The friar and the vizier on the range of the theoretical sciences

El fraile y el visir sobre el ámbito de las ciencias teoréticas

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Abstract: While the importance of Avicenna as a source of Aquinas's thought is generally recognized, the details of that dependence are just now being worked out. This article presents Avicenna's teaching on the "subjects" of the theoretical sciences—physics, mathematics, and metaphysics—as presented in his *Introduction to the Book of Healing*. Its influence on Aquinas's commentary on Boethius's *De trinitate*, q. 5, art. 1, is then presented. Comparing Avicenna with Thomas in this way shows the profound influence of Avicenna on Thomas's understanding of the range of the three kinds of theoretical sciences.

Keywords: Abstraction, Aquinas, Avicenna, divine science, mathematics, metaphysics, physics, science, separation, subject.

Resumen: Si bien la importancia de Avicena como fuente del pensamiento de Tomás de Aquino es generalmente reconocida, los detalles de esa dependencia apenas comienzan a trabajarse. Este artículo se ocupa de las enseñanzas de Avicena en lo que respecta a los "sujetos" de las ciencias teoréticas —física, matemáticas y metafísica— tal y como se presentan en la *Introducción al Libro de la Curación*. Posteriormente, se muestra su influencia en el comentario de Tomás de Aquino al *De trinitate*, de Boecio, q. 5, art. 1. A través de una comparación entre Avicena y Tomás se muestra la profunda influencia que tuvo Avicena en la comprensión tomista del rango de las tres clases de ciencias teoréticas.

Palabras clave: Abstracción, Tomás de Aquino, Avicena, ciencia divina, matemáticas, metafísica, física, ciencia, separación, sujeto.

RECIBIDO: MAYO DE 2014 / ACEPTADO: AGOSTO DE 2014

The 'vizier' is Ibn Sīnā, known in the Arabic world as the "sheikh and prince (*al-shaykh al-ra'īs*)" of the philosophers,[1] because he was for many years first minister to a series of emirs, and who was known in the Latin West as Avicenna. The 'friar' is Br. Thomas of Aquino, a Dominican and by profession a theologian. What I propose to consider here is but one aspect of the profound influence on the thought of Br. Thomas exerted by Avicenna's *Book of Healing* (*al-kitāb al-shifā'*), which he mined for truth taken from the rational "sciences" that he could introduce into theology, itself conceived as a "science." The term "science" both Avicenna and Br. Thomas understood in the Aristotelian sense, which is broader than our present cramped usage: the systematic and demonstrative study of a determinate area of reality, which Aristotle had said "has three parts: what it posits, the *subject* whose essential attributes it seeks; the so-called axioms [or *principles*], which are the primary premisses of its demonstrations; and the *attributes* demonstrated."[2]

Young Br. Thomas followed the lead of his Muslim master closely concerning all three features of the theoretical sciences. In his *De principiis naturae* he laid out the principles of physical science along Avicennian lines, and in his *De ente et essentia* he set out an Avicennian understanding of the principles of metaphysics.[3] In his *Scriptum super libros Sententiarum* he adopted Avicennian principles as well as many of Avicenna's philosophical conclusions, though he rejected conclusions at odds with Christian doctrine, like the eternity of the world and mediated creation. And in 1256-7, while waiting to take his rightful chair among the "masters of theology" at the University of Paris, he wrote an incomplete com-

1. L. Gardet, *La pensée religieuse d'Avicenne* (Vrin, Paris, 1951), 17 n. 1.
2. Aristotle, *Posterior Analytics* 1.10 (76b13-17). All translations are my own, unless otherwise indicated.
3. R. E. Houser, *Avicenna and Aquinas's De principiis naturae, cc. 1-3*, "Thomist" 76/4 (2012) 577-610 and *The Real Distinction and the Principles of Metaphysics: Avicenna and Aquinas* in R.E. Houser (ed.), *Laudemus viros gloriosos: Essays in Honor of Armand Maurer CSB*, Center for Thomistic Studies Series (University of Notre Dame Press, Notre Dame, 2007) 75-108.

mentary, *Super Boetium de trinitate*, which contains a careful study of the "subjects" of the theoretical sciences.[4] I propose here to show that the first article of Q. 5 is profoundly dependent upon

