WILLIAM E. CARROLL

Distinguished Visiting Professor of Philosophy
Zhongnan University of Economics and Law (Wuhan, China)
carrol.williame@googlemail.com

The Condemnations of Paris of 1277 and the Origins of Modern Science

Recibido: 13 de abril de 2023 Aceptado: 15 de mayo de 2023

Abstract: After discovering a treasure-trove of medieval manuscripts on various topics in the philosophy of nature, the French physicist, historian and philosopher of science, Pierre Duhem (1861-1916), concluded that the Middle Ages witnessed profound reflections in the understanding of the natural world. He eventually argued that developments in the 14th Century at the University of Paris concerning projectile motion anticipated the theories of inertia set forth by Galileo, Descartes, and Newton. Scholars like Jean Buridan, according to Duhem, rejected the Aristotelian principle that everything that is moved is moved by another. He claimed that the intellectual horizon in which Buridan and others operated was made possible by the actions of Étienne Tempier, Bishop of Paris, who in 1277 issued a list of 219 proposition condemned as false - many of them grounded in Aristotelian physics. For Duhem, the real Scientific Revolution begins with Bishop Tempier's condemnations. There are problems, however, with Duhem's thesis. The theory of impetus set forth by Burdian is not so much a rejection of Aristotelian principles but a new development within the broad Aristotelian tradition. Duhem does help us to reject the view that there is a fundamental incompatibility between Catholic theology and science. However, the Condemnations of 1277, in the appeal to divine omnipotence to counter claims about what is true in nature, incorporate a view that is really an obstacle to the development of science. Concerns about challenges of Aristotle to Christian faith, evident in the condemnations, were not shared by thinkers such as Albert the Great and Thomas

Aquinas.

Keywords: Pierre Duhem, Jean Buridan, Étienne Tempier, Stanley Jaki, Hans Blumenberg, T.F. Torrance, Aristotelian physics, impetus theory, God's absolute power, necessity in nature, creation out-of-nothing

Las condenas de París de 1277 y los orígenes de la ciencia moderna

Resumen: Tras descubrir un tesoro de manuscritos medievales sobre diversos temas de la filosofía de la naturaleza, el físico, historiador y filósofo de la ciencia francés Pierre Duhem (1861-1916) concluyó que la Edad Media fue testigo de profundas reflexiones en la comprensión de lo natural. mundo. Finalmente argumentó que los avances ocurridos en el siglo XIV en la Universidad de París en relación con el movimiento de los proyectiles anticiparon las teorías de la inercia expuestas por Galileo, Descartes y Newton. Eruditos como Jean Buridan, según Duhem, rechazaron el principio aristotélico de que todo lo que se mueve es movido por otro. Afirmó que el horizonte intelectual en el que operaban Buridan y otros fue posible gracias a las acciones de Étienne Tempier, obispo de París, quien en 1277 publicó una lista de 219 proposiciones condenadas como falsas, muchas de ellas basadas en la física aristotélica. Para Duhem, la verdadera revolución científica comienza con las condenas del obispo Tempier. Sin embargo, la tesis de Duhem plantea problemas. La teoría del ímpetu expuesta por Burdian no es tanto un rechazo de los principios aristotélicos sino un nuevo desarrollo dentro de la amplia tradición aristotélica. Duhem nos ayuda a rechazar la opinión de que existe una incompatibilidad fundamental entre la teología católica y la ciencia. Sin embargo, las Condenas de 1277, al apelar a la omnipotencia divina para contrarrestar las afirmaciones sobre lo que es verdadero en la naturaleza, incorporan una visión que es realmente un obstáculo para el desarrollo de la ciencia. Las preocupaciones sobre los desafíos de Aristóteles a la fe cristiana, evidentes en las condenas, no fueron compartidas por pensadores como Alberto el Grande y Tomás de Aquino.

Palabras clave: Pierre Duhem, Jean Buridan, Étienne Tempier, Stanley Jaki, Hans Blumenberg, T.F. Torrance, física aristotélica, teoría del ímpetu, poder absoluto de Dios, necesidad en la naturaleza, creación de la nada

If we had to assign a date to the birth of modern Science [*la naissance de la Science moderne*], without doubt we would choose this year 1277 when the Bishop of Paris solemnly proclaimed that several Worlds could exist [*qu'il pouvait exister plusieurs Mondes*], and that the entirety of the heavenly spheres could, without contradiction, be animated by rectilinear motion [*être animé d'un mouvement rectiligne*]. . .

It is from the Logic and the Physics of the Parisians that, in Italy, the initiators of modern Science borrow arms [*empruntent les armes*] in order to combat the out-of-date teachings [*les enseignements surannés*] of the Philosopher [Aristtole] and the Commentator [Averroes]. Those who exert themselves in shaking off the yoke of tyrannical routine have their eyes fixed upon Paris, with its nominalist Scholasticism, which has for centuries possessed intellectual liberty. [1] Pierre Duhem

One of the more widely accepted narratives of the modern world locates its origins in the 17th Century with the

[1] *Études sur Léonard de Vinci: Ceux qu'il a lus et ceux qui l'ont lu* (Paris: 1909), vol. 2, 412; and *Études*, vol. 3, 227 [Voilà pourquoi nous ne comprendrions rien à l'avènement des idées qui devaient placer la Terre au rang des planètes si nous ignorions comment l'Église catholique a lutté contre les Métaphysiques et les Théologies léguées à l'Islam par l'Antiquité hellénique. (*Le système du monde*: *histoire des doctrines cosmologiques de Platon à Copernic* (Paris: Hermann, 1913-1959), vol. 4, 320.

emancipation of the natural sciences both from the antiquated natural philosophy and metaphysics of Aristotle and from the domination of theology and ecclesiastical control. This orthodox narrative of science, religion, and the modern world is the context in which historians, philosophers, theologians, and scientists have made competing claims about how to understand the origin and nature not only of the natural sciences but also the very contours of modern Western culture.

An important challenge to the common narrative is the work of the French physicist, historian, and philosopher of science, Pierre Duhem (1861-1916). In 1904 Duhem was working in the Bibliothèque Nationale in Paris, searching for material for a book he planned to write on the history of mechanics. He discovered a treasure-trove of mediaeval manuscripts in the natural sciences and mathematics. Contrary to the popular view that the Middle Ages was scientifically barren, he concluded that just the opposite was the case.

