1 Introduction

Thomas Aquinas, one of the greatest theological minds, started in the thirteenth century what might be one of the longest intellectual traditions in philosophical and theological history, namely, Thomism. This Element will be devoted to showing how this tradition has of late engaged with the natural sciences. I will suggest that there is at hand a new methodology, which I called 'science-engaged Thomism', that can be conceived in broader terms as aligned with the recent science-engaged theology movement, asking theological questions that require the input of the natural sciences. Still, science-engaged Thomism relies on a tradition of thought that possesses a vast arsenal of metaphysical tools with which to consider the natural sciences and address contemporary questions that arise therefrom. As such, recent, and not so recent, developments have modified, reinterpreted, or reformulated, when necessary, Thomistic notions as they were informed by the natural sciences.

Thomas Aquinas' philosophical and theological production is vast, and this is not the place to comment on it. Suffice it to say that he wrote the *Summa Contra Gentiles*, the *Summa Theologiae*, biblical commentaries, commentaries on Aristotle and on Peter Lombard's *Sentences*, as well as many other commentaries to different Neo-Platonic works, in addition to numerous opuscules, letters, and other minor writings. Due to his adoption of Aristotelian ideas, Aquinas found himself in the middle of two opposing sides: the philosophers who read Aristotle following some Arabic commentators such as Ibn-Rushd (or Averroes, as he was known then), and the theologians who claimed that Aristotelian philosophy implied the falsity of several theological claims. Throughout his life, he placed his thought between these two positions, arguing that Aristotelian philosophy was key to understanding the contents of faith.

1.1 What Is Thomism?

The history of Thomism as a school of thought is vast and long, and, again, I will not attempt to present one here.[1] Interestingly, one cannot really claim that Thomas left disciples during his life. In fact, it took several decades for his ideas to take hold in the minds of scholars. The epithet 'Thomist' was used from the fourteenth century onwards, first to distinguish those who defended Aquinas' doctrines against other positions, such as the Scotists or, later, the Molinists. Then, the label came to mean something broader as those who followed Aquinas' ideas in one way or another. Leonard Kennedy has produced

[1] For a short history of early Thomism up to the eighteenth century, see Fabro 2022.

a catalogue of Thomists from the late thirteenth century onwards until the nineteenth century, listing 2034 scholars over six centuries.[2]

Romanus Cessario has claimed, however, that 'there are no universally agreed criteria for answering the question: Who is a Thomist?'[3] Still, the most widely used definition for is that of James Weisheipl, OP (1923–1984). For him, Thomism is 'a theological and philosophical movement that begins in the thirteenth century, and embodies a systematic attempt to understand and develop the basic principles and conclusions of St Thomas Aquinas in order to relate them to the problems and needs of each generation'.[4] That is, Thomism is a historical movement and tradition that does not merely repeat Aquinas' ideas, but rather develops Aquinas' key notions as to face the philosophical and theological problems of the day. Thus, it started with Thomas Aquinas, grew through the fourteenth century, became prominent in the following centuries, particularly through the Counter-Reformation, and continued to expand and flourish until today.

Interestingly, each era has engaged with Aquinas' ideas differently. So, for instance, the early Thomists read more eagerly Aquinas' *Commentary on the Sentences*, whereas both *Summae* were more influential throughout the sixteenth century until the mid twentieth century. Today, scholars are moving beyond the *Summae* and offering due attention to his other philosophical and theological works.[5]

Almost every Thomist would agree to some basic philosophical principles. These include, for a start, metaphysical realism, due to the emphasis given to the act of being or existence. From this, the reality of creation, followed by the possibility of knowing, though imperfectly, the divine nature from its works, and the discourse about it in analogical terms. In addition, within the philosophy of nature, a Thomist would hold that natural things are hylomorphically composed, human beings having a special hylomorphic composition due to their *intellectual* soul.