4. Studies of Aquinas's *Super Boetium de Trinitate*: L. Elders, *Faith and Science. An Introduction to St. Thomas' Expositio in Boethii de Trinitate* (Rome, 1974). A. Maurer, *Introduction to St. Thomas Aquinas. The Division and Methods of the Sciences* (Pontifical Institute of Mediaeval Studies, Toronto, 1986) vii—xli. W. A. Wallace, *St. Thomas's Conception of Natural Philosophy and its Method*, in L. Elders (ed.) *Studi Tomistici. La philosophie de la nature de saint Thomas d'Aquin*, (Vatican City, 1982) 7-27. D. Hall, *The Trinity: An Analysis of St Thomas Aquinas' Expositio of the De Trinitate' of Boethius* (Brill, Leiden, 1992). Also, B. Ashley, *The Way Toward Wisdom* (University of Notre Dame Press, Notre Dame, 2006) 61-131.
On the "subject" of metaphysics (sometimes called the 'subject matter,' though there is no separate word for 'matter' in the texts) according to Avicenna, see: M. Marmura, *Avicenna on the Division of the Sciences in the Isagoge of his Shifa'*, "Journal for the History of Arabic Science" 4 (1980) 240-251. M. Marmura, *Avicenna's Critique of Platonists in Book VII, Chapter 2 of the Metaphysics of his Healing*, in J.E. Montgomery (ed.), *Arabic Theology, Arabic Philosophy. From the Many to the One: Essays in Celebration of Richard M. Frank* (Peeters, Leuven, 2006) 355-370. A. Bertolacci, *The Reception of Aristotle's 'Metaphysics' in Avicenna's 'Kitāb al-Shifā'. A Milestone of Western Metaphysical Thought* (Brill, Leiden/Boston, 2006) esp. 209 and 118-126. P. Porro, *Astrazione e separazione: Tommaso d'Aquino e la tradizione greco-araba*, in P. Porro (ed.), *Tommaso d'Aquino, Commenti a Boezio* (Bompiani, Milan, 2007) 527-580. P. Porro, *Immateriality and Separation in Avicenna and Thomas Aquinas*. D. Hasse, A. Bertolacci, *The Arabic, Hebrew and Latin Reception of Avicenna's Metaphysics* (De Gruyter, Berlin/Boston, 2012) 275-307.
How Aquinas understood "abstraction" and "separation" produced an extensive debate. For bibliography, see: P. Porro, *Metafisica e teolgia nella divisione delle scienze speculative del Super Boetium De Trinitate*, in P. Porro (ed.), *Tommaso d'Aquino, Commenti a Boezio* (Bompiani, Milan, 2007) 467-526. Also, P. Porro, *Immateriality and Separation in Avicenna and Thomas Aquinas*, "The Arabic …," 283-4, n. 13 and 14, and 305-307. In this fine article, Porro correctly finds the source of Aquinas's use of "abstraction" and "separation" in *Super Boethii de trinitate*, q. 5, to be Avicenna; and he locates the source in Avicenna's critique of Platonism in his *Metaphysics*, Bk. VII. Aquinas's peculiar understanding of "separation" is certainly displayed there, but my contention is that the direct and fundamental source of the peculiar way Aquinas understands "separation," is Avicenna's *Introduction*, which Br. Thomas also mined for how he often expresses the way essence can be understood, as Gilson saw long ago: "Essences are to be found in three different conditions: in themselves, in concrete things, or in our intellect. Considered such as they are in themselves, they constitute the proper object of metaphysics; considered such as they are in singular things, they constitute the proper object of natural science, or physics; considered such as they are in our intellect, they constitute the proper object of logic." E. Gilson, *History of Christian Philosophy in the Middle Ages* (Random House, New York, 1955) 189.

Avicenna's *Introduction to Philosophy and Logic*,[5] and that a correct understanding of Aquinas's conception of the three theoretical sciences depends upon seeing this dependence.

Following Aristotle and Avicenna, Br. Thomas distinguished three areas of the theoretical sciences: the physical sciences, the mathematical sciences, and metaphysics. In his *Introduction*, Avicenna had offered some innovations on Aristotle. He introduced cognitional aspects, in addition to real aspects, in order to establish the "subjects" of these three sciences, going well beyond Aristotle. This innovation opened the way for using both real separation from physical matter, as well as abstraction and separation from matter in thought, as criteria for distinguishing the theoretical sciences. By doing so, Avicenna could distinguish things that *can* exist separately from matter from things that *must* so exist, especially when explaining the "subject" of metaphysics. And this distinction in turn allowed Avicenna to include within metaphysical science both ontology and rational theology. On all these points, we shall see that when Br. Thomas developed his own understanding of the theoretical sciences, he followed Avicenna closely.

1. Three Introductions

First, a point of clarification. There are actually three introductions to *The Book of Healing*. The one to which I refer was the first one, written by Avicenna around 1024, which for the sake of clarity I call the *Introduction to Philosophy and Logic*, because it serves both

5. The title *Introduction to Philosophy and Logic* is my term of art, based on Juzjani's *Introduction to the Healing*, sec. 5. See D. Gutas, *op. cit.*, 32 and n. 12, where Gutas says that the "part, here identified as 'opening address,' is almost certainly chapters 2-4 in the Cairo edition, containing the introduction to philosophy and Logic, not the Prologue to *The Cure*" Avicenna wrote about 1029. Some of the material Aquinas uses is also contained in Avicenna's *Metaphysics of the Healing*, 1.1-2, written earlier. But the order of Aquinas's presentation in *Super B. de trinitate*, 5.1, what it contains and what it leaves out, and its language, all accord more directly with Avicenna's *Introduction to Philosophy and Logic* than to *Met*. 1.1-2. What is indisputable, however, is Aquinas's doctrinal, argumentative, and linguistic dependence on the Latin Avicenna.

of these purposes.[6] It was translated into Latin in Toledo around 1160 and read by Br. Thomas while an undergraduate in Naples.[7]

The last of the three introductions was also written by Avicenna (about 1029), after he had finished *The Healing* (written 1020-27).[8] In looking back, Avicenna conceived *The Book of Healing* as one book. "Our purpose in this book," he said, was to combine the best of "the philosophical sciences attributed to the ancients," that is, Aristotle, with "some of the things which I perceived through my own reflection … especially in physics and metaphysics."[9]

The middle introduction was written about 1027, just after Avicenna had finished *The Healing*, not by Avicenna himself, but by his disciple and biographer al-Juzjani. Avicenna was "the vizier of Emir Shams-al-Dawla," we are told, but after the emir's death

> Avicenna saw fit not to remain in the same state nor to resume the same duties, and trusted that the prudent thing for him to do, in furthering his purposes in this regard, would be to hide [from his political enemies] in anticipation of an opportunity to leave that region. Availing myself of his unexpected seclusion and leisure, I pressed him to complete *The Healing*. He voluntarily applied himself with great earnestness to its composition, and in a period of twenty days he finished

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6. Sadly, this introduction is the only one not analyzed by D. Gutas in his invaluable *Avicenna and the Aristotelian Tradition*, 2nd ed. (Brill, Leiden/Boston, 2014). The Arabic text is contained in Ibn Sīnā, *Shifā'*, *Mantiq*, *Madhal (Eisagoge)*, c. 2, I. Madkour, M. el-Khodeiri, G. Anawati, F. el-Ahwati (ed.) (Imprimerie nationale, Cairo, 1952) 12-16. The Latin text is Avicenna, *Logica*, c. 1, which I have taken from *Avicennae peripatetici philosophi ac medicorum facile primi Opera omnia* (1508 rpr., Venice, 1960). All my English translations of what I am calling Avicenna's *Introduction to Philosophy and Logic* are from the Latin text, though I have included Latin and Arabic words, where appropriate.
7. The evidence he knew Avicenna's *Introduction* that early is because his teacher in Naples, Master Peter of Ireland, knew it and used it to begin his own commentary on Aristotle's *On Interpretation* (ca. 1260). See Peter of Ireland, *Magistri Petri De Ybernia*, "Philosophes médiévaux" 334 (Peeters, Louvain, 1996). Date of composition: 1260-8, p. xvi; uses Avicenna's *Introduction*, 3.1-4.42.
8. D. Gutas, *op. cit.*, 41-46.
9. D. Gutas, *op. cit.*, 42-3.

