . . has something in common with the comets in its signification. Because the heavenly kingdom of Christ shall break in pieces, and shall consume all the kingdoms of the earth, and itself shall stand forever.' Aquinas is aware of what was common astrological lore: that comets are omens that predict the death of kings. But his answer was not that such predictions are beyond the scope of sufficiently founded astrological science. Instead, he argues that the behaviour of the star does not follow the generalities of comets, and adds that in a way, it was still an omen of falling kingdoms, following the prophecy of the book of Daniel. It is possible that, as Rutkin (2019, 230–234) argues, Aquinas's view on the role of celestial influence and how it plays into the mode in which God providentially rules the world is not only central to Aquinas's theology, but much more important than what is usually argued in Thomistic literature.

Epistemology of astronomy and the theology of the Trinity

In the previous section we saw how epistemological considerations regarding a particular science were of service to Aquinas in answering questions on moral theology, particularly about the virtue of religion. In this section we want to show another interaction that this kind of epistemic analysis had for his theology. Our focus will be on a classical question in Christian theology and how Aquinas tackles it in *S.Th.* I, 32, 1, namely, whether the Trinity

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can be known by natural reason. Aquinas's answer is a definitive no. The basic reason is that, because we are limited to knowing God through his effects, we are limited to knowing him as a creative cause. But the creative power of God is common to the three Persons, so there is nothing in creatures that will lead us to conclude that there is a distinction of persons in God. In fact, he is adamant in calling out Christians not to claim that they are able to prove this dogma as if it were demonstrable, because they would be in danger of falling 'under the ridicule of the unbelievers: since they suppose that we stand upon such reasons, and that we believe on such grounds'. This negative approach notwithstanding, Aquinas does not object to using reason to argue, in some way, in favour of a trinitarian understanding of God. In his reply to the second objection, he explains that reason

> may be employed in two ways to establish a point: first, for the purpose of furnishing sufficient proof of some principle, as in natural science, where sufficient reasons can be brought to show that the movement of the heavens is always of uniform velocity. Reason is employed in another way, not as furnishing a sufficient reason of a principle, but as confirming an already established principle, by showing the congruity of its results, as in astrology the theory of eccentrics and epicycles is considered as established, because thereby the sensible appearances of the heavenly movements can be explained; not, however, as if this reason were sufficient, forasmuch as some other theory might explain them. (*S.Th.* I, 32, 1, ad 2)

So, one way to argue in favour of a certain thesis is to give sufficient proof that the thesis is true. Even if he gives an example from astronomy (a natural science as he calls it), Aquinas is thinking here, for example, of the theological question of the existence of God. Given certain effects, it is possible to give a proper demonstration that an ultimate cause has to be responsible for them. Thus, for Aquinas, the existence of God can be properly derived from a given set of evidence. Another way to argue in favour of a thesis, however, is to show that what is previously known from another source is coherent, that is, it fits, with that thesis. The Trinity of persons in God is an example of such a kind question: Aquinas presents Richard of St Victor's idea that a trinitarian God seems to go in line with God's infinite and eternal happiness, inasmuch as happiness is enjoyed the more within a community than in isolation. So, a God that is relational is a better fit with the idea of a joyful God.

This epistemic distinction is one that Aquinas brought directly from Greek natural science, particularly astronomy. Since Plato's call to *save the phenomena*,[15] Greek astronomy was acutely aware of the problem today referred to as the *underdetermination of theory by evidence*. When it comes to explaining his point, Aquinas chooses an astronomical example. These were, in fact, the canonical examples for these types of problems. Just as epicycles give an appropriate account of celestial phenomena, so does the trinitarian thesis account for many things in an appropriate manner. This, however, is not enough to assert that the existence of epicycles, or of a Trinity of persons, has been established by proper demonstration.