Throughout its history, Thomism received a great deal of Pontifical support, ever since John XXII canonised Aquinas about fifty years after his death. Mandates and commendations to study Aquinas are present in the Code of Canon Law (Can. 252, §3) and in several nineteenth- and twentieth-century Papal encyclicals,[6] particularly Pope Leo XIII's 1879 encyclical, *Aeterni Patris*. In this letter, Pope Leo stated a straightforward mandate to study the work of Thomas Aquinas in every Catholic institution around the globe, calling all Catholic philosophers and theologians to restore Christian Philosophy in the

[2] Kennedy 1987. [3] Cessario 2003, 20. [4] Weisheipl 1967, 126. [5] See Cessario 2003, 11.
[6] Once again, Fabro's volume is an excellent resource.

spirit of the thought of Aquinas. This mandate started what is known as Neo-Thomism, a movement that lasted until the mid twentieth century and that produced a plethora of volumes that attempted to systematise the thought of Thomas Aquinas in direct engagement with then-contemporary philosophical ideas.[7] These volumes were used worldwide well into the second half of the century. An important example for us is that of the Catholic University of Leuven, which, following the papal mandate, decided to open a Thomistic Philosophy Chair. The call for applicants explicitly requested the chairholder to be 'both a learned scholastic and a modern man . . . and having followed the development of the sciences, psycho-physics, cell microscopy'.[8] The Catholic Belgian priest Désiré Mercier (1851–1926), later the influential Cardinal Mercier, was selected for it, holding it until 1905. During his tenure, he created the Higher Institute of Philosophy, a beacon of Thomist philosophy, in which scholars were encouraged to engage with the modern sciences, in particular through a laboratory for experimental psychology.

Many have argued that after the Second Vatican Council (1962–1965), Thomism was a dying tradition.[9] Others, however, offer a different assessment. Romanus Cessario, OP, has suggested Thomism remains active in both secular and religious circles.[10] Corroborating this point is the fact, of particular interest to us, that the thought of Thomas Aquinas has seen a revival in the studies of science and theology.

Regarding the natural sciences, there is no clear agreement on how to interpret their results among Thomist. There are at least two main streams of thought, namely, that of Jacques Maritain (1882–1973) and that of the so-called River Forest Thomism, with authors such as Charles de Koninck (1906–1965), James Weisheipl (1923–1984), William Wallace (1918–2015), and Benedict Ashley (1915–2013).[11] These two streams disagreed most basically on the value of the natural sciences in knowing nature and advancing the philosophical and theological enterprise. For Maritain, the natural sciences, which are truly distinct from the philosophy of nature, reach knowledge of nature but only at the observable and measurable level to formulate laws of the regularities observed, while the philosophy of nature reaches nature's essence, that is, it penetrates the nature of its object of study.[12] For River Forest Thomism, on the contrary, the natural sciences are an intrinsic part of the philosophy of nature, meaning that they reach knowledge of the very nature of things. In affirming this, River Forest Thomism stresses the idea that Thomist metaphysics must be

[7] See Elders 2020, 13. [8] Van Riel 2022. [9] See Rahner 1983, 4.
[10] Cessario 2022, 12. Also, Torrell 2003; Hudson 1992.
[11] See Reese 2024 for a recent analysis of this school within Thomism.
[12] See Maritain 1959, 178–180.

preceded by a study of the natural sciences interpreted under the light of Aristotelian philosophy.[13] Building on this tradition, I will suggest constructing what I have termed in the past as science-engaged Thomism, that is, a Thomism, both philosophical and theological, that is actively and positively engaged with the natural sciences. The main point will be that this active and positive engagement was the attitude that Thomas Aquinas had towards the knowledge of the natural world of his time, so that, despite the formal difference between that knowledge and the natural sciences today, a Thomist could be inspired by Aquinas' own example in doing philosophical and theological work.

In the next section I will present this strategy in depth together with some basic Thomistic metaphysics of nature and of God, creation and providential action in particular, as ground on which to build the presentation of the subsequent sections. Basically, I will offer a simple analysis of the underlying philosophical resources brought from Aristotelian philosophy of nature in terms of the four classical causes (material, formal, efficient, and final), and the God 'factor' at play in every natural happening, that is, the relation between God as primary cause and natural causes as secondary (created) causes. These doctrines are the set of tools in what I like to call Aquinas' metaphysical toolbox, tools which he employed when he discussed some particular theological doctrines, and those which Thomists today can also source for their work.