> Metaphysics and Physics, relying solely upon his natural talents. He also started on Logic and wrote the *opening address* and associated material.[10]

"Twenty days" might seem hyperbolic—and it was toned down in Juzjani's biography (written after 1037)—but there is no reason to doubt his relative chronology. This "opening address," then, must be the very same *Introduction to Philosophy and Logic* considered here. It was written after Avicenna had composed the bulk of the physics and all the metaphysics of *The Healing* (1022-4), and as he was moving to its logical and mathematical sections (1024-7).

2. The Greeks

In the *Apology*, Socrates relates that in response to the Oracle he questioned three groups of Athenians—craftsmen, statesmen, and poets.[11] These three became emblems for three kinds of knowledge—productive, practical, and theoretical. Though we normally think knowledge is about things in our common world, knowledge itself exists subjectively in the mind of the individual knower, making it notoriously hard to grasp. This difficulty first drove Plato, then Aristotle, to turn outside the mind to the things known (*noeta*) in order to understand knowledge itself. In his *Republic*, Plato famously proposed to explain the knowledge his "philosopher king" should seek—a unified and all-encompassing wisdom—by looking outside the soul, to "the thing known," what since the middle ages has been called the "object" of knowledge.[12] In his divided line, he set out four types of intellectual cognition, based on four different "objects." "Image thinking (*eikasia*)" and "belief (*pistis*)" are kinds of "opinion (*doxa*)" that is uncertain and changes because their "objects" are changing individual physical things. Those things

10. D. Gutas, *op. cit.*, 32.
11. Plato, *Apology* (20b1-22e4).
12. L. Dewan, *OBIECTUM: Notes on the Invention of a Word*, "Archives d'histoire doctrinale et littéraire du moyen âge" 48 (1981) 37-96.

are "movable (*kineton*)" because material. But beyond opinion lies a realm of unchanging, universal, and necessary knowledge, which at the highest level Plato calls "science (*episteme*)."[13] What makes such knowledge truly "science" are its exterior objects, "immobile" because separate from changing physical matter. Higher knowledge is divided into "deductive knowing (*dianoia*)," exemplified but not exhausted by the objects of mathematics, and "understanding (*noêsis*)," achieved by the "science of dialectic"[14] that studies the forms. If we recognize that the "objects" of both *eikasia* and *pistis* are physical things, we get three levels of cognition: opinions about natural things, deductive knowledge about mathematicals, and scientific understanding of forms.

In a triumph of common sense over theoretical purity, Aristotle fractured Plato's unified wisdom into many parts and divided theoretical knowledge into three areas: the physical sciences, the mathematical sciences, and what came to be called "metaphysics." At *Metaphysics* Γ.1, Aristotle described the "subject" of metaphysics this way:

> There is a science that studies being as being and its essential attributes. This science is not the same as any of the so-called particular sciences, for none of the others studies being as being universally; but they cut off some part of it and study the accidents of it, such as the mathematical sciences.[15]

But lest we think that metaphysics is completely universal in scope, Aristotle goes on to explain that "being is said in many ways," as are "healthy" and "medical," so that metaphysics is confined to the prime instance of "being (*on*)," that is, "substance (*ousia*)." Consequently, "of substances the philosopher must grasp the principles and causes."[16]

Then at *Metaphysics* E.1 Aristotle dashed any hope that "universal" metaphysical science would look like Plato's comprehen-

13. Plato, *Republic* 6 (509d1-511e2), 7 (533a1-534b3).
14. Plato, *Republic* 6 (511c5) and 7 (533d4, e8).
15. Aristotle, *Metaphysics*, *Γ*.1 (1003a20-7).
16. Aristotle, *Metaphysics*, *Γ*.1 (1003a32-b19).

sive wisdom, both theoretical and practical. Aristotelian wisdom must be purely theoretical knowledge; and then Aristotle transformed Plato's divided line into three theoretical sciences:

> Natural *science* is about things that are not separate and not immobile; and some mathematical sciences are about things that are immobile but also not separate, as they are in matter; and the first science is about things that are separate and immobile… Therefore, there will be three theoretical philosophies: mathematical, physical, and theological."[17]

The criteria Aristotle uses to distinguish these "sciences" are motion and its principle matter, criteria that are purely objective, that is, concerned solely with the things studied in these sciences. Theology studies the gods, who are "separate" from matter, "immobile," and therefore "eternal." Mathematics studies what is "immobile" and so the source of unchanging knowledge, but its objects are "not separate" from matter. How this is possible Aristotle does not work out here, but it required him to invent his theory of mathematical "abstraction" from matter, which he elaborated in *Metaphysics* M and N.[18] Physics studies things that are "not separate (*achôrista*) and not immobile."[19] In his description of the