It is certainly interesting to note that Aquinas was not at all convinced that epicycles existed in reality. The reason lay not in a lack of empirical adequacy – which he declared to be sufficient – but in the physical difficulties that epicycles carried with them. Commenting on *Metaphysics* XII, he refers to Ptolemy's epicyclic astronomy:

> something contrary to the points demonstrated in the philosophy of nature seems to follow from this [Ptolemaic] hypothesis . . . it follows that a sphere containing an eccentric sphere either is not of equal density, or there is a vacuum between one sphere and another or there is some body besides the substance of the spheres

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> that lies between them which will not be a circular body and will have no motion of its own.[16]

First, Aquinas shows his acquaintance with what was at the time a lively cosmological discussion: how can the most successful mathematical models, namely, Ptolemy's, be brought within the monumental and coherent Aristotelian philosophy of nature?[17] The particular objection Aquinas brings regarding the physical interpretation of an eccentric sphere could be almost a direct quotation from an Arabic astronomical text from the ninth century:

> In two non-concentric orbs, where the interior of the encompassing (orb) touches the exterior of the encompassed, then the encompassing orb would be of variable thickness, as in the case of the encompassing complement with the eccentric, or the epicycle with the planet. If the encompassing (orb) was of uniform thickness, then there must be a space between the two orbs . . . Because the orbs do not come together in all directions, and because void is non-existent, then there must be a third body between any two orbs, which is not one of the two.[18]

The text is a typical case of the Arabic discussions of the time, a couple of centuries before the bulk of Greek science was passed on to European scholars. Unlike what Aquinas suggests, the unknown Arabic author proposes that there is a solution to the problem.

So, after this analysis we can have a much better picture of what Aquinas had in mind when discussing the knowability of the Trinity: simply because a proposition (the existence of eccentrics and epicycles/trinitarian belief) seems to be in accordance with other truths of which we are aware (observed celestial positions/richness of communitarian life), that should not lead us to think that we have properly demonstrated the initial proposition. In astronomy we have a cautionary example: even though Ptolemaic epicycles enjoy a powerful predictive power, Aristotle's physics – which is a properly demonstrated discipline – shows us that they cannot exist, unless one accepts a series of physical impossibilities. So, through a careful epistemic analogy, acknowledging that there can be no proper demonstration of the falsehood of the trinitarian view, Aquinas decisively instigates Christians not to expose faith to the scorn that a refutation of their pseudo-demonstrations of the trinitarian position would bring.

'Engaged' *dicitur multipliciter*

Aquinas's examples show the great diversity of ways in which theology can truly engage with systematic discourses about the natural world. The levels of engagement with the knowledge of the natural world vary and would ultimately depend on the issue at stake. This variety and diversity recall the teachings of John H. Brooke, who insisted in his ground-breaking work in 1991 that the relations between science and theology (or religion in general) are complex, assuming that there is a wide range of possible interactions at many different levels.

In a non-trivial sense, John Brooke changed the settings of how to approach the study of the relations between science and religion, something at which Perry and Leidenhag seem to aspire inspired in the work of Peter Harrison. In his volume, Brooke argued that the history of the relations between science and religion showed no fixed pattern in these relations, but rather, that they were so complex that it was not possible to group them in any typology. By arguing for this approach, Brooke became known as the father of the 'complexity thesis' for describing the relations between science and religion. He wrote:

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> The point we need to consider is whether . . . it is appropriate to focus exclusively on the impact *of* science *on* religion. Standard treatments of the subject are often preoccupied with that formulation, as if the streams of relevance and implication could flow in one direction only. But if religious beliefs have provided presupposition, sanction, even motivation for science; if they have regulated discussions of method and played a selective role in the evaluation of rival theories, the possibility of a more wide-ranging inquiry opens up. (Brooke 1991, 31–33)

Brooke finds examples of these different types of relations particularly in the rise of modern science during the seventeenth, eighteenth, and nineteenth centuries. For instance, Brooke finds that, during the early beginnings of modern science, theological thought played a key role in developing the new experimental, atomistic, mathematic, and mechanical philosophy of nature.