From Impetus to Inertia

Duhem argued that theories in physics in 14th Century Paris anticipated in important ways the contributions of Galileo and Newton in the 17th Century. These medieval developments that, according to Duhem, rejected tenets of Aristotelian physics, were encouraged by the actions of the Bishop of Paris, Étienne Tempier, who in March 1277 condemned a series of 219 propositions, many associated with the philosophy of Aristotle. Duhem claimed that Tempier's action freed natural philosophers from the straight-jacket of Aristotelian science and encouraged them to examine ways of understanding the world that Aristotle

would reject. Duhem celebrated the origin of modern science in the following schema:

> This effort [to replace Aristotelian science] took its support from the most ancient and the most splendid of the medieval Universities: the University of Paris. How could a Parisian fail to be proud of this?
>
> Its most eminent promoters were Jean Buridan from Picardy and Nicole Oresme from Normandy. How could a Frenchman fail to entertain a legitimate sense of pride in this?
>
> It resulted from the obstinate struggle [*la lutte opiniâtre*] which the University of Paris — at that time the true guardian of Catholic orthodoxy — waged against Peripatetic and Neoplatonic paganism. How could a Christian fail to acknowledge his gratitude for this to God?[2]

These comments reflect, at least in part, the cultural milieu of late 19th century France, in particular, and within a broader context the rejection of the philosophy of positivism. The claim that the real Scientific Revolution occurred earlier than the traditional story relates -- and itself has its origins in the actions of the Bishop of Paris -- supplies an antidote to the view that sees a fundamental hostility between science and Christianity. Characteristic in this regard is the work, in the late 19th Century, of Andrew Dickson White, the founding president of Cornell University: *History of the Warfare Between Science and Theology in Christendom.* For many who wish to find an alternative to anti-religious currents in contemporary culture, Duhem's thesis continues to be an attractive.

Duhem's antipathy to the contributions of Fourteenth-Century Oxford scholars such as William of Ockham, Thomas Bradwardine, Roger Swineshead, William Heytesbury, and others, flows from his negative evaluation

[2] *Études*, vol., xii-xiv.

of what he considers to be Oxford's fascination with logical mind-games. Oxford dialectics is a danger that needs to be avoided if science is to advance. At one-point Duhem remarks that "in truth the Oxford masters were possessed of terribly foggy intellects; in order to make things clear, they were in dire need of going in search of the light of Paris."[3]

Duhem thought that the work of Jean Buridan (1301-1358) on projectile motion entitles him to be called a precursor of Galileo and Newton. For Aristotle all motion requires a conjoined moving cause. Buridan offered an explanation of the continuing motion of a thrown object only in terms of an impetus imparted to it when it is first put into motion. Buridan and others, according to Duhem, lay the foundations of modern mechanics. In 1913, in a lecture in Italy, Duhem summarized his findings in the following way:

> [I]n the Fourteenth Century the masters of Paris, having rebelled against the authority of Aristotle, constructed a dynamics entirely different from that of the Stagirite; that the essential elements of the principles thought to have received mathematical expression and experimental confirmation from Galileo and Descartes were already contained in this dynamics; that at the beginning of the Fifteenth Century these Parisian doctrines spread into Italy, where they encountered a vigorous resistance from the Averroists, jealous guardians of the Aristotelian tradition…; that they were adopted in the course of the Sixteenth Century by the majority of mathematicians; and finally that Galileo, in his youth, read several of the treatises containing these doctrines.[4]

Since the principle of inertia is the key to Newtonian science and since its acceptance seems to require the denial

---

[3] *Le système du monde*, vol. 7, 636.

[4] *Rendiconti della Reale Accademia dei Lincei (*Roma: Classe scienze fisiche, matem.) 22 (1913), 429.

of the first principle of Aristotelian physics – that all motion requires a mover, Buridan's anticipation of inertia in the 14th Century represents the true scientific revolution. Duhem lists the following anti-Aristotelian developments: explanations of the continuation of projectile motion (impetus theory) and of the acceleration of bodies in free fall; development of the doctrine of the latitude of forms; assertion of the possibility of infinite and infinitesimal magnitudes; the possibility of the existence of the void; the possibility of the rotation of the earth and of the plurality of worlds.[5] This revolution, as Duhem saw it, is thoroughly Christian in inspiration because it was made possible by the Bishop of Paris' theological condemnations of claims made in Aristotelian science.

One of the principal defenders of Duhem's thesis was the Benedictine theologian and physicist, Stanley Jaki, who wrote a biography of Duhem: *Uneasy Genius: The Life and Work of Pierre Duhem*. Jaki thought that in all ancient cultures, including the Greek, science "suffered a ... monumental stillbirth," and it is "biblical revelation … that made the only viable birth of science possible." [6] Jaki argued 1) that modern science rests on Newton's laws, the most important of which concerns inertial motion, , and 2)

[5] He describes these in the second and third volumes of the *Études sur Léonard de Vinci.*

[6] Jaki argues that the belief that the heavens are in some sense divine prevented all ancient cultures from discovering a single set of natural laws for both the earth and the heavens. S. Jaki, "The Biblical Basis of Western Science," *Crisis* 15 (October 1997), 17-18. Among his many books, see *The Relevance of Physics* (University of Chicago Press, 1966); *The Road of Science and the Ways to God* (University of Chicago Press, 1978); and *Bible and Science* (Christendom Press, 1996).

that the formulation of this law can be found in the work of Jean Buridan.

Buridan's reflecting on the absolute beginning of the universe -- something which Aristotle's science would reject – led him to examine *how* God might have set the heavenly bodies in motion. In creating the heavens and the earth, God gave a certain quantity of motion [impetus] to all celestial bodies, which quantity they keep because they move in an area where there is no friction. This is, according to Jaki, "an uncanny anticipation of Newton's first law, the law of inertial motion."[7]

For Duhem and Jaki – and indeed for many historians of science – the principle of inertia rejects the need to find a conjoined cause for continuous motion. As Duhem remarks, "Galileo's mechanics was the adult form of a living science of which Buridan's mechanics was the larva."[8]

The relationship between Buridan's and Aristotle's physics is a complex question. The problem of projectile motion — that is, the need to account for the causality of its continuing motion after the projectile is separated from the thrower — arises in the larger context of Aristotle's distinction between natural and violent motion and his general principle that all motion as it occurs requires a cause. Natural motion has its source in the moving body itself (most obvious in living things), whereas violent motion has its source extrinsic to the moving body. Since a projectile does not move itself, Aristotle conjectured that

[7] *Ibid.*, 17.

[8] *Le système du monde*, vol. 8, 200.

somehow the cause of such motion must be in the medium through which it moves.