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17. ARISTOTLE, *Metaphysics* E.1 (1026a13-20).
18. ARISTOTLE uses "abstraction" (*aphairesis*) only about mathematical science. See *Metaphysics* K.3 (1061a28-b3); *Physics*, II.2 (193b34-5); *On the Soul*, III.7 (431b12-16). Also, J. OWENS, *The Doctrine of Being in the Aristotelian 'Metaphysics'* (Pontifical Institute of Mediaeval Studies, Toronto, 1951) 239: "The Mathematicals are not separate, but they are considered by the mathematician as separate. This treatment is made possible by 'abstraction,' that is by subtracting and leaving out of consideration all the other sensibles and retaining only the quantity. … From the standpoint of the sciences, then, 'abstraction' is reserved for the Mathematicals."
19. Schwegler emended "not separate" to "separate (*chôrista*). On the reading of the manuscripts, "separate" and "not separate" in all three descriptions are understood in the same way, in relation to matter. On Schwegler's emendation, when describing physics Aristotle meant 'separate from other things,' in contrast with accidents, for example. But this change would mean he employed two different senses of "separate." The reading of the manuscripts is more plausible; but on either reading physics studies the changing and material beings of the visible world, in contrast with the unchanging objects of mathematics and metaphysics. See P. PORRO, *Immateriality and Separation in Avicenna and Thomas Aquinas*, 278-9.

three theoretical sciences, then, Aristotle introduced the notion of "separate" from matter as a *purely ontological term*; it was not meant to describe some act of cognition. And he also introduced the notion of "abstraction," which does describe a mental act; but he applied it only to mathematics. If Aristotle, then, supplied Avicenna with a conclusion—there are three theoretical sciences—the Vizier would have to develop his own arguments for it.

3. Avicenna's *Introduction to Philosophy and Logic*

In Avicenna's *Introduction*, before the reader is introduced to logic, he is ushered into the whole of *The Healing*, because the three theoretical sciences are the end, for whose attainment logic is the method. Since he argues from their ends to their subjects, Avicenna begins with their common end: "The *purpose* of philosophy is to comprehend the truth of all things, in so far as it is possible for a human to understand" (1Av).[20] In using the word "thing" (*shay'*, *res*) Avicenna shows he is using the principles and the language of the *Metaphysics* he had just completed: "being (*mawjūd*, *ens*), thing (*shay*, *res*), and necessary (*darūri*, *necesse*)," along with "existence (*wujūd*, *esse*)."[21] In order to organize this terrain, Avicenna sets out a series of divisions, for the purpose of uncovering definitions, a dialectical mode of argument. While Aristotle had divided knowledge directly into the three Socratic types—productive, practical, and theoretical—the best division is exhaustive bifurcation, which is just what Avicenna does. So his *first division* is this:

20. The references in parentheses refer to section in the appended table: "Friar and Vizier." Numbers are taken from the order of the sections of Avicenna's text, to which abbreviations for Aristotle (Ar), Avicenna (Av), and Aquinas (Aq) are added. For example, 3Av) refers to the third section of the text of Avicenna's *Introduction*. Parallel to this text are 3Ar) from Aristotle, *Metaphysics* E.1 and 3Aq) from Aquinas, *Super librum Boetii de trinitate*, q. 5, art. 1. Using these numbers, parallel texts from all three authors can be directly compared. This example also shows that, while 2Aq) and 3Aq) make use of 2Av) and 3Av), Aquinas has reversed Avicenna's order of presentation.
21. Avicenna, *Metaphysics*, 1.5 sec. 1 (Marmura 22.11) and sec. 8 (24.6).

> Now the *things* that are either *have existence not* owing to our choice or operation, or they have existence *owing* to our choice or operation. Knowledge of the first type is called *speculative philosophy*, while knowledge of the second type is called *active* [later practical] *philosophy* (2Av).

Avicenna then turns again to final causality, to the "ends" of these two kinds of knowledge. While all philosophy aims to "know the truth," the end of speculative philosophy is "the perfection of the soul as simply knowing," while the end of "active" philosophy is "knowing what one ought to do and doing it" (3Av). Knowledge, then, is part of the end, even of practical philosophy.

Avicenna next sets out on the trail of the speculative sciences using a series of further divisions. In his *second division*, things "whose existence does *not* come from our will or operation, are divided into two, into things *mixed with motion* and things *not* mixed with motion" (4Av). This division will eventually yield the three speculative sciences in Aristotle's list, but not immediately; further divisions are required. Avicenna's *third division* is this: "Now things mixed with motion are divided into two: into things that do *not* have existence unless it is *possible* that they be mixed with motion, such are humanity and square and similar things; or into things that *can* have existence without this [motion]" (5Av). The notion of things that *must* move is familiar from Aristotle's conception of "nature" as an intrinsic principle of motion and rest (repeated by Avicenna).[22] But the second group—"things that *can* have existence without motion"—is a bit baffling, since it seems to cross the divide between the material and the immaterial. It certainly was never mentioned by Aristotle. The term "can" introduces the notion of possibility, one of his trinity of modal metaphysical principles—necessary, possible, and impossible. This innovation opens up the possibility of a "sci-

22. ARISTOTLE, *Physics* II.1(192b1-193b22); also, AVICENNA, *Physics*, *Bk. 1*, *On the Causes and Principles of Natural Things*, in MCGINNIS (ed. and tr.); 1.5 sec. 3, 39.1-13 and 1.6. sec. 1, 45.3-6, Latin translation: AVICENNA, *Liber primus naturalium: tractatus primus de causis et pricipiis naturalium*, in VAN RIET (ed.); 1.5, 51.37-52.54, and 1.6, 59.3-11.

ence" that studies things that *can* exist materially, but also can exist in an immaterial way. But what is that science?

Avicenna first elaborates the more familiar side of his distinction. His *fourth division* is this: Things "mixed with motion are again divided into two: for they are such that they can *neither exist nor be understood* without their proper matter, for example, the form of a human or an ass; or such that they *can be understood* but they cannot exist without matter, for example, square" (6-8Av). Avicenna's examples make it clear that he is distinguishing the physical sciences from the mathematical ones. Since motion has matter as its principle, Avicenna collapses Aristotle's 'motion' and 'matter' into a single real criterion that holds for both, but which he describes using his own metaphysical principles: "existence with matter."