Brooke's perspective was somewhat brought to the present in the work of David Livingstone, who argues that one must complicate the study of those relations even today, and that this study cannot fit these relations into contemporary typologies. For Livingstone, this complication should *pluralize* the engagement of the different sciences to the diversity of religious traditions; *localize* this engagement, by placing it in their geographical settings; *hybridize* it, drawing attention to cross-cultural synthesis; and even *politicize* it. Livingstone is, ultimately, pointing towards the fact that the idea of science or religion as pure enterprises should be subverted, and that this impurity 'alerts us to the wider context of science and religion' (Livingstone 2011, 287). In a way, this is the idea that Peter Harrison put forward by looking at the history of the very notions of science and religion, in his 2015 *The Territories of Science and Religion*. This work basically argued that 'religion' and 'science' were not natural kinds, and as such, they could not have a perennial kind of relation that could be typified, and hence Perry and Leidenhag's project is presented as a continuation of Harrison's work.

Our point here is that by looking at the examples of engagement in the work of one of the most influential theologians in history, Thomas Aquinas, one can enrich the contemporary idea of science-engaged theology with the subtlety of diversity in how theology can engage with the natural sciences, borrowing the complexity idea in these relations from John Brooke's work. In fact, Aquinas's examples show that the very basic method that Perry and Leidenhag pose as a guidance for science-engaged theology, namely that theologians are bold in asking empirical questions of the natural sciences, opens the path to a large array of possibilities. Thus, there will be theological problems that are scientifically informed in their answers, others that would be scientifically backed, and others that would simply engage in a comparative dialogue for mutual enrichment. And, going beyond the scientific knowledge of the natural world, Aquinas engages with philosophical reflections about this very knowledge.

These different types of engagement become apparent if one revisits the examples described in the previous section. The first one, regarding the Incarnation of Christ in relation to embryonic biology, is actually quite complex. In a rather Kuhnian fashion, Aquinas's acceptance of Aristotle's theory of human reproduction determines the way in which he interprets not only the Patristic text with which he is dealing, but even the very question he is asking. He was certainly fully aware of his reshaping of the question, since he knew that his way of understanding the Damascene's text was not in line with the Greek Father's original intention. Nevertheless, he goes ahead and adds at least one new layer of meaning to the expression *ex purissimis sanguinibus virginis*. This is an image taken form the natural world: an anatomical element such as blood, which makes the theological question fall directly under the scope of the natural sciences, opening the path to exploring it from that perspective. Hence, Aquinas fleshes out new aspects

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of the blood image via his Aristotelian understanding of the natural processes related to the image. The fact that the original human author of this image, the Damascene, may have been ignorant about the natural sciences related to the elements he chose does not imply that later theologians cannot follow the hermeneutic path we are describing. For although, unlike Aquinas with his Aristotelian biology, the Damascene may not have known how blood was related to human reproduction, his selecting *blood* as the element that represents the organic relation between Christ and his human mother can be read as a providential selection. His qualification of this blood as *the purest*, even if it originally pointed to the spiritual immaculateness, can also be explored in its anatomical implications, which Aquinas did.

The cases of the location of Eden and the convenience of the order in the Genesis account of creation are of a different nature. In both cases Aquinas aims at saving the letter of the sacred text. Regarding Eden, he insists that the story told in Genesis is to be taken as an historical account, so there must be a geographical location that corresponds to the Garden. Something similar happens regarding the order of creation depicted in Genesis 1. Because we are dealing with a geographical location in the first case, the first argument must be carried out with the tools provided by geography. In the second case, because the celestial bodies are the subject under discussion, Aquinas must turn to astronomy. He finds that both sciences presented enough evidence to hold his interpretation of the biblical texts: the first by showing that there are indeed unexplored – and even unexplorable – locations to the east of the known world that are suitable candidates for Eden; the second, by indicating that the celestial bodies relate to the celestial spheres in a way that corresponds to the biblical account. This mode of engagement, instead of relying on the fact that there is some kind of overlapping due to the use of images, as in the example of Mary's blood, finds the overlapping due to a certain way of understanding the sense of the sacred text. Thus, Aquinas is engaging the best knowledge of the natural world by using discrete information provided by disciplines studying the natural world other than theology to draw comparisons with the biblical text in such a way as to advance a particular theological interpretation of those texts.

