The Journal of Medieval and Renaissance Studies

Volume 17

Durham, North Carolina
Duke University Press
1987

Medieval and Renaissance scholastic conceptions of the influence of the celestial region on the terrestrial

EDWARD GRANT, *Indiana University*

Among the numerous disputes and controversies in medieval cosmology and physics, certain principles and 'laws' were accepted as virtually self-evident. One of these assumed that celestial bodies exerted a vital and even controlling influence over material things in the terrestrial region, which included everything below the concave surface of the innermost lunar sphere. Here was the ultimate foundation of astrological belief and the source of many explanations for the behavior of terrestrial bodies. The sources for this pervasive and ubiquitous medieval principle of the celestial dominance over terrestrial matter were undoubtedly Aristotle and Ptolemy, although a variety of other authors—Latin, Greek, and Arabic—had reinforced that belief in a number of physical and astrological works that were available in western Europe by the end of the twelfth century.

The Theoretical Basis for Belief in Celestial Causes of Terrestrial Change

It was Aristotle above all others who provided the intellectual basis for the conviction that the heavenly region excelled over the terrestrial. In a series of arguments in *De caelo* (*On the Heavens*),[1] Aristotle contrasted the natural, uniform, and eternal circular motions of the heavenly bodies with the natural, non-uniform, and finite, rectilinear motions of the four elementary terrestrial bodies and concluded that each type of motion must be associated with radically different kinds of simple bodies. Because they described uniform circular motions that had neither beginning nor end, the celestial bodies were held to be eternal and incorruptible. By contrast, all terrestrial bodies suffered incessant generation and corruption. Based on his conviction that the celes-

Journal of Medieval and Renaissance Studies 17:1, Spring 1987. CCC 0047-2573/87/$1.50

1. Bk. 1, chs. 2, 3.

tial substance was incorruptible, Aristotle conceived it as a divine ether and declared its divinity in a number of places.[2] It seemed appropriate that the incorruptible, divine, celestial substance should exercise an influence over the behavior of the corruptible and ever-changing sublunar bodies. Here was the basis for a hierarchically ordered cosmos associated with the motions of celestial and terrestrial bodies.

Using Aristotle's basic cosmology of four sublunar elements and a fifth, radically different celestial element, or ether, Claudius Ptolemy (fl. 2d c. AD), in his *Tetrabiblos* (or *Quadripartitum*, as it was known during the Latin Middle Ages), assumed that

> a certain power emanating from the eternal ethereal substance is dispersed through and permeates the whole region of the earth, which throughout is subject to change, since, of the primary sublunar elements, fire and air are encompassed and changed by the motions in the ether, and in turn encompass and change all else, earth and water and the plants and animals therein.[3]

That such a power actually emanated from the heavens and affected the earth was made virtually self-evident to Ptolemy and almost everyone else by the behavior of sun and moon.[4] By analogy with and extrapolation from these two most prominent celestial luminaries, the other planets and stars were also assumed to produce a never-ending succession of terrestrial effects. Because celestial bodies possessed different powers and had different positions, their effects also varied. Depending on a complex set of relationships, planets and stars could cause either beneficial or harmful effects. By a judicious combination of observation and theory, it was even possible to know when and where these effects would occur.[5] Thus did Ptolemy transform Aristotle's vaguely described celestial influences, focused, as we shall see, largely on the sun, into a solid foundation for judicial and horoscopic astrology.

The ideas of Aristotle and Ptolemy concerning the role of celestial

2. *De caelo* 1.3.270b.1–14; *Metaphysics* 1074b.1–14; *De partibus animalium* 1.5.644b.23–26; *Nicomachean Ethics* 6.7.1141b.1–2; and *De mundo* 2.392a.8–9. Although the last-named treatise was not by Aristotle, it was always so regarded in the Middle Ages. See also Friedrich Solmsen, *Aristotle's System of the Physical World: A Comparison with His Predecessors* (Ithaca, N. Y., 1960), 289–90.

3. Ptolemy, *Tetrabiblos*, ed. and trans. F. E. Robbins. Loeb Classical Library. (Cambridge, Mass., 1948), bk. 1, ch. 2, pp. 5–7. For a brief summary of its content, see Lynn Thorndike, *A History of Magic and Experimental Science*, 8 vols. (New York, 1923–1958), 1:110–16.

4. For a list of effects caused by sun and moon, see *Tetrabiblos*, 7.

5. See ibid. 11–13.

influences on terrestrial affairs had an enormous impact. Because Aristotle's works formed the core of the university curriculum during the Middle Ages, his ideas on celestial influences were frequently discussed in commentaries on his works, in commentaries on the *Sentences* of Peter Lombard, or in the form of separate questions in treatises titled *De materia celi.* Rarely did scholastics devote a distinct, separate treatise to the subject. An exception was Thomas Aquinas, who, in response to a question from a soldier, sought to explain the manner in which the celestial region influenced terrestrial bodies.[6]

Thomas begins his analysis with the elements. Many actions of an element are caused directly by the nature of the element itself. "A stone, for example, is moved towards the center [of the earth] according to the property of earth dominant in it. Metals also have the power of cooling according to the property of water."[7] But the manifold activities of a body do not always follow from the nature of its primary constitutent element, as, for example, in the case of the magnet's attraction for iron and the ability of certain medicines to purge humors. Such actions constituted occult phenomena and their causes had to be sought in the behavior of superior agents, of which two major kinds are distinguishable: (i) the heavenly bodies and (ii) separate(d), or spiritual, substances, a category that embraced angels, demons, and celestial intelligences.[8]

A superior agent can act on an inferior body in one of two ways: it can either impart some power or form to the inferior body that en-

6. *The Letter of Saint Thomas Aquinas 'De occultis operibus naturae ad quemdam militem ultramontanum"* by Joseph B. McAllister (Ph.D. diss., Catholic University, 1939). *Catholic University of America Philosophical Studies*, vol. 42. McAllister omits the Latin text but gives an English translation from vol. 24 of the Vivès edition of Aquinas's *Opera omnia* (1871–1880); for a later edition, see *Sancti Thomae de Aquino Opera Omnia iussu Leonis XIII P.M. edita*, vol. 43 (Rome, 1976), 183–86. The letter was probably written sometime between 1269 and 1272 (ibid. 15) and, since Thomas died in 1274, reflects his mature thoughts on this important subject. The authenticity of the treatise has never been challenged.