Jean Buridan was a member of the arts faculty at the University of Paris from around 1325 to 1358. He rejected Aristotle's explanation of projectile motion that proposed the role of the medium, for example air, as the continuing cause of the motion of the projectile.[9] Buridan argued that

---

[9] Buridan offers three major objections to Aristotle's theory. First he notes that it cannot account for the continued circular motion of a spinning top or of a potter's wheel because the air has no way of either circling in behind any part of the wheel or carrying any part of the wheel along with it. Second, he objects that the air seems to resist the motion of a projectile rather than to assist it. For example, when a ship is pulled through the water and then released it continues in motion even though no air can be felt to be pushing it from behind; yet the air in front of the ship can be felt to be resisting the motion. Third, if Aristotle were right it would seem that a feather could be thrown farther than a stone using the same force, but experience shows the opposite to be true. Jean Buridan, *Questions on the Eight Books of the Physics of Aristotle*, Book VIII, question 12, translated by Marshall Clagett in *The Science of Mechanics in the Middle Ages* (Madison, WI: The University of Wisconsin Press, 1959), 533-534.

"I]t seems to me that it ought to be said that the motor in moving a moving body impress (imprimit) in it a certain impetus (*impetus*) or a certain motive force (*vis motiva*) of the moving body, [which impetus acts] in the direction toward which the mover was moving the moving body, either up or down, or laterally, or circularly. And by the amount the motor moves that moving body more swiftly, by the same amount it will impress in it a stronger impetus. It is by that impetus that the [projectile] is moved after the projector ceases to move. But that impetus is continually decreased (*remittitur*) by the resisting air and by the gravity [of the projectile], which inclines it in a direction contrary to that in which the impetus was naturally predisposed to move it. Thus the movement of the [projectile] continually becomes slower, and finally that impetus is so diminished that the gravity of the [projectile]

the moving force, which he called *impetus*, had to be in the projectile itself and not in the medium.

For Buridan impetus was a qualitative power, a *virtus movens*, that was gradually overcome by the nature of the body, gravity, and the like.[10] The impetus was "unnatural," "violent," and "foreign," imposed by an extrinsic cause, only to be overcome by the natural forces within the body and, thus, eventually eliminated. As we have already seen, Buridan also suggested that the motion of the heavenly bodies could be explained by God's imparting an impetus to them which would not dissipate since there was no resisting medium nor any contrary tendency in the heavenly body.[11]

---

wins out over it and moves the [projectile] down to its natural place. This method [viz., this explanation], it appears to me, ought to be supported because the other methods do not appear to be true and also because all the appearances are in harmony with this method." *ibid.*, 534-535.

[10] "[I]mpetus is a thing of permanent nature (*res nature permanentis*), distinct from the local motion in which the projectile is moved … And it is probable (*verisimile*) that that impetus is a quality naturally present and predisposed for moving a body in which it is impressed, just as it is said that a quality impressed in iron by a magnet moves the iron to the magnet. And it is also probable that just as that quality [the impetus] is impressed in the moving body along with the motion by the motor; so with the motion it is remitted, corrupted, or impeded by resistance or a contrary inclination." *ibid.*, 537.

[11] "Also, since the Bible does not state that appropriate intelligences move the heavenly bodies, it could be said that it does not appear necessary to posit intelligences of this kind, because it would be answered that God, when He created the world, moved each of the celestial orbs as He pleased, and in moving them He impressed in them impetuses which moved them without His having to move them any

Impetus, as Anneliese Maier[12] and others have recognized, is really a development within Aristotelian physics. Aristotle thought that the continuing causality of the mover, in projectile motion, had to be *extrinsic and external*, and thus he explained it in terms of the medium's possessing a certain power to continue the motion. Buridan, however, maintained the essentially *extrinsic* character of the motor causality but argued that the power to continue the motion of the projectile is *internal*, that is within the thrown object. The theory of impetus provided medieval natural philosophers with a way of preserving the Aristotelian distinction between natural and violent motion and also of explaining more satisfactorily than did Aristotle the observed phenomena of nature. The theory of impetus is a development within Aristotelian physics; it is not a rejection of the principles of that physics, although it is a denial of a particular claim Aristotle makes.

To appreciate the real background to the principle of inertia we need to look to the development of the

---

more except by the method of general influence whereby He concurs as a co-agent in all things which take place… And these impetuses which He impressed in the celestial bodies were not decreased nor corrupted afterwards, because there was no inclination of the celestial bodies for other movements. Nor was there resistance which would be corruptive or repressive of that impetus. But this I do not sat assertively, but [rather tentatively] so that I might seek from the theological masters what they might teach me in these matters as to how these things take place." *ibid*., 536. Impetus was also used to explain accelerated natural motion: as the body falls it gains impetus from the motion which flows from its own natural heaviness.

[12] Anneliese Maier, *Die Impetustheorie*, in *Zwei Grundprobleme der scholastischen Naturphilosophie*, 3rd edition, *Studien zur Naturphilosophie der Spätscholastik*

application of mathematics to the study of motion: and especially at Oxford in the Fourteenth Century. In this respect we ought to mention Thomas Bradwardine (c. 1290-1349), Fellow of Merton College and later Archbishop of Canterbury. In his influential *Treatise on the Proportion of Velocities in Moving Bodies* (1328) he argued:

> Since every successive motion is commensurate to another with regard to velocity, natural philosophy, which studies motion, ought not to ignore the proportion of motions and velocities; and since an understanding of this is necessary and extremely difficult, and not discussed fully in any part of philosophy, we have accordingly composed the following work on the proportion of velocities in moving bodies.[13]

Bradwardine hoped to provide a mathematical law of dynamics valid for all changes in velocity.

Other scholars at Merton College — William Heytesbury, John Dumbleton, and Richard Swineshead — sought to treat variations in velocity in a way similar to variations in the intensity of a quality. Thus, the intensity of a velocity increased with speed just as the redness of an apple increased with ripening. The details of the

---

[13] Quoted in James Weisheipl, *The Development of Physical Theory in the Middle Ages*, (Ann Arbor: University of Michigan Press, 1971), 73-74. In his *Tractatus de Continuo* [q. 385], Bradwardine remarked: "It is [mathematics] which reveals every genuine truth, for it knows every hidden secret, and bears the key to every subtlety of letters; whoever, then, has the effrontery to study physics while neglecting mathematics, should know from the start that he will never make his entry through the portals of wisdom." Quoted in Weisheipl, 73. For analyses of theories of motion in the fourteenth century, see John E. Murdoch and Edith D. Sylla, "The Science of Motion," in *Science in the Middle Ages*, edited by David Lindberg, 206-264, and Edward Grant, *The Foundations of Modern Science in the Middle Ages* (Cambridge University Press, 1996), chapters 4-6.

contributions of these *calculatores* to a mathematical account of motion — and the relationship between this account of motion and that provided by Galileo — can be found in standard texts on medieval science. Once motion is treated as a velocity, a ratio of distance to time, then motion can be seen as analogous to a quality inhering in an object. And the quantification of such a quality (what was called the intension and remission of forms) seemed to be an important part of the understanding of motion.