Finally, and perhaps surprisingly, the final examples set in the previous section also show that Aquinas engaged epistemological discussions in his theology, in a similar manner to a different trend of contemporary science-engaged theology does today, emphasizing the link between theology and the philosophy of science.[19] Even if Aquinas did not develop a full framework for relating theological questions with considerations of philosophy of science (for instance, on his take on how an instrumental mathematical reading of astronomy could bear on theological matters), the examples provided above show some clear instances in which he does rehearse such a relation. There are at least two kinds of relations in the examples we chose. The first one represents an investigation of the epistemic foundations of divination, mainly astrological divination. His philosophical analysis of the epistemological level of astrology allows Aquinas to ground the ethical conclusions he will present in the end. The second case is even more peculiar: in it, Aquinas uses a distinction originally found in his philosophical reflections on astronomy and applies it analogically to a purely theological question, namely, that of the Trinity.

Again, these instances of Aquinas facing theological questions by engaging with the best knowledge of the natural world he had at hand point towards the variety and diversity of possible types of engagements available also today. One might even argue that, unlike what Perry and Leidenhag claim for science-engaged theology, Aquinas's example shows that one can engage with the natural sciences at a local level, and by doing that also contribute to a larger theological project, and hence engage at a more general theological level. Aquinas's larger theological project is, certainly, that of showing the non-

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irrationality of the Christian faith, and hence his constant engagement with philosophy in general and with the medieval natural sciences in particular.

Conclusion

We have emphasized in this article the plurality of ways in which theology can engage science by analysing some examples of engagement in the works of Thomas Aquinas. Peter Harrison's work allowed Perry and Leidenhag to suggest a new method of enquiry for theology in relation to the natural sciences. By retrieving John Brooke's seminal ideas, we suggest that this very method can be thought of as diverse and varied in multiple levels.

Looking at Aquinas, we find a concrete historical example of how the science-engaged theology project is not necessarily one that has to be identified as a piecemeal project. Each natural science has its own subjects, methods, sets of evidence, community codes of conduct, etc. Because of this, it is tempting to concede that theological projects that include, to some extent, examples of engagement with science are necessarily ones that will only aim at solving particular and concrete theological puzzles without a greater theological project in mind. Aquinas's case is a clear example of that. While he does use the sciences of his day to tackle discrete theological problems, these are presented as part of a greater argumentative and even pedagogical structure that has a theological *telos* in its horizon. We do not claim that all science-engaged theological work must be conceived as a part of such a grand project: we simply hold the view that this work can play an important role in them.

Most importantly, though, Aquinas's examples highlight the perishability of these engagements. History of science provides numerous examples of outdated and discarded scientific discourses. Regardless of what philosophy of science can tell us, for example, about the truth-content of the Ptolemaic astronomical models, it is also true that many of its physical and cosmological tenets are today simply held as false. Something similar can be said about science-engaged theological puzzle solving. *Historia magistra vitae*. While Aquinas might have found that Aristotle's or Ptolemy's geographical knowledge was a suitable tool for defending his interpretation of Genesis, no contemporary theologian would hold such view, regardless of their exegetical position on the Genesis text. But what applies to Aquinas, also does to us. Whatever the value of carrying out science-engaged theological projects – and we think that there is great value in it – we must also not forget that it will be an engagement that, as most engagements do, will change in time.