7. Ibid. 20. The translation extends over pages 20 to 30.

8. Ibid. 21, 79–80. For Thomas, God is the creator of all separated, or separate, substances. Whether Thomas also included God, who is, of course, a spiritual substance, as a member of the class of separate substances is not relevant to our purposes. However, in his *Tractatus de substantiis separatis*, Thomas seems clearly to imply that God is among the separate substances when he includes a chapter "On the error of those who say that God and the Angels do not have a knowledge of singulars." See *Saint Thomas Aquinas on Separate Substances*, a Latin-English edition of a newly established text based on 12 mediaeval manuscripts, with introduction and notes, edited by Rev. Francis J. Lescoe (West Hartford, Conn., 1963), 108. The editor judges the treatise to be between 1270 and 1272 (see pp. 3–6), placing it very near the end of Thomas's life.

ables the latter to perform some action; or it imparts no form or power, but by its own motion causes the inferior body to move just "as a carpenter uses a saw for cutting." As illustrations of the second type of occult phenomena, Thomas mentions the power of the moon to cause the ebb and flow of the tides, which it accomplishes by its own movements that somehow physically agitate the water. Separated substances achieve similar effects by curing sick people through contact with a saint's relics. Here again, no form is implanted in the relics, but the divine power nevertheless uses them to perform the miraculous cures.[9]

Species of bodies or objects that have had forms implanted in them by a superior agent act in a constant manner. Thus *every* magnet attracts iron, and rhubarb *always* purges a certain humor. By contrast, species of inferor bodies in which forms or powers are not intrinsic act irregularly. In such instances, the superior agent chooses certain members of a species and confers the power on them alone. Thus "not every bone nor all relics of the saints heal upon touch, but those of some at some times . . . nor does all water ebb and flow according to the movement of the moon."[10]

But how are the two types of superior agents related? As was customary during the Middle Ages, Thomas assumed that separated substances were superior to corporeal celestial bodies. The former exist apart from matter and are unmoved, whereas the latter exert their power by their movements. Indeed the separated substances operate through celestial bodies to affect the inferior bodies of the terrestrial region.[11] Here then Thomas had the basis for a grand cosmic hierarchy. At the top are separated substances followed by the celestial bodies, which are controlled by the separated substances. The inferior bodies, in turn, are organized "in such a way . . . that some are less perfect and closer to matter, while others, however, are more perfect and closer to superior agents."[12] In this scheme, the forms of the elements were the most imperfect while bodies that approached greater uniformity of

9. Ibid. 22.
10. Ibid.
11. Ibid. 25. As John of Jandun put it in his *Questions on De caelo*: "The Commentator [Averroes] says in the first book [of this *De caelo*] that the heaven is the tie [or link] (*ligamentum*) between abstracted [that is, separated] substances and inferior things." *Ioannis de Ianduno in libros Aristotelis De coelo et mundo quae extant quaestiones subtilissimae quibus nuper consulto adiecimus; Averrois sermonem De substantia orbis cum eiusdem Ioannis Commentario ac Quaestionibus nuperrime in capita accurate divisum ac maxima diligentia recognitum* (Venice, 1552), fol. 2r, col. 2.
12. Ibid. 26.

composition "became in some way or other like to heavenly bodies.... And therefore the greater the uniformity of mixture which such bodies approach, so much the more noble a form do they receive from God. Such is the human body, which, enjoying a most uniform composition, as the excellence of touch in men indicates, has a most noble form, namely a rational soul."[13] Thomas's hierarchical order was arranged according to the nobility of specific forms, all of which (except, of course, the soul) derived from superior agents associated with the celestial region.

Hierarchy was thus the essential reason why celestial bodies and substances affected the behavior of terrestrial bodies. It was fit and proper that what is more noble and more perfect should influence and guide what is less noble and less perfect. With an occasional exception (for example, Roger Bacon), Saint Bonaventure spoke for virtually all scholastics of the Middle Ages when he declared:

> The reason why superior things act on inferior things... is because they are nobler bodies and excel in power, just as they excel with respect to location. And since the order of the universe (*ordo universitatis*) is that the more powerful and superior should influence the less powerful and inferior, it is appropriate for the order of the universe that the celestial luminaries should influence the elements and elementary bodies.[14]

When the creator of the world made the celestial bodies incorruptible, He ordained that they should rule over corruptible and inferior things and for the attainment of this goal assigned appropriate powers to each celestial luminary.

13. Ibid. Thomas placed inanimate bodies like stones, metals, and minerals above simple elemental bodies. The former not only have the powers of the elements, but also other virtues drived from specific forms that were imparted to them by superior agents.

14. Saint Bonaventure, *Commentaria in quatuor libros Sententiarum Magistri Petri Lombardi*, bk. 2, dist. 14, P. 2, art. 2, qu. 2 ("Utrum diversa luminaria diversas habeant impressiones super corporalia") in *Opera omnia* (Quaracchi: 1882–1901), vol. 2 (1885), p. 360, col. 2. For medieval views on celestial perfection, see Edward Grant, 'Celestial Perfection from the Middle Ages to the Late Seventeenth Century,' in *Religion, Science, and Worldview: Essays in Honor of Richard S. Westfall*, ed. Margaret J. Osler and Paul Lawrence Farber (Cambridge, 1985), 137–62. Because visual rays had to be multiplied or extended all the way to the celestial region for us to see celestial bodies, Roger Bacon was convinced that terrestrial influences could affect the celestial region. But he asserts that this does not detract from the nobility of the heavens. See David C. Lindberg (ed. and trans.), *Roger Bacon's Philosophy of Nature, A Critical Edition, with English Translation, Introduction, and Notes*, of *De multiplicatione specierum* and *De speculis comburentibus* (Oxford, 1983), 72–75 (text and translation), lxi–lxii (for Lindberg's description).

Empirical Basis for Belief in Celestial Actions on Inferior Things

Thus far we have emphasized metaphysical and even intuitive appeals and arguments in support of celestial causal superiority. But empirical evidence was also invoked. Indeed beginning with Aristotle there was a steady accumulation of experiences that were believed to demonstrate the reality of celestial causation in the terrestrial world. The radical contrast between celestial and terrestrial bodies, the former incorruptible and the latter continually undergoing change, was itself founded upon observation. "For in the whole range of times past, so far as our inherited records reach," declared Aristotle, "no change appears to have taken place either in the whole scheme of the outermost heaven or in any of its proper parts,"[15] a claim he supported by locating meteors, comets, shooting stars, and the milky way in the fiery sphere just below the moon.[16] By contrast, incessant changes in the sublunar region were readily observable,[17] a fact that confirmed the superiority of the celestial region over the terrestrial.

The most graphic evidence of specific celestial causation, however, was provided by the sun. Once again Aristotle would point the way. Numerous observations of the sun's annual motion in the ecliptic prompted him to declare that "The evidence of sense-perception clearly agrees with our views; for we see that coming-to-be occurs when the sun approaches, and passing-away when it withdraws."[18] The sun also produces the rains that make life on earth possible.[19] Indeed the sun's circular motion produces the cycle of the seasons and therefore the things associated with those seasons.[20] Aristotle also assigned a role to the sun in human generation when he declared that the sun and a man were required to produce a man.[21] Although the sun's actions on the earth were more noticeable than those of any other celestial body, Aristotle held that the totality of celestial motions was the ultimate source of change for terrestrial bodies.[22]

15. *De caelo* 1.3.270b.13–17.
16. See the first book of Aristotle's *Meteorologica*, esp. 1.1.338b.21–25, 1.3.341a.32–35; 1.4.342a.30–31; and 1.8.346b.10–15.
17. *De generatione et corruptione* 1.1.314b.13–15.
18. Ibid. 2.10.336b.16–19.
19. *Meteorologica* 2.2.354b.24–33 (Oxford translation by E. W. Webster).
20. *De generatione et corruptione* 2.11.338b.1–5.
21. See *Physics* 2.2.194b.13–14.
22. *Meteorologica* 1.2.339a.20–33.