In order to distinguish mathematics from physics, Avicenna needs a second criterion. Aristotle was little help, because he had focused solely on the realities studied (4Ar, 7Ar, 10Ar). This is why he had hesitated between Plato's separationist theory of mathematics and the abstractionist account Aristotle himself sketched out elsewhere.[23] So Avicenna appeals a second time to modal notions, now applied, not to realities, that is, to the natures of the things studied, but applied to the possibility of our understanding them. This second criterion is a signal innovation: our mental ability to *understand* the thing *without* its "proper matter." The physical sciences study things that cannot exist separately from physical matter, nor can they be understood apart from physical matter (7Av). The mathematical sciences, by contrast, study things that can be understood apart from *physical* matter, even if they "cannot exist without matter" (8Av). While every real square,

23. ARISTOTLE, *Metaphysics* E.1 (1026a13-15), ROSS (trans.). On Aristotle's theory of abstraction, see J. OWENS, *The Doctrine of Being in the Aristotelian 'Metaphysics'*, 2nd ed. (Pontifical Institute of Mediaeval Studies, Toronto, 1963) 382-384. "What is 'abstracted' for Aristotle is really 'subtracted.' It is removed from consideration. … Mathematics alone among the sciences deliberately 'leaves out' much that is knowable in the things with which it deals. It omits, in fact, everything knowable in them *except quantity*." Avicenna and Aquinas would try to show how this is possible; Aristotle had not done so. On Aquinas's theory of mathematics, see A. MAURER, *Thomists and Thomas Aquinas on the Foundation of Mathematics*, "Review of Metaphysics" 47 (1993) 43-61.

say, a table-top, actually exists in physical matter, the geometrical object "square" has no necessary connection with some physical species like a wooden table, nor with motion, like the table being built by a carpenter. Avicenna's explanation rests on a theory of abstraction, but he does not go into that theory, nor as yet even use that terminology. By using human understanding to distinguish physics from mathematics, however, Avicenna brings cognition into the very division of the sciences and the explanation of their "subjects," something Aristotle did not do in *Metaphysics* E.1. This innovation will not escape the notice of Br. Thomas.[24]

Having distinguished physics from mathematics (6-8Av), Avicenna returns to the other side of the third division (5Av), to "things that *can* be mixed with motion, but also have existence without it" (9Av). At first glance, it may not be obvious to the reader just what kinds of things Avicenna is talking about or how they are related to the subject of the science we expect here—metaphysics. So the first thing he does is to offer some helpful examples. He means "things like identity, unity, multiplicity, and causality" (9Av). At *Metaphysics* 1.5, Avicenna had introduced the 'one and many' as examples of what later will be called the transcendentals, because they are not confined to some one of Aristotle's ten categories, or to any of them. Identity or sameness, in its most precise Aristotelian meaning is simply unity limited to the category of substance,[25] but Avicenna, like Aristotle himself, does use "same" to refer to an individual, even one outside the category of substance. And while a cause is not a transcendental in the strictest sense, there are both physical causes and causes completely separated from matter. So let us call these four terms—identity, unity, multiplicity, and causality—examples of *Avicennian transcendentals*.[26]

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24. See AQUINAS, *Super Boetium de Trinitate*, q. 5, art. 2 and 3.
25. ARISTOTLE, *Metaphysics*, I.3 (1054a30-b2).
26. Avicenna was aware of, but did not thematize, the difference between traits like being, unity, goodness, and truth, which are found in everything that exists, and attributes like causality, which are not. "Cause" can be thought of as a "disjunctive transcendental," because all things are either causes or effects. This approach to the transcendentals was popularized by Scotus, whose prime example was 'finite and infinite being.'

That Avicenna intends these transcendentals to introduce his description of the subject of metaphysics is clear from the very next sentence:

> Among the things that *can* be denuded (*denudari; tajarrad*) from motion is truth (*veritas*; *ṣiḥḥa*), which takes two forms: either *necessary truth*, such as *God* and an *intelligence*, (10Av) or truth that is not necessary but is truth for things that are not impossible, for example, the dispositions of *identity*, *unity*, *causality*, *and the kind of number that is multiplicity* (11Av).

With this crucial sentence, Avicenna makes several important points. Let us consider each in turn.

First, Avicenna introduces one of the two terms he uses in the *Introduction* to signify the "abstraction" or "separation" of something from matter: *jarada* (the other is *faraqa*). The basic meaning of *jarada* is to remove the outer portion of something, as in peeling the rind of an orange, and when applied to people it can mean to 'undress.' Here the Toledo translators rendered it "denuded (*denudari*) of motion." While moving things have a kind of ontological truth, truth can also be abstracted from motion, when truth is found in immobile things. In "abstraction," then, two things happen: something is left behind or 'abstracted from'—in these examples, motion and the natural matter found in things that move; and something is 'taken away' or 'lifted off' from its natural subject, in this case, truth. Later (12Av) Avicenna uses the same word for the mental process of abstracting one notion from another: "consideration of them [the Avicennian transcendentals] does not change when they are despoiled (*spoliatae sunt*, *mujarradat*) [of matter]" (12Av).[27] Avicenna's final use of this term comes

27. The Toledo translators here made use of the memorable history of *spoliare*, which included the *spolia opima*, the "rich spoils" taken when a Roman general wins in single combat with an opposing general, and also Augustine's "spoiling the Egyptians," when he compared Christians using the philosophy of the Greeks to the Hebrews taking the gold from the Egyptians when they escaped under Moses for the Promised Land. AUGUSTINE, *De doctrina christiana*, 2.144-7; *Confessions*, 7.9.15.

at the end of his explanation of how mathematicians demonstrate the "dispositions that follow on number." These attributes, he says, "can be *abstracted* (*abstrahi; tajarrada*) in a certain way, so that it is not necessary to assign *specific* matter to them" (14Av), that is, the kind of matter found in nature. Of the three translations of the same Arabic word, *abstrahi* is the word Aquinas will adopt, as we shall see.[28] We will take up the other term—*faraqa*—in due course.