The importance of the work of Bradwardine and others at Merton College was that it was the beginning of a new mathematical approach to nature. Bradwardine's conceptions reach their fruition in the work of another more famous Englishman, Isaac Newton, the title of whose major work is *Philosophiæ Naturalis Principia Mathematica* [Mathematical Principles of Natural Philosophy]. But this mathematical approach to the study of nature is not so much a challenge to Aristotle's physics as it is a development in a different science, a mathematical physics, with its own proper first principles. The Scientific Revolution, especially the work of Galileo and Newton, represents a flowering of this mathematical physics — and its first principle is the principle of inertia. My larger point here is that the principle of inertia does not contradict Aristotle's principle, that everything that is moved is moved by another; rather the principle of inertia is a first principle of a different science, a science that considers nature in terms of certain mathematical principles.[14]

[14] See my "Creation and Inertia: The Scientific Revolution and Discourse on Science-and-Religion," in *Science and Faith Within*

Regardless of how we come to understand specific developments in physics in the 14th Century, especially the theory of impetus, Duhem's emphasis on the action of the Bishop of Paris invites reflection on how we should understand the historical relationship among the sciences, the philosophy of nature, metaphysics, and theology.

The Condemnations of 1277

The 1277 Condemnations were the most important of a series of reactions at Paris throughout the 13th Century to what were perceived by conservative theologians to be the threat of Aristotelian thought to Christian truth. Aristotle claimed that the world is eternal, and argued, so it seemed, against the immortality of the soul. Furthermore, his insistence that science discovers necessary connections between causes and their effects involved a necessity in nature that seemed to be a denial of God's freedom to create (and to make changes in) whatever kind of universe God wished. The Islamic world had already experienced a similar debate, and some Muslim theologians had also urged the proscription of the texts of Aristotle.

Despite various efforts to keep Aristotle out of the curriculum of the University of Paris, by the middle of the 13th century his texts had come to play an important role not only in the Faculty of Arts, but also in the Faculty of Theology. Along with the works of Aristotle that entered the Latin West in the 12th and 13th Centuries, came

---

Reason, edited by James Navarro (Farnham, UK: Ashgate, 2011), 63-81.

important commentaries, especially those of the Muslim philosopher, Averroes.

Already in 1210, a council of bishops meeting in Paris (presided over by the Archbishop of Sens, Peter of Corbeil) ruled against teaching in Paris, whether in public or privately, Aristotle's books of natural philosophy, as well as related commentaries. In 1215 the papal legate, Cardinal Robert of Courçon, whom Pope Innocent III had charged with reorganizing the academic curriculum in Paris, reiterated the anti-Aristotelian measures of 1210 and included Aristotle's *Metaphysics* along with his natural philosophical texts. In 1231 Pope Gregory IX issued a kind of basic charter for the university in which he preserved the ban on Aristotle's texts, but he mitigated it considerably by explaining that it would only last for the period during which the contentious writings were examined in order to purge them of any errors discovered. Furthermore, for a period of seven years the pope abrogated the penalty of excommunication that threatened the professors who would have contravened the teaching prohibitions, and he granted the university masters the right to decide themselves on the content of their courses. In so doing, Gregory IX opened the doors to the works of Aristotle that had been previously prohibited. Iin his decree, Gregory noted that some of the prohibited books contained useful information and he ordered that the texts be carefully studied to purge them only of dangerous parts.

In 1255 the Faculty of Arts issued statutes stipulating an obligatory program of studies in which the whole of Aristotle's translated works were included, as well as apocryphal works, such as the *Book of Causes*, which was an adaptation of Proclus' *Elements of Theology* (composed

in Baghdad in the 9th Century).[15] The debate about the teaching of these texts was not over. Between 1267 and 1273, Bonaventure, the famous Franciscan master in the Faculty of Theology, warned his contemporaries of the danger that certain of Aristotle's doctrines represented for the faith and of the peril that a pagan philosophy pursued for its own sake posed for human redemption. In many ways Bonaventure's thought was an inspiration for the theologians who aided Bishop Tempier in his condemnations. For example in his *Collationes in Hexaemeron* of 1273, Bonaventure noted a three-fold error in Aristotelian thought: an ignorance of God as exemplar cause of all things (exemplareity), an ignorance of divine providence, and an ignorance of the *ordonnancement* of the universe, from which, according to him there arose a three-fold blindness: claiming that the world is eternal, affirming a–single intellect for all human beings, and denying the possibility of eternal punishment.[16] Bonaventure was particularly concerned with the doctrine of the eternity of the world, and with it Aristotle's conception of time and nature, views that Bonaventure thought resulted in the perversion of all of Holy Scripture and denying that the Son of God became incarnate: "pervertere totam sacram Scripturam et dicere quod Filius Dei non sit incarnatus."[17]

---

[15] The Statutes of 1255 for the Arts Faculty required that all the known works of Aristotle be read. See H. Denifle and A. Chatelaine, *Chartularium Universitatis Parisiensis*, vol. 1, pp. 277-279, n. 246.

[16] David Piché, *La condemnation parisienne de 1277* (Paris: J. Vrin, 1999), 162, n. 1.

[17] *Collationes*, vol. 5, 514.

The debate about the eternity of the world, and the rejection of Aristotle's claims on this question, is a good example of a topic that developed well before the Condemnations of 1277.

A more positive reaction to Aristotelian thought is found in the work of Dominicans like Albert the Great and Thomas Aquinas who sought to discover a complementarity between features of Greek thought and Christian theology. Their analysis, however significant, remained a minority position in Paris in the 13th Century.

In December 1270 the Bishop of Paris condemned thirteen propositions and excommunicated all who chose to defend them. They included the views that the intellect for all human beings is numerically one and the same; that the world is eternal; and that there never was a first human being.

In January 1277, Pope John XXI wrote to Bishop Tempier asking him to inquire about dangerous doctrines that continued to circulate at the University of Paris. Tempier formed a commission of sixteen theologians, the most famous of whom was Henry of Ghent, and had a list of 219 propositions drawn up. On his own, without replying to the Pope, Bishop Tempier formally condemned them all on 7 March 1277. As one scholar observes, "it seems clear that the condemnation of 1277 marked the triumph within the Theology Faculty of a highly conservative group of theologians who were uncomfortable with many of the new developments in philosophy and theology and who were only too ready to recommend them

to Tempier for condemnation."[18] The scope of the condemnations was broad and the relation to natural philosophy is clear.