During the period under investigation here, approximately 1200 to 1650, a considerable variety of other 'experiences' were offered as clear evidence that the heavens influenced the inferior region.[23] As the most obvious source of celestial influence, the sun and moon were most frequently cited. According to Emmanuel de Goes of the Coimbra Jesuits, the sun's motion was assumed to cause the four seasons of the year with two equinoxes and two solstices, thus producing coldness and hotness, which in turn made the generation and destruction of things possible.[24] Lesser activities of the sun were not ignored, as, for example, its power to cause heliotropism in flowers and to make the cock crow daily before sunrise.[25] In his *Questions on Aristotle's Meteorology*, Themon Judaeus, in the fourteenth century, cited a number of such experiences (*per experientias*).[26] After the sun has risen, its light causes heat and also

23. Although many scholastics provided lists of experiences, the examples presented here have been drawn from Themon Judaeus (fourteenth century), *Questions on the Meteors*; The Coimbra Jesuits (Conimbricenses; last decade of the sixteenth century), *De coelo*; Bartholomew Amicus, S.J. (1562–1649), *Commentary on De caelo*; and Georgius de Rhodes, S.J. (seventeenth century), *Philosophia peripatetica*. Full titles will be given below.

24. *Commentarii Collegii Conimbricensis Societatis Iesu in quatuor libros De coelo Aristotelis Stagiritae* (2d ed.; Lyon, 1598), bk. 2, ch. 3, qu. 1 ("Whether or not celestial bodies act on the sublunar world"), art. 2, p. 191. Although the Coimbra Jesuits published their Aristotelian commentaries under the collective title "Conimbricenses," the *De caelo* commentary was actually the work of Emmanuel de Goes, S.J. (1542–1597) and first appeared in 1592. Bartholomew Amicus also included this one in his lengthy list of experiences; see his *In Aristotelis libros De caelo et mundo dilucida textus explicatio et disputationes in quibus illustrium scholarium Averrois D. Thomae, Scoti, et nominalium sententiae expenduntur earumque tuendarum probabiliores modi afferuntur* (Naples, 1626), Tractatio sexta: De influxibus caelorum, qu. 1 ("An caeli influant in haec inferiora"), p. 348, col. 2. The section on the influences of the heavens on inferior things constitutes the longest tract in Amicus' extensive commentary on *De caelo*.

25. Ibid. The experience of heliotropism was included by Bartholomew Amicus, *De caelo*, p. 349, col. 2, while the cock-crowing example was repeated by Georgius de Rhodes, S.J., *Philosophia peripatetica ad veram Aristotelis mentem libris quatuor digesta et disputata Pharus ad theologiam scholasticam nunc primum in lucem prodit* (Lyon, 1671), p. 297, col. 1.

26. Themon's treatise appears in *Questiones et decisiones physicales insignium virorum: Alberti de Saxonia in octo libros Physicorum; tres libros De celo et mundo; duos lib. De generatione et corruptione; Thimonis in quatuor libros Meteororum; tres lib. De anima; Buridani in lib. De sensu et sensato; librum De memoria et reminiscentia; librum De sommo et vigilia; lib. De longitudine et brevitate vite; lib. De iuventute et senectute Aristotelis. Recognitae rursus et emendatae summa accuratione et iudicio Magistri Georgii Lokert Scotia quo sunt Tractatus proportionum additi* (Paris, 1518), fol. 155r, col. 2. Themon was at the University of Paris during the 1350s and perhaps 1360s. In a brief preface to the work just cited, George Lokert, its editor, ranked Themon, Albert of Saxony, and John Buridan as a famous triumvirate of eminent men at the celebrated school of Paris. The passage is quoted by Henri Hugonnard-Roche, *L'œuvre astronomique de Thémon Juif maître Parisien du XIVe siècle* (Geneva and Paris, 1973), 11.

causes seeds and fruits to grow; the setting of the sun at night causes the temperature to become colder; it also causes winds and rain.

The moon manifests its terrestrial influence by the well-known association of its motion with the tides. Indeed the association of the moon with liquid prompted Themon to mention that humors in animals increased when the moon waxed and decreased when it waned. Physicians regularly linked the moon's motion with the critical days of an illness, which suggested to Themon that "this could not occur unless the moon did act powerfully on these inferior things."[27]

But the sun and moon were only the most obvious celestial agents. All planets together were the cause of the great multiplicity of terrestrial activity. Toward the very end of the sixteenth century, the Coimbra Jesuits described numerous powerful correspondences that were assumed to obtain between the planets and terrestrial objects. The planets corresponded to the different parts of the human body: the sun to the heart; Mars to the gallbladder; Jupiter to the liver; Mercury to the mouth and tongue; Saturn to the head; and so on.[28] Also mentioned are the famous Shakespearean ages of man linked to the seven planets, a linkage that was probably already ancient when Ptolemy included them in his *Tetrabiblos*.[29] The moon corresponds to infancy; Mercury to boyhood; Venus to adolescence; the sun to youth; Mars to the virile age; Jupiter to old age; and Saturn to very old age or senility. Because gold cannot produce gold, nor a gem produce a gem, Georgius de Rhodes, in the seventeenth century, inferred that only the heavens could cause metals and gems.[30]

The origin of this and most similar beliefs was the ancient world, when some (though not Aristotle) already believed that every planet influenced a particular species of metal. The following correspondences, which de Rhodes and many others repeated, were already established: gold was related, or corresponded, to the sun; silver to the moon; iron and steel to Mars; lead to Saturn; tin to Jupiter; quicksilver to Mercury; copper or bronze to Venus.[31] Another famous correspon-

27. Themon Judaeus, ibid. See also Conimbricenses, *De coelo*, p. 191, Amicus, *De caelo*, p. 348, col. 2, and Georgius de Rhodes, *Philosophia peripatetica*, p. 297, col. 1, for virtually the same and similar examples of lunar efficacy.

28. Conimbricenses, *De coelo*, p. 191 and Amicus, *De caelo*, p. 349, col. 1.

29. See Robins, trans. *Tetrabiblos*, bk. 4, ch. 10, pp. 441–47. Earlier in the treatise, Ptolemy had proposed four ages of mankind (bk. 1, ch. 10, pp. 59–61).

30. De Rhodes, *Philosophia peripatetica*, p. 297, col. 1.

31. Ibid.; see also Themon Judaeus, *In quatuor libros Meteororum*, fol. 155r, col. 1 and Amicus, *De caelo*, pp. 348, col. 2–349, col. 1.

dence related the planets and bodily humors where it was assumed that Mars produced yellow bile, that Saturn was the causative agent for the melancholic humor, that the moon generated phlegm, and that the sun and Jupiter created blood.[32] Many also assumed that the planets dominated the four sublunar elements, where planet and element paired off according to similar qualities. Thus Saturn dominated earth, the moon water, Mercury air, and Mars fire. Indeed these four planet-element pairings were believed to determine human complexions: the moon and water producing a phlegmatic complexion; Mercury and air a bloody complexion; Mars and fire a choleric complexion; and Saturn and earth a melancholic complexion.[33]

Finally, it was generally assumed that celestial virtues were the cause of magnetic force. So closely were these related, that together they were thought capable of producing perpetual motion. According to Themon, the author of the *De magnete* (probably Peter Peregrinus's *Letter on the Magnet*) declared that if a piece of iron were placed at each of the two poles of a properly mounted spherical magnet, the magnetic sphere would revolve perpetually and synchronously with the heavens because each part of the magnet would correspond to a similar part of the heaven. Thus each part of the heaven influences its corresponding part on the magnet, "which would not happen," says Themon, "unless every part of the heaven influenced that stone [or magnet] here below."[34]

The phenomena just described were characterized as "experiences" and were thought sufficiently corroborative to convince anyone of the pervasive role played by celestial bodies in terrestrial affairs. Among such experiences, Themon even included the belief of astrologers that human fortunes and misfortunes depended on the heavens.[35]

The Instrumentalities of Celestial Action

With so many effects and experiences attributed directly to celestial bodies, it was natural to inquire how they were transmitted to the sublunar region. Three instrumentalities of celestial action were often

32. Conimbricenses, *De coelo*, p. 191 and Amicus, *De caelo*, p. 349, col. 1.

33. See Amicus, *De caelo*, p. 349, col. 1.

34. Themon Judaeus, *In quatuor libros Meteororum*, fol. 155r, col. 1. Citing only Agricola, Amicus provides a similar account of the magnet and perpetual motion. See *De caelo*, p. 349, col. 1.