Notes

1 There is no reason to reserve a special category for the knowledge of the natural world, understood as separated from the social world of persons. In fact, the *Summa Theologiae*, I–II and II–II, are full of examples where theological reflection could be nourished by the contributions of social sciences such as sociology, economics, and political science, among many others. Aquinas' corpus includes many biblical commentaries in which history, cultural studies, and philology can act as relevant auxiliary disciplines. We thank an anonymous reviewer for pointing this out. The larger question of philosophy as the mediator between the natural sciences and theology is far too ambitious to be discussed in this article. We refer the reader to the works of great Thomists of the twentieth century such as, for instance, Jacques Maritain (1937) or William Wallace (1996). Translations of the *Summa Theologia* are taken from Aquinas (1920).

2 For Aquinas as a heterodox thinker, consider how some of his doctrines were subject to the 1277 condemnation by Etienne Tempier, bishop of Paris. See, for instance, Wippel (1977) and (1997), Van Steenberghen (1980), Bianchi (2009). For Aquinas on faith and science, and his heterodox thought, see Konyndyk (1995).

3 For many more examples not referenced in this article, see Beltrán (2009).

4 As quoted in Perry and Leidenhag (2021, 248).

5 *De Fide Orthodoxa*, III, 2 (*Patrologia Graeca*, 94, 985).

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6 For the case of the Sun, Ptolemy presents two models, one with an epicycle and a geocentric deferent, and one with no epicycle but an eccentric deferent. He shows how both can be geometrically equivalent. Interestingly, though, he prefers the latter, for reasons of simplicity. See Ptolemy (1984, 153).
7 See *S.Th.* I, 68, 4, in which, in another example of his sourcing knowledge of the natural world to solve theological puzzles, Aquinas explains the diversity of the heavens.
8 Aristotle (1952, 95). Parnassus was Aristotle's name for the Hindu-Kush range, probably a Greek rendering of the Akkadian *Paruparaessana*. See Bosworth (1993, 408).
9 Ptolemy (1940, 3–5).
10 Ptolemy (1940, 19).
11 *Contra Gent.* III, c. 86, n° 14; *In Metaph.* XII, lect. 9, n° 8; *In De Caelo* II, lect. 18, n° 11.
12 *Super Boeth.* III, 5, 1, *sc*; *Super Boeth.* III, 5, 3, obj. 8; *Super Boeth.* III, 6, 1, *sc*.
13 Aquinas is not too restrictive here. He even accepts that it is allowed to make predictions based on the behaviour of birds, a practice which he knew was very ancient. This is because 'the causes from which they [the patterns of bird flight] proceed are also the causes of future occurrences' (*S.Th.* II–II, 95, 7, co.). So, because he is able to – partially – furnish ornithomancy with some kind of basis in natural philosophy, he is able to allow it, albeit with many cautions.
14 To support this idea, Aquinas frequently quotes the *Centiloquium*, which he thought was Ptolemy's work: *sapiens dominatur astris* (cf., as a few examples, *S.Th.* I–II, 9, 5, *ad* 3; *Super Sent.* II, 14, 1, 5, exp.; *Contra Gent.* III, c. 85, n° 20; *De sortibus* c. 4).
15 Eudoxus of Cnidus is said to be the first of the Hellenes to have made use of such hypotheses, Plato (as Sosigenes says) having created this problem for those who had concerned themselves with these things: on what hypotheses of uniform and ordered motions could the phenomena concerning the motions of the planets be preserved? (Simplicius 2005, 29)
16 *In Metaph.*, XII, lect. 10, n° 2. The translation is taken from Aquinas (1961).
17 See Grant (1987) for a more detailed discussion on the subject.
18 Saliba (1994, 131–133). The authorship of the work is discussed there, but there is no definitive conclusion.
19 This different strategy can be found in the forthcoming 'Theology meets Philosophy of Science' issue to appear in *Religious Studies* shortly, entirely devoted to articles engaging theological questions with contemporary philosophy of science.

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