Following this, I will discuss different topics from the natural sciences with which Thomists have engaged throughout the twentieth and twenty-first centuries. Starting with quantum mechanics, I will show how it opened the path for the reintroduction of formal causes, reinterpreting the doctrine of degrees of being, and rethinking how divine providence can be understood to be active through the indeterminate processes of nature. I will, then, delve into cosmology, starting with some early encounters, followed by how Thomists interpreted Big Bang cosmology and the multiverse, and engagements with recent developments in astrobiology. Evolutionary biology will be the subject of the following section, being perhaps the topic that awoke more disagreement among Thomists, ranging from a complete dismissal up to a metaphysical acceptance of the evolutive origin of species. I will present this development within Thomism chronologically, with a final part devoted to the contemporary challenges arising from the problem of evil and original sin. Finally, I will bring forth several other topics in which Thomists currently work engaging their received Thomistic wisdom with the contemporary natural sciences: the

[13] Tanzella-Nitti 2023 offers a review of some dealings of late Thomism with the natural sciences.

cognitive sciences, human enhancement, the possibility of miracles, and the origin of life, ecology, and embryology.

2 Some Preliminary Definitions

2.1 Science-engaged Thomism

The next few pages will be devoted to discussing the benefits and merits of a different strategy within Thomism, suggesting how Thomists could re-engage with contemporary science. I do not claim that this strategy has not been followed before within this school or that it is not currently being pursued; as I hope to show in the coming pages, there are many scholars who offer inspiring engagements of science and Thomism, both in philosophy of nature and in theology. Still, identifying this methodology will also benefit this theological school in terms of its dialogue with others.

Thomas Aquinas assumed a similar strategy when facing some questions that the theology of his time posed when they related to the knowledge of the natural world. As a thirteenth-century scholar, Aquinas embraced the most up-to-date philosophical and theological problems of his time, addressing the most pressing and determining problems he and his contemporaries faced. While sourcing much of his thought from Augustine and the wisdom of the Fathers, Aquinas also incorporated the ill-reputed Aristotelian philosophy that had recently arrived from Muslim sources. This attitude meant he had, for some, the image of a heterodox thinker rather than that of the orthodox scholar we often assume. 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, Aquinas was engaging theology with the best knowledge of the natural world for attempting solutions for discrete theological problems. It is true that his search was for philosophical and theological wisdom and in this his pursuit was different from contemporary theology; but, in this search, he was solving discrete theological questions: one only needs to look at the way in which his *Summa Theologiae* or his commentary on Peter Lombard's *Sentences* is structured into questions and articles.

This strategy for approaching theological matters, resourcing to issues of nature when needed, could be compared to what John Perry and Joanna Leidenhag have recently described as science-engaged theology.[14] Perry and Leidenhag suggest that this 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

[14] See Perry and Leidenhag 2023.

findings'.[15] For them, science-engaged theology should ask empirical questions to contemporary science, which is conceived, thus, as a material 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,[16] which can be thought of as resembling this science-engaged theology of which Perry and Leidenhag speak.

When considering the question about the location of the Garden of Eden,[17] for instance, Aquinas sources the best geographical knowledge he had at hand. To the objection that men had already *diligentissime* (that is, very thoroughly) explored the whole of the habitable world and that no one had mentioned the Garden at all, Aquinas suggests that Eden is shut off from us by some natural impediment that cannot be crossed: Eden would be on the other side of either the impassable mountains (probably to the East, i.e., the Hindu-Kush range or even the Himalayas, which Alexander the Great did not manage to pass), or the great sea (probably to the West, the Atlantic Ocean, which was only crossed more than two centuries after), or the torrid central section of the globe (which for Aristotle was impenetrable). Eden was, hence, impossible to access, but was located on Earth.

Another rather interesting example of a theological puzzle comes from the consideration of the Incarnation of the Second Person of the Trinity. His Aristotelian approach to the question whether the flesh of Christ was conceived of the Virgin's purest blood (*ex purissimis sanguinibus virginis*) served not only as to provide an answer but also helped to shape the very question itself. The term *purissimis* was usually understood in the spiritual sense of Mary being the purest of creatures. Aquinas' reply shows how Aristotle's reproductive biology reconfigured the question, assuming the term *purissimis sanguinibus* biologically as well as spiritually, that is, as the purest blood out of which the flesh of a new human being was made. When explaining human reproduction, Aristotle teaches that the male and female seeds are formed as the final heightening of the blood's potential for form. Assuming the divine intervention (due to the lack of the male seed), Aquinas explains that the female principle of generation was 'the woman's blood brought to a more perfect stage of secretion by the mother's generative power'.[18] By affirming that Mary provided the blood in the most

[15] See Perry and Leidenhag 2021, 247.
[16] For other examples not referenced here, see Beltrán 2009, and Silva and Recio 2023.
[17] *S.Th.* I, 102, 1, *ad* 3. [18] *S.Th.* III, 31, 5.

perfect stage, Aquinas reinterprets the very question as a reference both to Mary's holiness and virginity and also to the fact that the blood on which God acted was, biologically speaking, at its highest perfection. 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.