35. Ibid.

identified: (i) motion (*motus*), (ii) light (*lumen*), and (iii) influence (*influentia*).[36] Scholastics were unanimous in the belief that these instrumentalities could operate only if the celestial and terrestrial regions were joined in a manner that made it impossible for vacua to exist between them, for otherwise, as Themon Judaeus explained, "the heaven could not act on this world . . . because action cannot occur through a vacuum."[37]

Themon Judaeus presented a typical, brief summary of the three instrumentalities.[38] That the superior celestial region acted on the inferior was evident to Themon, who believed, as did many others, that the celestial motions caused the sphere of fire to rotate, which, in turn, caused the upper part of the sphere of air to rotate and heat up. In this way motion caused heat to be transmitted downward to other things and ultimately to the earth itself.[39] The case for light, or *lumen*, as an

36. Among those who accepted this threefold division were Themon Judaeus in *Questions on the Meteors*, bk. 1, qu. 1, fol. 155v, col. 1, in the edition cited above in n. 26; Albert of Saxony, *Questions on De celo*, bk. 2, qu. 12, fol. 109v, col. 1, in the edition cited above in n. 26; Johannes de Magistris, *Questions on Aristotle's Meteorology* in *Questiones perutiles supra tota philosophia magistri Johannis Magistri doctoris Parisiensis cum explanatione textus Aristotelis secundum mentem doctoris subtilis Scoti* (Venice, 1490), p. 8, col. 2 (the folios are unpaginated; I have counted the pages from the beginning of the treatise on *Meteors*); and Paul of Venice *Liber De celo et mundi* in Paul's *Summa naturalium* (Venice, 1476), sig. g3r col. 2–g3v, col. 1. The same threefold division was still in vogue during the seventeenth century. See, for example, Bartholomew Amicus, who treated each at great length (see his *De caelo*, p. 356, col. 1–398, col. 2; see also Illuminatus Oddus, *Disputationes De generat. et corrupt. ad mentem Scoti. . . . Cum resolutione aliquorum dubiorum ad libros De coelo & Meteoris spectantium . . .* (Naples, 1672), 100–108.

37. The essentials of the brief text of Themon Judaeus' argument follow: "Necesse est istum mundum esse contiguum et immediatum celo. Probatur quia alias oporteret poni vacuum inter celum et mundum istum et tunc celum non posset agere in mundum istum . . . quia actio non fieret per vacuum. Patet etiam ex hoc: quia agens debet esse immediatum passo; et celum est agens et illa inferiora patiuntur ab illo." *Questions on the Meteors*, bk. 1, qu. 1, fol. 156r, col. 1. Johannes Magistri also insisted that the heaven and inferior regions must be continuous in order to avoid a vacuum (see his *Questions on Aristotle's Meteorology*, p. 8, col. 2). The denial of vacuum at the points of contact between the celestial and terrestrial regions was but a special case of the universally held medieval dictum that "nature abhors a vacuum." See Edward Grant, *Much Ado About Nothing: Theories of Space and Vacuum from the Middle Ages to the Scientific Revolution* (Cambridge, 1981), ch. 4, "Nature's Abhorrence of a Vacuum", pp. 67–100. Although medieval scholastic natural philosophers frequently discussed imaginary vacua, not one of them, to my knowledge, accepted the real existence of an extended void space anywhere in the cosmos.

38. This discussion occurs in the second conclusion of bk. 1, qu. 1, of Themon's *Questions on Aristotle's Meteorology*, fol. 155v, col. 2: "Secunda conclusio est de modo agendi quomodo celum agat. Et est ista: quod celum agit per motum vel per lumen vel per influentiam tanquam per instrumentum."

39. "Probatur primo per motum, nam dicitur in primo huius quod celum motu suo

instrumentality of celestial motion was all too obvious from its production of daylight and heat as it approached the earth and night and coldness as it receded, effects which we directly experience.[40] As evidence for the existence of celestial influences (*influentiae*), Themon pointed to the formation of metals within the depths of the earth. Because light could not penetrate the earth, he, like most scholastics, assumed that some kind of influence caused metals to develop within the darkness of the earth. The tides caused by the moon were the result not of its reflected light but of invisible influences.[41] Thus although *lumen* and *influentia* were similarly diffused throughout the whole world, they differed in at least three major respects: light is visible, whereas influence is undetectable by any of our senses, as in the example of a magnet attracting iron; influence can penetrate solid, opaque bodies, but light cannot; finally light is caused by the sun and stars, whereas influence is caused by the other, starless parts of the heaven.[42]

---

rapit secum ignem in sua sphera et circumvoluit eum; et ignis aerem in superiori parte. Et ex tali motu calefit aer et per consequens alia" (ibid.).

40. "Secundo probatur quod per lumen quia hoc experientia docet in die" (ibid.). Some lines before, in the first conclusion of the first question, Themon used another experience to demonstrate the action of the heaven, or fifth element, on inferior things when he declared: "hoc patet per experientias. Nam sol medianto accessu suo ad nos causat calorem mediante lumine et post recessum autem eius fit nox et fiunt frigora." In his similarly brief account of the three instrumentalities, Paul of Venice, in the fifteenth century, declared that light acts on the inferior region by causing heat: "Lumine etiam ut ad experientiam patet quo agit in hec inferiora calorem" (*Summa naturalium*, sig. g3r, col. 2). *Lumen* was usually contrasted with *lux*, the latter being the source of light within the lucid body itself, while the former is the light of a luminous body as it is radiated externally; or in medieval terms, it is the species of *lux*. See David C. Lindberg, *Theories of Vision from al-Kindi to Kepler* (Chicago, 1976), 113, 134.

41. "Tertio probatur quod per influentiam agit in ista inferiora nam in profundo terre generantur metalla virtute stellarum et tamen non potest ibi pervenire lumen. Immo maxime tenebre sunt ibi quantum est ex parte celi et hoc est per influentiam. Similiter etiam mare fluit et refluit quando luna est in puncto anguli terre. Sic tamen quod lumen non attingit mare in illo loco propter quod oportet quod per influentiam agat" (ibid.).

42. "Sed diceres que res est influentia vel quid est. Dico quod est quedam qualitas sive virtus diffusa per totum mundum sicut multiplicatur species caloris vel luminis. Tamen differentia est inter influentiam et lumen. Primo quia lumen est qualitas visibilis et sensibilis, sed non influentia cum non sentiatur aliquo sensu sicut apparet in virtute qua causatur a magnete quando movetur ferrum ad ipsum per nullum enim sensum sentitur illa virtus. Secundo differunt quia talis influentia non impeditur saltem totaliter si aliquod corpus interponatur sed transit per corpora opaca et densa per que non potest transire lumen sicut apparet de magnete quia unus movet alium superius in vase natantem si sub vase bene denso teneatur. Tertio differunt lumen solis solum causatur a sole et lumen celi a stellis celi. Sed influentia causatur ab aliis partibus celi non stellatis" (ibid.).