Bishop Tempier explained his concerns in the prologue to the Condemnations. Certain scholars in the Faculty of Arts of the University of Paris:

> are exceeding the boundaries of their own faculty [*limites facultatis excedentes*] and are presuming to treat and discuss, as though they were debatable in the schools [*quasi dubitabiles in scolis tractare et disputare presumunt*], certain obvious and loathsome errors… that are contained in the roll joined to this letter… [I]n support of the aforesaid errors they adduce pagan writings that… they assert to be so convincing that they do not know how to answer them. So as not to appear to be asserting what they insinuate, however, they conceal their answers in such a way that, while wishing to avoid Scylla, they fall into Charybdis. For they say that these things are true according to philosophy but not according to the Catholic faith, as though there were two contrary truths and as though the truth of Sacred Scripture were contradicted by the truth in the sayings of the accursed pagans… Lest, therefore, this unguarded speech lead simple people into error, we, having taken counsel with the doctors of Sacred Scripture, and other prudent men, strictly forbid these and like things and totally condemn them. We excommunicate all those who shall have taught the said errors or any one of them, or shall have dared in any way to defend or uphold them, or even to listen to them, unless they choose to reveal themselves to us or to the chancery of Paris within seven days, in addition to which we shall proceed against them by inflicting such other penalties as the law requires according to the nature of the offense..

Tempier forbade scholars in the Faculty of Arts from affirming as true a wide variety of propositions about nature, human nature, and God. Topics of the condemned propositions included: the eternity of the world, the nature and function of angels, the nature of the heavens, whether

[18] John Wippel, "Thomas Aquinas and the Condemnation of 1277," *The Modern Schoolman* 72 (1995), 239.

there is a single active intellect for all human beings, the extent of God's power, and, in general, what can be known with certainty on the basis of reason and science alone.

The tension between certain elements in the Faculty of Arts and theologians can be seen in three propositions Bishop Tempier condemned: that theological discussions are based on fables; that nothing is known better because one knows theology; that the only wise men of the world are philosophers. The relationship between faith and reason, or, more particularly, between theology and philosophy, was at issue. Some members of at the arts faculty, notably Siger of Brabant (ca. 1240-1280) and Boethius of Dacia (ca. 1240-1284) have sometimes been cited as embracing the theory of the double truth, i.e., the view that the truths of faith and the truths of reason may at times be at odds with one another. Recently, scholars have come to recognize that the so-called theory of the double truth is not really accurate. Siger and Boethius think that when reason and faith disagree, faith must prevail they do not think that one should hold simultaneously two conflicting truths: one of faith, the other of reason.

Already in the prologue to the Condemnations Tempier mentions a doctrine of double truth when he denounces those who say that things are true according to philosophy, but not according to the Catholic faith; as though there could be two contrary truths. One proposition [90] condemned those who believed that "a natural philosopher ought to deny absolutely the newness [that is, the creation] of the world because he depends on natural causes and natural reasons. The faithful, however, can deny the eternity of the world because they depend upon supernatural causes." A related proposition [89] condemns

the view that it is "impossible to refute the arguments of the Philosopher concerning the eternity of the world."

> When arts masters yielded to the faith, however, they appeared to do so in a manner that left the theologians uneasy and suspicious. They implied, and often explicitly stated, that the truths of natural philosophy, based on the application of natural reason to *a priori* principles and sense experience, could not be reconciled with the truths of faith. Under such circumstances, the faith had to be upheld. But it was upheld ambiguously because the arts masters usually left the reasoned conclusions of natural philosophy intact, even as they proclaimed the corresponding truths of the faith." Thus, they would reject the arguments for the eternity of the world not because they were flawed but only because they were contrary to the faith. "It left the impression that there were two truths, one for natural philosophy, and one for the faith.[19]

Bishop Tempier and his supporters sought to affirm the primacy of revealed truth, expressed in theological discourse, over the claims of philosophy, especially the philosophy of Aristotle and his Muslim commentators. The relationship between faith and reason, or, more particularly, between theology and philosophy, was at issue. The Condemnations show the predominance of a theological view that is uncomfortable with many of the new intellectual currents associated with the reception of newly translated texts of Aristotelian philosophy.

Duhem thought that two condemned propositions in particular were of crucial importance for scientific developments in the 14th Century: that God could not produce a plurality of worlds[20], and that God could not move the entire universe in rectilinear motion, since this

[19] Edward Grant, *The Foundations of Modern Science in the Middle Ages* 76-7.

[20] Proposition 34: Quod prima causa non posset plures mundos facere.

would result in a void.[21] The first rejected the view that God cannot create more than one world; the second allowed for the development of new views concerning place and the void.

In exploring the consequences of these possibilities, concepts contrary to Aristotelian physics and cosmology were found plausible rather than impossible. Not only could God create other worlds, but each would be a closed system like ours with its own proper center and circumference. With the simultaneous existence of a plurality of centers and circumferences rendered hypothetically intelligible, Aristotle's argument for the necessary existence of a single center and circumference, on which he had founded his belief in a unique world, was plainly subverted.[22]

Aristotle might say that a vacuum is impossible and, hence, motion in a void is absurd, but proper attention to the possibilities that are reflected in God's omnipotence requires that one reject Aristotle's conclusion that motion in a void in impossible.

For Duhem, these two condemned propositions were the foundation of the "whole edifice of Aristotelian physics and their being declared anathema implicitly demanded the creation of a new physics that would be acceptable to Christian reason." [23] Although explaining projectile motion

---

[21] Proposition 49: Quod Deus non possit movere celum motu recto. Et ratio est, quia tunc relinqueret vacuum.

[22] Edward Grant, "The Effect of the Condemnation of 1277," in *The Cambridge History of Later Medieval Philosophy*, p. 538.

[23] *Le système du monde*, vol. 6, 66. See Murdoch, "The Science of

was not a consideration of any of the condemnations, Duhem emphasizes the rejection of what he calls the "whole edifice of Aristotelian physics," a purge that he thinks prepares the ground for Buridan and the theory of impetus.