The second thing Avicenna does is to add another transcendental: "truth."[29] Truth does not mean what Aristotle had meant—cognitional truth existing only in the mind, which consists in a correlation of mind with reality.[30] Rather, Avicenna means truth in an ontological sense, as a feature of all beings, one that he had used in setting out the principles of his own *Metaphysics*.[31] There Avicenna identified this sense of truth with the ontological principle "quiddity" (*quidditas; māhiyya*), the basis for his understanding of the fundamental metaphysical notion "thing." Since "truth" is as universal a notion as "being" (*māwjūd*; *ens*), it points to the subject of metaphysics, "being as being" understood as common to

28. A.M Goichon, *Lexique de la langue philosophique d'Ibn Sina (Avicenne)* (Desclée de Brouwer, Paris, 1938) entry 89 (38).
29. The Arabic term *ṣiḥḥa*, in a metaphysical context means a strong sense of objective (as opposed to cognitional) truth. Its verbal form was often rendered by "to be certified (*certificari*)", "to be verified (*verificari*)" or even "able to be (*posse esse*)." It was here rendered into Latin as *veritas*, but was sometimes rendered into Latin as *certitudo* or *certus*. It is one of three terms for ontological truth Avicenna uses. See S. Van Riet, *Lexiques*, vol. 3 of *Avicenna Latinus: Liber de philosophia prima sive scientia divina* (Peeters, Louvain-la-Neuve, 1983), Arabic root 468. The second term is "veracity (*ṣidq*)," root 473, which was often rendered into Latin as *certitudo*, and the adjective as *certus*. The third and most normal term is "truth (*ḥaqq*)," root 192, which was often rendered as *verus* or *veritas*, but also as *certus* or *certitudo* in contexts where an ontological sense of truth is intended. At 10-11Av, Avicenna clearly means truth in its ontological sense.
30. Aristotle, *Metaphysics*, E.4 (1027b17-1028a5) and Θ.10 (1051a34-1052a12).
31. Avicenna, *Metaphysics*, 1.5 sec. 5 (23.11) and 9 (24.9-11), and 1.8 sec. 1 (38.15-17). On the ontological and cognitional senses of truth in Avicenna, and the Arabic and Latin terminology, see R. E. Houser, *The Real Distinction and the Principles of Metaphysics: Avicenna and Aquinas*, in R.E. Houser (ed.), *Laudemus viros gloriosos: Essays in Honor of Armand Maurer CSB*, Center for Thomistic Studies Series (University of Notre Dame Press, Notre Dame, 2007) 75-108; Bertolacci, *Reception*, 166, 262-3.

all things.[32] For Avicenna, then, this Aristotelian formula for the "subject" of metaphysics includes "things that *can* be mixed with motion, but also have existence without it" (Av9).

Thirdly, Avicenna here divides the things that *can* be abstracted from motion into "necessary truth," that is, necessary beings such as God and the intelligences *('aql*, *intelligentia*),[33] whose very nature requires them to be completely separate from motion and matter, and the "truth" of possibles, things which *can* exist in conjunction with motion and matter or "denuded" of motion and matter. This division effectively distinguishes two parts of "metaphysical science," theology and ontology. This is the hard lesson Avicenna had learned from al-Farabi's little work *On the Objects of Aristotle's Metaphysics*, as Avicenna himself would say later in his *Autobiography*.[34]

Avicenna mentions theology but briefly, in order to move directly to his ontology (11-14Av). Ontology considers "truth that is not necessary but is truth for things that are not impossible" (11Av), that is, beings that are *possible in themselves*. To clarify, he immediately adds examples, which turn out to be the very same ones he introduced earlier (at 9Av)—identity, unity, causality, and multiplicity. Repeating the examples does not seem to be a scribal error, but seems designed to point out that "consideration of them does not change when they are despoiled [from matter]" (12Av). But if they remain the same, whether existing in matter or not, why should treatment of them be placed in metaphysics rather than another science? Avicenna's answer is telling. Since the transcendentals are such universal attributes of things, they do turn up in all three theoretical disciplines—physics, mathematics, and metaphysics—though not in the same way. So in order to explain his ontology and thereby the "subject" of his metaphysics, Avicenna

32. Avicenna, *Metaphysics*, 1.2 sec. 12-13 (Arabic: 9.17-10.8; Latin 12.3-13.46).
33. S. Van Riet, *Lexiques*, root 574, 82. "Intelligences" is not in Avicenna's Arabic text, but it is in the Latin translation.
34. Farabi, *Fī aghrāḍ*, in F. Dieterici (ed.), *Alfarabi's Philosophische Abhandlungen* (Brill, Leiden, 1890) 34-38. Avicenna, *Autobiography*, sec. 9, in Gutas, *Avicenna and the Aristotelian Tradition*, 28.

briefly sketches how the transcendentals he has used as examples—one, many, identity, and cause—are treated, first in metaphysics, then in physics, and finally in mathematics. And in the course of this sketch, Avicenna introduces the language of "separation (*faraqa*)," in addition to "abstraction (*jarada*)." Br. Thomas will adopt both terms, in their Avicennian meaning, in his own explanation of the three theoretical sciences, as we shall see.

The transcendentals are studied in metaphysics "because these things *as such* are not in matter" (12Av). Unity considered as such, multiplicity considered as such, and also causality and identity considered in themselves, are not limited to material things. So they are studied the science that studies immaterial things, to be sure, but the study of the transcendentals falls within the ambit of the ontology, not theology. In short, while metaphysics includes a rational theology, it first must include an ontology that studies the attributes that span the universal range of beings, whose emblem here is transcendental "truth."