Themon's capsule summary of the three celestial instrumentalities is sufficient to convey a simple sense of the manner in which each operated. There was, of course, much more to say about them, and some authors, like Bartholomew Amicus, devoted lengthy sections to each.

Celestial Motion as a Necessary Agent for All Terrestrial Change

Of the three types of celestial causes that have been distinguished—namely motion, light, and influence—the category of motion was generally thought to be the most fundamental for generation and corruption.[43] Although Themon had attributed to Aristotle, in the eighth book of the latter's *Physics*, the position that celestial motion is the primary motion and therefore causes and rules all other motions,[44] it was Aristotle's great Arabian commentator who made a much more sweeping claim for the dominion of celestial motion over terrestrial change. In his widely known *De substantia orbis*, Averroes declared:

> the Giver of the continuation of motion is [also] the Giver of celestial motion (*dator motus coeli*). For if not, motion would be destroyed and if motion were destroyed, so would the heaven itself [be destroyed]. Indeed the heaven exists because of its motion; and if celestial motion were destroyed, the motion of all inferior beings would be destroyed and so also would the world. From this [then], it is verified that the Giver of the continuation of motion is the Giver of existence to all other beings.[45]

With Averroes, then, not only were terrestrial bodies influenced and affected by celestial motions, but their very existence was totally dependent on those motions. For much of the thirteenth century, Averroes' attitude was influential. Sometime around 1271, Robertus Anglicus, in his *Commentary on the Sphere of Sacrobosco*, explained that

43. In this article, I shall confine myself to the role of motion and treat of light and influence in a later paper.

44. Themon, *In quatuor libros Meteororum*, fol. 156r, col. 1. In the eighth book of the *Physics*, where Aristotle derives the unmoved mover, he establishes the superiority of circular motion over rectilinear and therefore of celestial over terrestrial motion.

45. *De substantia orbis*, ch. 4 in *Aristotelis opera cum Averrois commentariis*, 9 vols. in 11 parts plus 3 supplementary vols. (Venice, 1562–1574); reprinted in facsimile, Frankfurt a.M., 1962), vol. 9, fol. 10v, col. 1. The passage has also been translated by Pierre Duhem, *Le Système du monde. Histoire des doctrines cosmologiques de Platon à Copernic*, 10 vols. (Paris, 1913–1959), 6:59–60.

the sky moved continuously because without the celestial motion, nothing could be moved here below,[46] thus implying that the inferior region could not exist without celestial motion. Despite some evidence to the contrary, Thomas Aquinas was also identified, rightly it seems, with the Averroistic position.[47] According to Johannes Versoris in the fifteenth century, Thomas held that a cessation of celestial motion would be followed by a cessation of terrestrial, or inferior motion.[48] At the end of the sixteenth century, the Coimbra Jesuits would say much the same thing as they found themselves in disagreement with Thomas on this important issue.[49]

46. This is the third of four reasons explaining why the sky moves. For the Latin text and English translation, see Lynn Thorndike (ed. and trans.), *The "Sphere" of Sacrobosco and Its Commentators* (Chicago, 1949), 154 (Latin) and 208 (English). The other reasons include the desire to be assimilated to its Creator; the need to convey heat to inferior things; and to enable a star to exert its influence or virtue on all parts of the earth. Duhem quoted all four reasons in *Le Système du monde*, 6:60.

47. The contrary evidence appears in the passages described above from Aquinas's letter on the occult operations of nature, where he seems to have assumed that the actions of an element that derived from its nature were independent of the celestial motions. Relevant passages from other works of St. Thomas, however, support the contention of Versoris, the Coimbra Jesuits, and Bartholomew Amicus. This is obvious on the basis of a limited sampling of nine passages from the works of Aquinas. See Thomas Litt, *Les Corps célestes dans l'univers de Saint Thomas d'Aquin, Philosophes médiévaux*, vol. 7 (Louvain and Paris, 1963), 146–47; for two examples, see the next note. Although Bartholomew Amicus also listed Aquinas among those who adopted the Averroistic position, he does say that some believe that Thomas changed his opinion (see Amicus, *De caelo*, p. 407, col. 1).

48. "Sed secundum sanctum Thomam est dicendum quod cessante motu celi cessarent omnes motus inferiores." Johannes Versoris, *De celo*, bk. 2, qu. 5, fol. 20r, col. 1, in *Questiones subtilissime in via sancti Thome magistri Iohannis Versoris super libros De celo et mundo Arestotelis . . . Questiones Johannis Versoris super libros De generatione et corruptione . . . supra libros Metheororum. . . .* (Cologne, c. 1493). Perhaps Versoris had in mind Aquinas's statement in *De potentia* V, art. 8, where he declared that "with the cessation of celestial motion . . . there will be no action by which matter, which undergoes generation and corruption, is transmuted." My translation from *Sancti Thomae Aquinatis Quaestiones disputatae*, vol. 2, ed. P. Bazzi, M. Calcaterra, T. S. Centi, E. Odetto, P. M. Pession (Turin and Rome, 1949), 152; another candidate is Aquinas's commentary on *De caelo*, bk. 2, lectio 4, n. 342, where Aquinas declares that "it is better to say that, with the motion of the heaven ceasing, every motion of inferior bodies would cease, just as Simplicius says, because the powers of inferior bodies are like material and instrumental things with respect to celestial powers, so that those [material and instrumental powers] do not move [i.e. cannot move anything] unless they have been moved [by something else, namely by celestial powers]." See *S. Thomae Aquinatis In Aristotelis libros De caelo et mundo; De generatione et corruptione; Meteorologicorum expositio*, ed. P. Fr. Raymundi M. Spiazzi, O.P. (Turin and Rome, 1952), 166. In the passage from his commentary on *De caelo*, Thomas is presenting his own, and not Aristotle's, opinion. Moreover, since the commentary on *De caelo* was apparently Thomas's last work, we may conclude that we have here his final opinion on the matter in question.

49. We are told that "therefore St. Thomas thought that if the heaven ceased its motion, neither the heaven itself nor sublunar bodies could produce anything from

During the next two centuries, supporters of the Averroistic-Thomistic position were much in evidence: John of Jandun in the fourteenth century and Johannes Versoris and Johannes de Magistris in the fifteenth. In his commentary on *De substantia orbis*, John of Jandun fully supported the opinion of Averroes quoted above. Jandun explains that the destruction of all inferior things would follow upon the destruction of celestial motion not only because all inferior things depend for their existence—that is, their coming into being—on celestial motions but also because they depend on it for their very preservation. With reference to the second book of Aristotle's *De generatione et corruptione*, Jandun explains that while the sun in its motion around the ecliptic causes generations and corruptions, it is the daily celestial motion that is the cause of the eternal continuity and preservation of inferior bodies. With such total dependence on celestial motion, the inferior, or sublunar, part of the cosmos would obviously be destroyed if the celestial motions ceased.[50] For Jandun, as for all who adopted this position, the only exception to the total dominance of celestial bodies over terrestrial bodies was human actions. "Celestial bodies," Jandun explained, "do not have the power for causing the intellect to understand or not to understand and for necessitating the will to choose or not to choose, or to will or not to will."[51]

Johannes Versoris presented six conclusions drawn from Aristotle's *De caelo* and *De generatione et corruptione*.[52] The first five establish

---

prior actions. . . . This," they continue, "is the opinion of St. Thomas, which, although it is defended in the peripatetic school with great probability and has neither few nor ignoble defenders, has nevertheless proved unsatisfactory for us." Conimbricenses, *De coelo*, bk. 2, ch. 3, qu. 4, art. 2, p. 202.