Historians, philosophers, and theologians have written extensively about the Condemnations of Paris — both those in 1270 and the more famous ones of 1277 (as well as later ones at Oxford[24]) , and they have often addressed Duhem's claim that they are the source of modern science.[25]

Motion," 261. "It is worth noting. . . that among all of the issues in fourteenth-century science Duhem was able to relate, often with some straining, to the condemnations of 1277… not once was he able, save perhaps by very general association, to draw the terribly important new ideas concerning projectile motion and acceleration in free fall into the net. They remained impervious to 1277 and so, therefore, did two of the most essential elements that, in his view, made the fourteenth century such an important harbinger of the Scientific Revolution of the seventeenth century." Murdoch, 262.

[24] Condemned, eleven days later, by Archbishop Robert Kilwardby.

[25] The literature on this subject is vast. The most extensive work is that of Roland Hissette, *Enquête sur les 219 articles condamnés à Paris le 7 mars 1277* (Louvain: Publications universitaires; Paris: Vander-Oyez, 1977); "Étienne Tempier et ses condamnations," *Recherches de théologie ancienne et médiévale* 47 (1980), 231-270; "Albert le Grand et Thomas d"Aquin dans la censure parisienne du 7 mars 1277," *Studien zur Mittelalterlichen Geistesgeschichte und Ihren Quellen*, edited by Albert Zimmermann (Berlin: Walter de Gruyer, 1982), 226-246; "Saint Thomas et l'intervention episcopal du 7 mars 1277," *Studi* 2 (1995), 204-258; "L'implication de Thomas Aquin dans les censures parisiennes de 1277," *Recherches de Théologie et Philosophie Médiévales* 44 (1997), 3-31; "Philosophie et théologie en conflit: Saint Thomnas a-t-il été condamné par les maitres parisiens en 1277?" *Revue Théologique de Louvain* 28 (1997), 216-226; "Thomas d'Aquin directement visé par la censure du 7 mars 1277? Réponse à John F. Wippel." In *Mélanges offerts au Père L.E. Boyle à l'occasion de son*

75e anniversaire, vol. 1 (edited by J. Hamese, 425-37 (Louvain: FIDEM, 1998). David Piché, *La condemnation parisienne de 1277: Nouvelle édition du texte latin, traduction, introduction et commentaire* (Paris: J. Vrin, 1999); David Piché, "Parisian Condemnation of 1277," in H. Lagerlund (ed.), *Encyclopedia of Medieval Philosophy*. (Springer, 2011) pp. 910-917. Luca Bianchi, *Il Vescovo e i Filosofi. La condanna Parigiana del 1277 e l'evoluzione dell'Aristotelismo scolastico* (Bergamo: Pierluigi Lubrina Editore, 1990); Luca Bianchi, *L'errore di Aristotele: La polemica contro l'eternità del mondo nel XIII secolo* (Firenze: La Nuova Italia Editrice, 1984); Luca Bianchi, "1277: A Turning Point in Medieval Philosophy," in Jan Aersten and Andreas Speer (eds.), *Was is Philosophie im Mittelalter?* (Berlin: De Gruyter, 1998), 90-110; Luca Bianchi, *Censure et liberté intellectuelle à l'université de Paris (XIII-XIVe siècles)* (Paris: Belles Letres, 1999); Luca Bianchi, "New Perspectives on the Condemnation of 1277 and its Aftermath," *Recherches de théologie et philosophie médiévales* 70, n. 1 (2003), 206-229. Kent Emery and Andreas Speer, " After the Condemnation of 1277: New Evidence, New Perspectives, and Grounds for New Interpretations," *Nach der Verurteilung von 1277. Philosophie und Theologie an der Universität von Paris im letzten Viertel des 13. Jahrhunderts*, Miscellanea Mediaevalia 28 (Berlin/New York: Walter de Gruyter, 2001), pp. 1-19; M.M.H. Thijssen,"1277 Revisited: A New Interpretation of the Doctrinal Investigation of Thomas Aquinas and Giles of Rome," *Vivarium* 35 (1997), 72-101; *Censure and Heresy at the University of Paris 1200-1400* (Philadelphia: University of Pennsylvania Press, 1998). John F. Wippel, "The Condemnations of 1270 and 1277 at Paris," *Journal of Medieval and Renaissance Studies* 7 (1977), pp. 169-201; "Thomas Aquinas and the Condemnation of 1277," *The Modern Schoolman* 72 (1995), pp. 233-275; John F. Wippel, "Bishop Stephen Tempier and Thomas Aquinas: A Separate Process Against Aquinas?" *Freiburger Zeitschrift für Philosophie und Theologie* 44 (1997), 117-136; John F. Wippel, "David Piché on the Condemnation of 1277: A Critical Study," *American Catholic Philosophical Quarterly* 75, n. 4 (Fall 2001), 597-624; John F. Wippel, "The Parisian Condemnations of 1270 and 1277," in *A Companion to Philosophy in the Middle Ages*, edited by Jorge J. E. Garcia and Timothy B. Noone (Oxford: Blackwell, 2003), 65-73.

Today medieval intellectual historians, as well as historians of science, find the *specific* claims which Duhem makes about the relationship between the condemning of particular theses and the rise of modern science to be suspect.

Divine Omnipotence and Science

One of the 219 propositions, namely the 147th, reveals a principle that informs many of the condemnations of specific claims in the philosophy of nature. Condemned is the view "that the absolutely impossible cannot be done by God or another agent . . . . If impossible is understood according to nature."[26] The conclusion of this proposition,

---

Edward Grant, "The Effect of the Condemnation of 1277", *The Cambridge History of Later Medieval Philosophy*, edited by Norman Kretzmann, Anthony Kenny, and Jan Pinborg (Cambridge University Press, 1982), 537-539; Kurt Flasch, *Aufklärung im Mittelalter? Die Verurteilung von 1277. Das Dokument des Bischofs von Paris übersetzt und erklärt*. (Mainz: Dieterich, 1989); Alain de Libera, "Philosophie et censure: Remarques sur la crise universitaire parisienne de 1270-1277," in Jan Aersten and Andreas Speer (eds.), *Was is Philosophie im Mittelalter?* (Berlin: De Gruyter, 1998), pp.71-89. Dragos Calma, "Du bon usage des grecs et des arabes. Réflexions sur la censure de 1277," in Luca Bianchi (ed.), *Christian Readings of Aristotle from the Middle Ages to the Renaissance* (Studia Aristarum 29; Turbnhout, 2011), 115-184; Sara L. Uckelman, "Logic and the Condemnations of 1277," *Journal of the Philosophy of Logic* 39 (2010), pp. 201-227; Alexander Jensen, "The unintended consequences of the condemnation of 1277: divine power and the established order in question," *Colloquium* 41:1 (2009), 57-72.