The transcendentals, however, also come up in physics and mathematics. In physics, the four transcendental attributes Avicenna mentions are understood in relation to *specific* matter and motion. For example, consideration of the *one* in so far as it is *air* or *fire*; consideration of the *many* in so far as they are the *elements*; consideration of *cause* in so far as it is *cold or heat*, and consideration of a second, intelligible [actuality], in so far as it belongs to animals, namely, a principle of bodily motion, even if, when separated (*mufāraqat*; *separata*) from it, it can exist on its own. (14Av).

The one, the many, and cause are all identified by the physicist with specific kinds of matter. And the soul, which is the principle of identity in living things, is an especially apt example. While the souls of brute animals are the mortal, formal causes of their composite being, the human soul, by contrast, exists in both conditions, as the formal cause of the composite, and therefore only a part of its being, but also separately from its body, "on its own." The point here is that when, say, 'one' or 'many' are studied in physics, they are not studied *in themselves*, but as connected with some particular kind of matter, such as air or fire or the elements.

In treating physics, Avicenna introduces the other term relevant to his theory of abstraction—*faraqa*—which he will use five times. Its basic meaning is to distinguish, differentiate, or separate one thing from another. Avicenna consistently uses the noun *farq* to mean the logical notion "difference," which contracts a genus to its underlying species; and the Toledo translators rendered this word by *differentia*. The third form of the verb (*fāraqa*), which relates its action toward something else, was consistently translated as *separari*, whose plural passive participle, what is "separated" or "separate" is *mufāraqat*, consistently translated as *separata*.[35] The point of his example of the human soul, then, is that it can exist in two states, either united with the human body and functioning as its form, or separated from the body, existing in a purely spiritual state.

Avicenna then turns to the role his transcendentals play in mathematics. He begins with the difference between the way the objects of mathematics really exist and the way the mathematician considers them intellectually.

> Now even though this only occurs in relation to matter and with admixture of motion, nevertheless, sometimes their dispositions can be understood and verified *without consideration of their proper matter and motion*.

Avicenna then clarifies by listing some mathematical operations:

This kind of consideration happens, for example, concerning addition and subtraction (*al-tafrīq; segregatione*), multiplication and division, and the finding of a root, and in the other *dispositions that follow on number*.

His term for subtraction is not the modern *ṭraḥa* but a form of *faraqa*, since in (5 – 3 = 2), three units are removed or separated from five, with the result that five is reduced to two units. This

35. S. Van Riet, *Lexiques*, root 643, 93.

clarification allows us to see that the objects of mathematics can exist in two ways:

> For these follow on number and either exist in the intellect of humans *or* in existing moving things that are divided, subtracted (*mutafarriqat*, *segretatis*) or added. But understanding these things sometimes can be *abstracted* (*abstrahi; tajarradā*) in a certain way, so that it is not necessary to assign specific matter to them.

Here Avicenna again uses a form of the word 'separation' to describe subtraction; but he then points out what subtraction is performed on, a number that has been *abstracted* from the "specific matter" in which it really exists. The passage seems to imply that the number, 'two' in this case, once abstracted, does exist in some sort of matter, but not the kind of physical matter in which the objects of physics really exist and must be included in the physicist's understanding of numbers.

Avicenna's brief presentation of arithmetic, however, does not end at the level of separation, but he returns to abstraction, even to using this term. As Aristotle had first seen, abstraction is the operation that characterizes mathematics. The "specific matter" in which a number exists in the real, physical world is 'left behind'; and what is 'pulled off' is some quantitative feature of the thing, which now exists only in the mind of the mathematician. While Aristotle's metaphysics of form had difficulty explaining how such abstraction is possible, Avicenna's metaphysics of existence has no problem explaining abstraction. The existentially neutral quantitative quiddity, which existed materially in a physical being in the material world, now comes to exist immaterially in the mind of the mathematician. This is the sense in which, as Avicenna says, numbers are "abstracted in a certain way."

Having explained how the transcendentals are studied in all three theoretical sciences, Avicenna sums up his results. In doing so, he uses the term "separate (*mufāraqāt; separata*)," but with necessary qualifications:

> Therefore, the parts of the sciences are speculative knowledge about understanding those things that have existence and reality in motion and depend on the matter of their proper species; or speculative knowledge about what is *separate* from the matter of their proper species only in thought (*min haythu mufāraqāt li-tilka taṣawwurā lā qawāmā*, *secundum quod sunt separata ab his in intellectum tantum*); or about things *separate* (*mufāraqāt; separata*) from these conditions both in existence and in understanding (15Av).

One of Avicenna's two criteria for distinguishing these sciences is objective: Do the things studied "*exist* with motion" and matter? His other criterion is subjective: Does the *knowledge* the science achieves "depend upon the matter that is proper to its [natural] species?" The Latin translation is not as complete as the Arabic, since it omits half the story for physics and mathematics; but its message is clear enough. In explaining "divine science," however, Avicenna uses both criteria explicitly: "in existence" the things studied are "separate from these," that is, from material conditions, and so our "understanding" of them cannot involve motion and matter. The term "separate," then, clearly has two senses: "separate in thought" and "separate in existence."[36]

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36. P. Porro, *op. cit.*, 295-6 explains the two senses of 'separate' using logic: "Avicenna makes a distinction between plain or simple negation and negation by equipollence (or perhaps, better, metathesis). Plain negation denies the verb, and thus renders a proposition negative, as in the case: 'Zayd is not sighted'; whereas negation by metathesis (*'udūl*: equipollence, according to Inati's and Marmura's translations) is that negation which denies the predicate and, in this sense, is equivalent to a (metathetic) affirmation such as 'Zayd is non-sighted'." While Porro's formal logic is unexceptionable, his explanation of the distinction between "plain negation" and "negation by equipollence" is itself founded on more fundamental principles, Avicenna's three modal concepts. In his *Introduction*, Avicenna passes over the formal logic of propositions but draws his conclusions purely in terms of modal concepts, notably, the possible ("can") and the necessary. The Arabic verb *jāza*, which originally meant 'to pass through' or 'to be permitted', when used philosophically was used to express possibility, and was translated at Toledo as *posse*, *posse esse*, and *possibile esse*. See S. Van Riet, *Lexiques*, root 155, 22-23. The presence of this language in the *Introduction* makes it the direct source of Aquinas's views, as set out in *Super Boethii de trinitate*, q. 5.