50. "Notandum est quod dicit [i.e. Averroes] si destrueretur motus coeli, et tunc destruerentur omnia inferiora. Et hoc ideo quia coelum non est solum causa in esse istis inferioribus, sed etiam in conservari. Nam, sicut apparet secundo De generatione et corruptione, assumit secundo Coeli et Mundi, motus solis in obliquo circulo est causa generationis et corruptionis; motus autem diurnus est causa continuitatis et perpetuitatis et conservationis aeterne in re naturali. Quare patet coelum esse causam istorum inferiorum non solum in esse, sed etiam in conservari; quare destructo motu coeli, destruerentur omnia ista inferiora." *Ioannis de Ianduno in libros Aristotelis De coelo et mundo*, fol. 49r, col. 2.

51. For this sentiment, see Jandun's *Questions on De caelo*, qu. 1 ("Whether celestial bodies are the causes of these inferior generable and corruptible things"), fol. 2v, col. 1, in the edition cited in n. 11.

52. Versoris, *De celo*, bk. 2, qu. 5 ("Whether, in order to save generation and corruption in inferior things, it is necessary that the heaven be moved by a plurality of motions"), fol. 19v. A somewhat briefer presentation of the same six conclusions, called "conditionals" (*conditionales*), was presented by Johannes de Magistris in the latter's *Questions on De celo et mundo*, bk. 2, qu. 2 ("Whether a plurality of spheres and their motions must be necessarily assumed because of generations and corruptions"),

the existence of the four elements (earth, air, water, and fire) and their need to undergo continual generation and corruption.[53] In the sixth conclusion,[54] however, Versoris argues that a plurality of celestial motions is necessary to cause terrestrial generations and corruptions. No one thing in the universe can both conserve things and also cause generation and corruption. Morever, generations require a different source of motion than do corruptions. Hence a plurality of celestial motions is required to maintain the daily operation of the universe. Permanence and continuity of existence are the province of the prime motion (*primus motus*), that is, the daily east to west motion of the spheres of the fixed stars and planets. But the variety of generations and corruptions are caused by the annual approach and withdrawal of the sun in its annual west to east motion in the ecliptic (the oblique circle). Finally, the mutual relations, or aspects, between the firmament and the planets cause the great variety of things essential for species, figures, and other accidents. For Versoris, all change and permanence in the terrestrial region are completely dependent on the celestial motions. In view of what has just been said, we are not surprised to learn, later in the same question,[55] that Versoris declared motion as the most fundamental of the three instrumentalities. Indeed light and influence were both dependent on motion for diffusion and multiplication to inferior things. Hence they could not themselves cause the motions of inferior things. Celestial motion was thus the supreme and sole cause of terrestrial motion and change.

The Challenge to Total Celestial Dominance: Terrestrial Change Possible Despite the Cessation of Celestial Motion

From the thirteenth to the seventeenth centuries, there was a current of scholastic opinion that followed Averroes and made sublunar mo-

p. 19 (the text is unfoliated; I have counted pages from the beginning of the *Questions on De celo*, which appears in the collection of works by de Magistris cited above in n. 36). Since Johannes Versoris and Johannes de Magistris were contemporaries in Paris during the second half of the fifteenth century it is possible that one derived the six conclusions, or conditionals, from the other, or both drew on an earlier source. Indeed John of Jandun had earlier also considered the same problem in five consequences (*consequentiae*) in bk. 2, qu. 7 ("whether in the heavens, a plurality of motions ought to be assumed for the different parts [of the heavens]"), fol. 27r, cols. 1–2 of his *De caelo et mundo*.

53. The first five are based on Aristotle, *De caelo* 2.3.286a.3–286b.9 and *De generatione et corruptione*, ch. 3.

54. The sixth conclusion was drawn from *De generatione* 2.10.336a.15–336b.15.

55. Versoris, *De celo*, fol. 20r, col. 1.

tion (and therefore change) totally dependent on celestial motion. If the latter ceased, so would the former. But already in the late thirteenth century this opinion was challenged by a straightforward denial of its claim. In the famous theological condemnation of 219 propositions in 1277, the bishop of Paris and his advisors clearly had it in mind when, in article 156, they condemned the opinion that "if the heaven should stand [still], fire would not act on tow [or flax] because nature would cease to operate."[56] By the condemnation of article 156 and a few others,[57] the bishop of Paris left no doubt of his distaste for the idea that terrestrial actions were totally dependent on celestial motions, and, by implication, independent of God's actions. As a consequence, one had to concede, at least in the diocese of Paris, that if the celestial motions ceased, fire could indeed act by its own power and burn flax.

The impact of article 156 is already manifest during the last years of the thirteenth century. In a discussion of the third day of creation in his *Commentary on the Sentences of Peter Lombard*, Richard of Middleton (d. ca. 1300) argued that the four elements created on the third day were not made by the power of the heaven from celestial matter created on the first day, but were separately created by God.[58] He then inquired whether the elements could operate without celestial influence.[59] Of the three opinions Richard distinguished for this question,

56. The original version of article 156 appeared as "Quod si celum staret, ignis in stupam non ageret, quia Deus non esset." See H. Denifle and E. Chatelain, *Chartularium Universitatis Parisiensis* 4 vols. (Paris, 1889–97), 1:552. I have used the text as emended by Roland Hissette, *Enquête sur les 219 articles condamnés à Paris le 7 mars 1277* (Louvain and Paris, 1977), 142. Using alternative readings supplied by Denifle and Chatelain, Hissette changed "Deus non esset" to "natura deesset."

57. Although article 156 is of central importance in this study, the following articles are also relevant to the issue of celestial dominance over terrestrial actions:

"100. That theologians who say that the sky [or heavens] sometimes rests argue from a false assumption; and that to say that the sky exists and is not moved is to utter contradictories.

"137. That although the generation of men might become deficient, it does not because of the power of the first orb, which not only moves to generate the elements, but also to generate men.

"186. That the sky never rests because the generation of the lower things, which is the end purpose of celestial motion, ought not to cease; another reason is because the heaven has its being and power from its mover which things are preserved by its motion. Whence if its motion should cease, its existence would cease."

The translations are from Edward Grant, ed., *A Source Book in Medieval Science* (Cambridge, Mass., 1974), 49–50.

58. *Clarissimi Theologi Magistri Ricardi Media Villa . . . super quatuor libros Sententiarum Petri Lombardi quaestiones subtilissimae*, 4 vols. (Brescia, 1591; reprinted Frankfurt a.M., 1963), 2:181 (bk. 2, dist. 14, art. 2, qu. 5).