[26] Quod impossibile simpliciter non potest fieri a Deo, vel a agente alio. Error, si de impossibili secundum naturam intelligatur. See also, propositions 21, 34, 35, 48, 49, 139, 140, and 141, described in Grant, *The Foundations of Modern Science. . .*, 78-79.

and others like it, that emphasized God's absolute power, have led some to argue that even if we reject the specific claims of Duhem about the way in which the condemnations are important for the emergence of modern science, the emphasis on God's absolute power:

> encouraged speculation about natural impossibilities in the Aristotelian world system which were often treated as hypothetical possibilities. The supernaturally generated alternatives, which medieval natural philosophers considered in the wake of the condemnation, accustomed them to consider possibilities that were beyond the scope of Aristotle's natural philosophy, and often in direct conflict with it. [27]

This broad claim about the significance of the Condemnations finds support in the work of the German philosopher and intellectual historian Hans Blumenberg, who argues that the affirmation of God's absolute power marks "the exact point in time when the interest in rationality and human intelligibility of creation cedes priority to the speculative fascination exerted by the theological predicates of absolute power and freedom."[28]

One of the dangers, however, in invoking the absolute power of God in an approach to nature is the emphasis on reasoning *secundum imaginationem:* that is, a tendency to consider all *possible*, all *conceivable*, cases or examples within a problem under investigation without any notable

---

[27] Grant, *The Foundations*…, 81-2.

[28] Blumenberg, *The Legitimacy of the Modern* Age, trans. by Robert Wallace (Cambridge, MA: MIT Press, 1983), 160. Grant McColley remarks: "There occurred in 1277 one of the most interesting events recorded in history . . . the power of God definitely overshadows the physics of Aristotle." McColley, "The Seventeenth Century Doctrine of the Plurality of Worlds," *Annals of Science* 1 (1936), 399.

consideration of what cases might obtain in fact. One might well end up with a natural philosophy or science of nature without nature.

Discussions of God's absolute power — as distinct from his ordinary power, that is, the power by which He does what He does, as distinct from what, *absolutely* speaking, He could do — such discussions played an important part in the philosophical movement known as Nominalism. However, the more one emphasizes the world simply as the product of God's will, the more one risks the danger of denying an inherent intelligibility in nature — an intelligibility discoverable by human reason. Thus, an emphasis on sheer possibilities — on imagining what could be possible, given the fact that God is omnipotent — may well lead to the questioning of certain claims in Aristotelian natural philosophy, and this questioning can and did result in fruitful new examinations of nature. Still, we need to distinguish between specific claims about the world that Aristotle made and the general principles of his philosophy of nature concerning topics such as the nature of change and time.

It is easy to see how an emphasis on God's absolute power can result in the denial not only of an appropriate autonomy to the created order, but also in a denial of an inherent intelligibility of that order. This alleged opposition led Averroes, for example, to deny the doctrine of creation out-of-nothing in order to protect the existence of real causes in nature (and hence the possibility of a science of nature) and led Muslim kalam theologians to deny real causes in nature in order to protect divine omnipotence.

Nicole Oresme (ca. 1320-1382), an important theologian and philosopher of the Fourteenth Century, who argued for

the hypothetical consideration of the diurnal motion of the earth,[29] also thought that only faith can provide genuine truth about the world.[30] William of Ockham (ca. 1285-1349) concluded that, given God's omnipotence, "neither reason nor experience could provide certain knowledge of any necessary connection between causes and their alleged effects."[31] Not all Fourteenth Century thinkers, however, were willing to abandon necessary knowledge of nature in

---

[29] His argument comes in his analysis of the story in the Book of Joshua of Joshua's calling upon God to have the sun stand still. "When God performs a miracle we must understand and maintain that He does so without altering the common course of nature, in so far as possible. Therefore, if we can save the appearances by taking for granted that God lengthened the day in Joshua's time by stopping the movement of the earth or merely of that region here below — which is so very small and like a mere dot compared to the heavens — and by maintaining that nothing in the whole universe — and especially the huge heavenly bodies — except this little point was put off its ordinary course and regular schedule, then this would be a much more reasonable assumption." *Le livre du ciel et du monde*, ed. Albert D. Menut and Alexander J. Denomy, C.S.B., trans. Albert D. Menut (Madison, WI: University of Wisconsin Press, 1968), 537; [found in M. Clagett and E. Grant (ed.), *A Source Book in Medieval Science* Cambridge, MA: Harvard University Press, 1974), 507]. Oresme recognized that the surface meaning of the Bible seemed to say the opposite, but sometimes the text of scripture conforms "to the customary usage of popular speech just as it [i.e., Holy Scripture] does in many other places, for instance, in those where it is written that God repented, and He became angry and became pacified, and other such expressions which are not to be taken literally." *Le livre. . ..*, 531

[30] Edward Grant, "Science and Theology in the Middle Ages," in David C. Lindberg and Ronald L. Numbers (eds.), *God and Nature: Historical Essays on the Encounter Between Christianity and Science* (Berkeley: University of California Press, 1986), 58.

[31] *ibid.*, 59

the face of the affirmation of divine omnipotence. Indeed, Buridan distinguished between different senses of necessity and argued that the science of nature demonstrates on the basis of "suppositional necessity," as it reasons from effect to cause. In his commentary on Aristotle's *Metaphysics*, Buridan asks the question: whether it is possible for us to comprehend the truth concerning [contingent] things? He remarks:

> It follows as a corollary that some people do great harm when they attempt to destroy the natural and moral sciences because of the fact the in many of their principles and conclusions there is no evidence *simpliciter*, and so they can be falsified through cases that are supernaturally possible; for evidence *simpliciter* is not required for such sciences, since it suffices for them that they have evidence *secundum quid* or *ex suppositione*. Thus Aristotle speaks well in the second [book] when he says that mathematical certitude is not to be sought in every science. And since it is now apparent that firmness of truth and firmness of assent are possible for us in all the aforementioned modes, we can conclude with regard to our question that the comprehension of truth with certitude is possible for us. [Buridan, *In Metaph.* II, q. 1]

It was one of the great accomplishments of Thomas Aquinas to balance the claims of divine omnipotence, evident for example in the doctrine of creation out-of-nothing, with the existence of real causes in nature that manifest an integrity and relative autonomy of creatures. How Thomas navigates what to many of his colleagues is an either/or proposition is another story. His views were seen by many of his contemporaries to be too radical a departure from orthodox Catholic theology. But the emphasis on God's absolute power by thinkers in the 14th and 15th Centuries did lead some theologians to skepticism with respect to the possibility of scientific knowledge, especially of the knowledge of necessary connections between causes and effects. At the very least, one had to subordinate all human knowing to God's will.