What matters in these examples is not the actual answer, but the way for approaching a discrete theological question. On the first one, Aquinas had previously followed the opinion of the Fathers and explained that the Garden was somewhere in the East. Still, he opens up the theological game in the replies to the objections. The theological question regarding the *earthly place* of Eden required the use of empirical data (understood in the broadest possible sense) that was brought about by philosophers, explorers, and historians. Relying on the testimony of other authorities on the natural world of the time, Aquinas considers the data and finds that Eden *could* be located elsewhere, beyond the infrangible sea, mountains, or desert. On the second example, Aquinas accepts the usual interpretation of *purissimis* as referring to a spiritual sense, but again moves the theological boundaries beyond the traditional path and making use of Aristotelian reproductive biology offers a new twist to a key theological matter. Thus, Aquinas' appeal to the knowledge of the natural world offered by medieval natural philosophy shows the importance that he gave to this kind of knowledge for his theological enterprise. This strategy bares quite a resemblance to today's science-engaged theology.

Some early twentieth-century Thomism engagements with the natural sciences offer some contrasts with this strategy. I have referred to the revival of Thomism after the impulse of Pope Leo XIII, who had three goals in mind, the third of which is of every importance to this narrative. His call was to restore the wisdom of St. Thomas 'for the defence and beauty of the Catholic faith, for the good of society, and *for the advantage of all the sciences*'.[19] That is, the sciences would gain much from their interaction with the philosophical and theological thought of Thomas Aquinas. This papal call was, at least at times, understood in the sense that Thomists should produce something like Thomism-engaged science. Rather than making use of contemporary science to delve deeper into the mystery of creation and the divine, some Thomism mapped science into Thomist jargon, so to speak.

I do not want to claim that this is a completely unfortunate strategy to engage with the sciences. Thomism-engaged science could certainly have

[19] Pope Leo XIII 1879, §31 (my emphasis).

something of value to offer to the natural sciences and the philosophy of science. In fact, Werner Heisenberg, for instance, somehow claimed for this when in his 1955–1956 Gifford Lectures on *Physics and Philosophy*, rejecting the Cartesian philosophy of pure actuality, he suggested adopting the two Aristotelian fundamental notions of act and potency. From Thomistic camps, some decades earlier – the very same year when Heisenberg published his uncertainty principle – Petrus Hoenen, SJ (1880–1961), who held a doctorate in physics, claimed that the new physics would be 'be Aristotelean-Thomistic or it will not be'.[20] Similarly, by the end of the twentieth century, Dutch philosopher Leo Elders (1926–2019) claimed that, in sight of the new atomic theory, 'we should continue holding the doctrine of the essential nature of things according to which the underlying substance of material things is the bearer of their properties and functions'.[21]

My suggestion, thus, is for a methodological turn in Thomist engagements with the natural sciences, a turn from assuming that Aquinas' thought can be construed as a closed philosophical or theological system that solves all conundrums and tensions between science and faith, and to construct this science-engaged Thomism, a strategy that closely follows Aquinas' own example. Certainly, this new methodology does not neglect the ample Thomistic tradition in philosophy and theology, but rather hopes to reinvigorate it by approaching theological questions with a set of metaphysical and scientific tools that, together, are helpful to solve these questions.

Peter Harrison has reflected on the 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'.[22] Science-engaged Thomism could certainly avoid these pitfalls as well, even if some past Thomism has failed to do so. In fact, Thomism is usually 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. Science-engaged Thomism wants to approach the study of nature and the divine hand-in-hand with the natural sciences, for the simple reason that one knows God from His effects. This approach could, as Harrison suggests, 'afford us new opportunities to reimagine aspects of a Christian tradition that had been lost as a consequence of habits of mind that arise out of modern concepts and ideas'.[23] In fact, the search for a Thomistic 'system',

[20] As quoted in Flipse 2008, 1149. [21] Elders 1997. [22] Harrison 2021, 476.
[23] Harrison 2021, 478.