59. "Utrum elementa possent aliquid operari si caelum non influeret in ipsa" (ibid. 182). Richard's arguments appear in qu. 6 on pp. 182–83.

the second declared that if the heavens exerted no influence on the elements, the latter would cease to exist. This opinion is "false and dangerous," Richard declared "because it seems to favor those who say that prime matter was produced by God through the mediation of the celestial body."[60] Richard identified Moses Maimonides as a supporter of this condemned opinion. According to Richard, Moses held that "just as if the heart should cease from its motion for the blink of an eye, a man would die and his motion and powers would be destroyed, so also if the celestial motions should rest through the point of an hour [that is, for a moment], the whole world would disappear and all the things in it would be destroyed." Moreover, Richard continues, Moses said all this, "believing that the heaven does not influence anything except by motion."[61]

But it was precisely such an opinion, Richard insists, that the bishop of Paris condemned when he threatened with excommunication those who held that if the heaven ceased to move, the elements could not operate and therefore fire would not burn tow, a clear allusion to article 156. Thus did Richard reject any attempt to make the sublunar elements and the bodies compounded of them totally dependent on the celestial motions. He believed that "although the elements could not do all the things they could do with the influence of the heavens, they could nevertheless operate in some ways by a natural operation." They could do this because God had created the elements independently of the celestial bodies. Under the influence of condemned article 156, Richard rejected a necessary nexus between heaven and earth where the latter was totally dependent on the former. The sublunar region was now accorded some capacity for independent activity.

The Cessation of Celestial Motion and The Formation of Mixed Bodies

But the changes of the elements that would occur upon the cessation of celestial motion were not all derived from the powers of the now

60. This is surely a reference to article 38 of the Condemnation of 1277, which denounces the claim "that God could not have made prime matter without the mediation of a celestial body." From Grant, *Source Book in Medieval Science*, 48.

61. Richard's reference is to "Rabbi Moses, ch. 67." I have not found the reference in Maimonides' *Guide for the Perplexed*, but note that Bartholomew Amicus (*De caelo*, p. 354, col. 1) said that "Rabbi Moyses" held that "the heaven is in the universe as the heart in an animal [so that] resting for an hour all things would cease to exist." No reference is given.

stationary heavenly bodies. For Hervaeus Natalis (ca. 1260–1323), a Dominican follower of St. Thomas Aquinas (though he would differ from his master on the issue we are considering) terrestrial change was not just a matter of a stationary sun heating or not heating elements. Fire, for example, had sufficient power of its own to act, and the recipients of its power had sufficient power to receive its action—all without the motion of the celestial region. In fact, Hervaeus held that motion was not even the active principle of the heavens. That distinction belonged to its quality, which remained constant whether or not the heaven moved.[62] Hervaeus conceded, however, as would others, that without celestial motion the diversity of change would be considerably diminished because every stationary star and planet could exert its power over only a limited part of the earth.

Up to this point, the terrestrial bodies under discussion have been of an elemental nature—that is, earth, water, air, and fire. Many were agreed that such bodies would continue to change despite the cessation of all celestial motion. But what about mixed bodies—that is, what about bodies compounded of at least two elements? Would they be capable of change if celestial motions ceased? Sensing that he had gone as far as he could in downplaying the power of celestial motion, Hervæus explains that if the celestial motions were not to be wholly superfluous—for he had already shown that they were unnecessary for the continued activity of elemental bodies—it was essential that they cause the generation of mixed bodies. If they were also unnecessary for the generation and corruption of any mixed bodies, it would follow that the motion of the sky is superfluous, an unacceptable consequence.[63] Celestial motion must therefore be essential for the generation and corruption of at least some mixed bodies. In this category Hervaeus included all mixed bodies derived from putrefaction, a process that depended exclusively on the heavenly movements and which produced all metals, minerals, and some living things. For putrefaction to occur, however, different parts of the sky had to pass over one and the same place and

62. Hervaeus discussed the problem of celestial influence in his *De materia celi*, questions 7 and 8 in *Quolibet Hervei subtilissima Hervei Natalis Britonis theologi acutissimi quolibeta undecim cum octo ipsius profundissimis tractatibus infra per ordinem descriptis . . . De beatitudine; De verbo; De eternitate mundi; De materia celi; De relationibus; De pluralitate formarum; De virtutibus; De motu angeli* (Venice, 1513; reprinted Ridgewood, N.J., 1966), fols. 47v, col. 1–49r, col. 1 (qu. 7), 49r, col. 1–51v, col. 1 (qu. 8); for his denial of celestial motion as an active principle, see fol. 48v, col. 1.

63. Ibid., fol. 50r, col. 1.

successively transmit rectilinear rays to that place. With the cessation of celestial motion the production of all such mixed bodies would therefore immediately cease.

But if new mixed bodies were no longer generable upon the cessation of celestial motion, what would happen to mixed bodies already in existence? They would certainly not disappear at the instant when the motions ceased. At the very least, the forms of the elements that constitute each mixed body would continue to exist for a time. The continued existence of mixed bodies seemed apparent to Hervaeus from his conviction that the heavens exercised a preservative power over all inferior things. As evidence of this, he invoked the miracle of Joshua (Joshua 10:10–13) and assumed that when Joshua commanded the sun to stand still, all other celestial bodies also came to a halt. Although the sun's cessation of motion was a true miracle, "the mixed bodies that remained have not been attributed to any miracle by any doctor."[64] Hervaeus took this as proof that mixed bodies would continue to exist by natural means after the heavenly motions ceased. Their existence would eventually cease, however, because mixed bodies cannot endure forever, as is evident with living bodies.

During the fourteenth century, it was not unusual, especially in commentaries on *De caelo*, to inquire whether terrestrial elements and bodies could act independently if the celestial motions ceased, or, alternatively, whether a plurality of celestial motions was required for the occurrence of generation and corruption in inferior bodies. In 1377, one hundred years after the great Parisian condemnation, Nicole Oresme considered the latter question in his brilliant *Le Livre du ciel et du monde*, a French translation and commentary on Aristotle's *De caelo*.[65] Oresme straightaway denies that a plurality of motions is necessary for sublunar generation to occur. Rather he insists that

> if the heavens were at rest, change and growth would still exist, because if fire were at the present moment applied to a matter

64. As proof that mixed bodies would not disappear instantaneously if all heavenly motions ceased, Hervaeus declares: "Huius enim probabile signum potest accipi ex hoc quod accidit tempore Iosue quando sol stetit. Probabile enim videtur quod tunc omnis motus corporum celestium cessaverit. Et licet statio solis attribuatur miraculo, tamen mixta tunc remansisse non attribuitur miraculo ab aliquo doctore" (ibid. fol. 50r, col. 2). For "doctor," the reader may properly substitute theologian.

65. *Nicole Oresme: Le Livre du ciel et du monde*, ed. Albert D. Menut and Alexander J. Denomy, C.S.B.; translated with an introduction by Albert D. Menut (Madison, Wis., 1968), bk. 2, ch. 8, pp. 375–77. Oresme grappled with the problem in the form: "if generation exists, there must be many motions in the heavens," etc.