Hans Blumenberg pointed out that the theological view that celebrates God's absolute power prepared the way for its replacement by a radical conception of human autonomy that celebrates man's absolute power. In the 18th Century Leibniz argued that there really is no difference between a world founded exclusively on God's absolute will and one founded on chance: voluntarism and atomism go hand in hand! As Leibniz put it: "Will without reason would be the chance of the Epicureans."[32]

Creation out-of-nothing and science

The doctrine of creation out-nothing is an obvious example of divine omnipotence and there are many scholars who emphasize the importance of this doctrine in accounting for the rise of science in Western culture. The affirmation of the radical contingency of the world, that is, its being created, seems to stand out in stark contrast with the Aristotelian view of an eternal cosmos. An eternal universe seemed to be a necessary universe, contrary to a universe created by the free act of God. One representative of this view is the late Professor T.F. Torrance. He argued that the rationality essential to modern science is "a contingent rationality," unlike the abstract rational formalism of Greek thought.[33] Torrance's views have been

[32] Leibniz's "Fourth Paper," n. 18, in A *Collection of Papers, Which passed between the late Learned Mr. Leibniz, and Dr. Clarke, In the Years 1715 and 1716*, Samuel Clarke (ed.) (London: 1717) Published online: October 2006 (Oxford University).

[33] T.F. Torrance, *Divine and Contingent Order* (Oxford University Press, 1981), discussed in Colin E. Gunton, *The One, the Three, and the Many: God, Creation, and the Culture of Modernity* (Cambridge

especially influential among contemporary Protestant theologians as they reflect on the relationship between science and theology and see the Protestant Reformation as providing a crucial theological impetus for the rise of modern science. Torrance claimed that "Before it could begin its actual work, modern empirical science had to be liberated from the domination of medieval scholastic theology. This it owed above all to the great movement of thought at the Reformation." This liberation was necessary because, according to Torrance, medieval theology

> blurred the Biblical distinction between the Creator and the creature, and introduced into its doctrine of God an unfortunate ambiguity. What it implied was an eternal positing or even co-existence of creaturely being with God's eternal Being which made it difficult to deny the eternity of the world, even if it could not be affirmed, or at least not to be convinced of the ultimate changelessness of nature, i.e., of all that is not God… So long as this view of the natural world and its changeless and timeless bond to the divine mind prevailed, the rise of empirical science was severely handicapped… The questions which medieval thinkers asked were so philosophically controlled from behind that they were not properly free and open, nor were they put in the mode and idiom of a rationality that was congruent with real contingency. They were governed by a fixed notion of nature and were therefore of little use in opening up nature, for they excluded from consideration the kind of contingency and the kind of order upon which empirical science is based. [34]

Torrance's analysis takes us in a different direction from that of Duhem and Jaki, but it does show us another interpretative strategy that seeks to link the origin of science

---

University Press, 1993), 85. The seminal articles in this discourse is: Michael Foster, "The Christian Doctrine of Creation and the Rise of Modern Natural Science," *Mind* 43 (1934), 446-468; and "Christian Theology and Modern Science of Nature," *Mind* 44 (1935), 439-466.

[34] Torrance, *Divine and Contingent Order* 60, 62.

to Christian theology, in this case the theology of the Reformation. Torrance does agree with Jaki that Greek science had to be abandoned in order for modern science to begin, but he thinks that mediaeval scholastic thought was too dependent on Greek philosophy to provide the necessary intellectual context for modern science.

Contrary to the views of Torrance, at least in the case of Albert the Great and Thomas Aquinas, some Christian theologians in the Middle Ages nurtured the scientific tradition inherited from Aristotle and contributed to it, as some Muslim and Jewish thinkers had done before them. Christianity does not so much serve as the source for modern science as it reinforces an existing tradition. In some ways the Condemnations of Paris of 1277 are at odds with Christianity's positive effect on the development of science. In particular, as I have suggested, the emphasis on God's absolute power, so much in the forefront of the Condemnations, is dangerous to science.

Conclusion

It seems to me that the Condemnations of Paris of 1277 -- especially the emphasis on the absolute power of God -- provide not so much an occasion for the rise of modern science, as Duhem thought, as they encourage a view of God, human nature, and nature, that is finally an obstacle that must be overcome if the natural sciences are to continue to flourish.

Christianity is certainly not a barrier to the origin and growth of science, but nor is it a *necessary* prerequisite. Many scientists from the early stages of the Christian era until the present day have been motivated to explore nature because they thought such an exploration was an eminently

Christian calling. Nature, after all, contains the "footsteps of God." Rather than emphasizing diviner omnipotence in understanding nature, we would be better served by following the admonition of Albert the Great (1200-1280).

> In the natural sciences we do not investigate how God the Creator operates according to His free will and uses miracles to show His power, but rather what may happen in natural things on the ground of the causes inherent in nature. [*In I De caelo et mundo*, tr 4, c 10]

The natural world operates according to principles inherent in it, principles that ultimately depend upon God for their existence, but principles and causes that have a reality and an efficacy that can be studied independently of theological and religious convictions. The Condemnations of Paris fail to make such a distinction.

Scientists in the Middle Ages of the calibre of Albert the Great, carried on their investigations in the context of philosophical and theological commitments. Many scientists were also theologians and priests, teaching in the newly created universities: institutions that were supported and protected by popes. These scholars – although challenged by some of their contemporaries who defended a kind of theological absolutism -- were metaphysical realists, that is, they held that truth is not simply a human construction but is grounded in a reality independent of the human mind. Their faith in God as creator, sustainer, and redeemer of the universe helped them to recognize that all things that populate the universe have specific natures and functions. Natural objects, including human beings, are what they are and function as they do because God made them that way. Faith and reason, theology and philosophy, disclose a universe that is intelligible. An adequate understanding of reality requires both faith and reason.

The rediscovery of medieval science, that Duhem championed, enables us to recover something that has been lost, or at least seriously under-valued, for quite some time. For the real revolution in the 17th century was a philosophical one that enshrined the view that modern science was born by rejecting the Aristotelian science of mediaeval thinkers such as Albert and Thomas Aquinas. Accordingly, the integration of faith and reason, divine revelation and human science, that informed the thought of Albert, Thomas, and many others – this integration was replaced by a tendency toward fideism: a separation of religion, seen as a non-rational, private affair, from science, seen as a rational and public enterprise.

Pierre Duhem was wrong in locating a scientific revolution in the 13th and 14th Centuries, but his discoveries of a rich heritage of medieval science invites us to look again at the integration of faith and reason, of the fruitful synthesis of science, philosophy, and theology which was characteristic of medieval culture.