> which it heated and burned, it is unreasonable to suppose that it would stop heating or burning even should celestial motions be stopped. To say the contrary is to support an article condemned at Paris.[66]

At this juncture, and following upon this obvious reference to article 156, Oresme introduces the miracle of Joshua at the battle of Gibeon as a counterinstance to the claim that the inferior region is totally dependent on celestial motions. Oresme assumes that when Joshua commanded the sun and moon to cease their motions, all other celestial motions also came to a halt. While all were at rest, however, "generation and destruction did not cease because during the period of cessation the enemies of Gibeon were killed." While this corruption was going on at Gibeon, generation was taking place elsewhere, for during this very time, Hercules was said to have been conceived by Jupiter and Alcmena.[67]

John Buridan (ca. 1300–ca. 1358) and Albert of Saxony (d. 1390) were agreed with Oresme that generation and corruption would continue indefinitely. They offered quite similar explanations. Buridan, for example, believed that the region of earth lying under the sun would convert water to air and fire, whereas the opposite side of the earth, where coldness dominated, would continually convert fire and air into water. While water would diminish by evaporation on that side of the earth subject to the steady, invariant rays of the motionless sun, it would continually increase in that region of the earth perpetually deprived of sunshine. "Now," as Buridan explains,

> it is always natural that where water is higher, it is moved to a lower place. And so this water is continually moved around the earth to a place under the sun; and this air or fire, generated under the sun, is also moved to the opposite side. And thus the water that comes under the sun is always converted into air; and the air coming to the opposite side is converted into water.[68]

66. Already in a much earlier work, the unpublished *Quotlibeta*, probably composed in the 1350s, Oresme had, without reference or allusion to article 156, argued that generation and corruption would continue even if the sky stopped. See Lynn Thorndike, *A History of Magic and Experimental Science*, 8 vols. (New York, 1923–1958), 3:414.

67. Oresme characterized this tale as a fable but mentioned it only because "it is probable that the memory of this marvelous night dwelled among the pagans up to the time when Hercules was reputed a god and deified by them, and they thought or imagined that he had been conceived that night." *Le Livre du ciel et du monde*, 377.

68. Buridan, *De caelo*, 171.

Under a motionless sky, and under the conditions described, such generations and corruptions could continue forever. Albert of Saxony held that even if the heaven ceased its motion, the rays of the sun as well as rays of influence would continue to radiate to earth and cause changes. Obviously, such generations and corruptions would differ from what we normally observe because the sun and the planets would no longer be diversely applied to the different regions of the earth.[69]

If some medieval scholastics were convinced that generations and corruptions could continue even if all celestial motions ceased, it was, *a fortiori*, even more plausible for them to assume the persistence of change if the sky had but a single, unique motion. As Buridan explained it: "I also say that if there were only one celestial motion, there would yet be generations and corruptions, etc., because there could be no fewer [generations and corruptions with a single celestial motion] than if the whole heaven should rest."[70] But as Albert of Saxony would remind his readers, a single celestial motion could not produce the usual variety of daily generations and corruptions. Only a multiplicity of celestial agents could generate such a diversity of effects. The daily motion and the oblique motions of sun and planets in the zodiac are required. For "the sun and the other planets sometimes approach us and sometimes withdraw from us thereby making a diversity of times for us, namely winter and summer, and [making] the diversity of generations and corruptions in inferior things."[71]

Conclusion

The ideas we have described here marked a considerable departure from Aristotle and Averroes, who held that terrestrial generation and corruption were wholly dependent on the celestial motions. We saw that Thomas Aquinas, Robertus Anglicus, John of Jandun, Johannes Versoris, and Johannes de Magistris, among others, upheld this judgment. Most of those who sided with the Averroistic approach, would

69. Albert of Saxony, *De caelo*, fol. 109v, col. 2 (third conclusion).

70. "Dico etiam quod si esset solus unus motus caelestis, adhuc essent generationes et corruptiones etc., quia non minus essent quam si totum caelum quiesceret." Buridan, *De caelo*, 171. Albert of Saxony repeats this opinion (*De caelo*, bk. 2, qu. 12, fourth conclusion, fol. 109v, col. 2).

71. Albert of Saxony ibid., fifth and sixth conclusions. John of Jandun would have denied Albert's contention. In his judgment, variations in planetary distances from the earth are essential for producing the different motions involved in generations and corruptions. But variations in planetary distances are only possible by a plurality of celestial motions. Jandun, *De caelo*, bk. 2, qu. 7, fol. 27r, cols. 1–2.

probably not have denied the Joshua account as a counterinstance to their position. But they would have insisted that this was an abnormal state of affairs, an instance of God's direct intervention in the regular activities of the physical world. Indeed this was a way of neutralizing the impact of article 156. Marsilius of Inghen (ca. 1330–1396), who spent most of his academic life as a master of arts before becoming a theological master near the end of his life, took precisely this approach.

In his commentary on the *Sentences* of Peter Lombard, Marsilius considered the question "whether the firmament dividing the waters from the waters is, by its motion, the cause of generation."[72] Those who deny this insist that if the heaven were stopped or removed completely, the sun would yet illuminate and heat inferior things. Thus generation and alteration would continue. This is confirmed by an article of Paris that declares it an error "to say that when the heaven has ceased its motion fire could not burn tow next to it."[73] In responding, Marsilius distinguishes two ways to approach the problem: natural and supernatural. Thus he concedes that, with the heavens motionless, God could, presumably by His absolute power, cause the fire to burn tow. But God could do this only if He wished to deviate from the "accustomed course of nature" (*solitus cursus nature*). As long as the accustomed, or common, course of nature obtains, not even God could cause the fire to burn tow.

Although Marsilius' approach effectively neutralized article 156, the latter appears nevertheless to have produced a reaction against the defenders of total terrestrial dependence on celestial motion. Richard Middleton, Hervaeus Natalis, Nicole Oresme, John Buridan, Albert of Saxony, and others insisted that terrestrial elements and ordinary compound bodies would continue to undergo change even if all the celestial motions ceased. A popular counterinstance to the Aristotelian position was the Biblical account of the Joshua miracle. Article 156 and the Joshua miracle were common ingredients in the attempt to uphold the natural ability of terrestrial bodies to suffer change in the absence of celestial motion. By the late sixteenth and seventeenth centuries, the anti-Aristotelian position seems to have triumphed among scholastic

72. Marsilius of Inghen, *Questiones Marsilii super quattuor libros Sententiarum* (Strassbourg, 1501), bk. 2, dist. 14, qu. 10, fol. 241v, col. 2.

73. "Confirmatur per articulum Parisiensis dicente quod dicere quod ignis non possit comburere stupam sibi approximatam cessante motu celi: error" (ibid., fol. 242r, col. 1).

authors, who continued to cite article 156 and the Joshua argument.[74]

In part, the controversy concerned the relationship between God and the celestial bodies. To make all terrestrial change dependent on celestial motion was, as Richard of Middleton recognized, to make it appear that the celestial substance had somehow created the terrestrial elements. It gave too much power and dominance to the celestial region. The condemnation of article 156 in 1277 was probably a response to those who followed Averroes' strong deterministic interpretation in *De substantia orbis*. The continued operation of the sublunar world depended only on God, not on celestial motions. To confirm this, many scholastics restricted the influence of celestial motions by assigning varying degrees of independent action to terrestrial bodies. At the same time, however, they acknowledged that without regular celestial motions the world as we know it would be impossible.

I am grateful to the National Science Foundation, Division of Social Sciences, Program in the History and Philosophy of Science, for its continued support of my study on 'The Medieval Cosmos: 1200–1687,' of which this article forms a part.

74. For example, the Coimbra Jesuits, who insisted that the celestial region would continue to exert an influence on the terrestrial region even if it ceased all motion, appealed for support to both article 156—Emmanuel de Goes (see n. 24 above) speaks of "the consensus of the Parisian doctors, who condemned by one of their articles the opinion of those who believed that if the celestial motions ceased, tow or [flax] could not be burned by fire"—and the Joshua miracle. See Conimbricenses, *De coelo*, bk. 2, ch. 3, qu. 4, p. 203. The Coimbra Jesuits exerted a significant influence on seventeenth-century scholastic thought.