Once he has presented the objects studied in the three theoretical sciences, the very last thing Avicenna does is to name these sciences. The first is called "natural science," the second is "purely mathematical and the science of numbers," while the last is called "divine science" (15Av). Aristotle was correct to divide the theoretical sciences into these three, and Avicenna follows Aristotelian terminology. But Aristotle's explanations were inadequate.

4. Aquinas, *Super librum Boethii de trinitate*, Q. 5, Art. 1

When Br. Thomas turned to the "matter" or subjects of the theoretical sciences in his commentary on Boethius's *De trinitate*, he quite naturally thought of Aristotle, and quotes him in the "response" to the question "Is speculative science properly divided into these three parts: natural, mathematical, and divine?" Aristotle was an authority from whom Br. Thomas had much to learn; but at this early stage of his career, Avicenna's were the philosophical books he had read most carefully, including his *Introduction*. So it was quite natural that the Persian, rather than the Greek, was the direct source from whom Br. Thomas drew.

Br. Thomas's "response" in Art. 1 covers the same material Avicenna had covered in his introduction: the *ends* and the *subject-matters* of the three theoretical sciences. And he does so, by and large, in the same way, adopting Avicenna's language and his explanations and arguments. But as he always does in dealing with the Latin Avicenna, Br. Thomas shows even this early in his career that singular skill in summarizing, simplifying, and clarifying the often diffuse and always difficult text of the Latin Avicenna. While maintaining Avicennian doctrine and important parts of his language, he changes the Persian's order, simplifies, and clarifies. The response begins this way:

> The theoretical or *speculative* intellect is properly distinguished from the *operative* or practical intellect from the fact that the speculative intellect has for its *end* the *truth* it considers, while the practical intellect orders the *truth* it considers to *operation as to its end*. Therefore, the Philosopher says in

> *On the Soul* 3 that they differ from each other in their ends, and in *Metaphysics* 2 that 'the end of speculative science is truth, but the end of operative science is action' (3Aq).

Avicennian influence is present from the outset, for Br. Thomas begins on the subjective side, with "intellect," as Avicenna had taught him, rather than outside, where Aristotle had remained throughout his account. And he begins with Avicenna's bifurcation between practical and speculative intellect, rather than Aristotle's three-fold division. He then introduces "truth," an Avicennian theme. And led by Avicenna's assertion that "truth" is the "purpose" of all "philosophy," Thomas inserts "truth" into his description of the end of practical science, as well as theoretical science, following Avicenna. This point is quite different from Aristotle, even in the text Thomas quotes, where the Philosopher had *sharply contrasted* "truth" as the end *only* of theoretical science, with "action" as the *only* end of practical science. Finally, much of Br. Thomas's language—*speculativus*, *operativus*, and *veritas*—comes from the Latin Avicenna, not from the Latin Aristotle.

The only difference from Avicenna is that Br. Thomas begins with the ends of the sciences rather than their subjects; but he has a good reason for that, since Avicenna's argument, as distinct from his order or presentation, moved from the ends of the sciences to their subject-matters. Thomas's order of presentation simply follows the Avicennian order of the argument.

> *Therefore*, since matter must be proportionate to the end, it is necessary that the *matter* of the practical sciences is those *things* that *can* be done by *our operation*, so that knowledge of them *can* be ordered to *operation as to an end*. But it is necessary that the *matter* of the speculative sciences is those *things* that are *not* done by our operation, so that consideration of them *cannot be ordered to operation as to an end*. (2Aq)

Br. Thomas transitions gracefully from the "end" to the "subjects" of the sciences, following the direction of Avicenna's argument

("Therefore"). His description of the differences between the subject-matters, his language, and his doctrine come straight out of Avicenna's *Introduction*. Br. Thomas uses a bifurcating division, like Avicenna and different from Aristotle. His description of that difference is thoroughly Avicennian. Practical science concerns "things (*res*) that can be done by our *operation* (*nostro opere*)," while speculative knowledge concerns "*things* that are *not* done by our *operation*." The language is taken straight from the Latin Avicenna, even down to the technical term *res*, where a more Aristotelian *entia* might be expected. Most telling of all, Thomas describes the speculative sciences negatively—"things *not* done by our *operation*"—just as Avicenna had done, though Aristotle never had.

At this point, Avicenna had proceeded directly to further divisions of the theoretical sciences. Before doing that, however, Br. Thomas felt the need to justify why *motion and matter* should be the criteria used to distinguish the sciences, something both Aristotle and Avicenna had simply taken for granted. The reason he does so is because knowledge is a relation of knower to known, and so concerns the objects studied in a science. Now what is essential to that relation is not the same as what is essential to the thing known. Thomas illustrates the point using sensation. "For to be an animal or plant is accidental to an object of sense, taken as object. This is why distinctions among the senses are not based on this difference, but rather on the difference between color and sound" (2aAq). Now Plato and Aristotle had distinguished different kinds of cognition based solely on real differences in the things cognized. Plato had distinguished four different levels of intellectual knowledge based solely on the differences among four kinds of things known; and Aristotle had distinguished different kinds of knowledge—both sensory and intellectual—based of different real features of things known.[37] But Avicenna had introduced a subjective component into his division of the sciences, as we have seen. One of his criteria for determining the subjects of the theoretical sciences was whether the *things* studied are subject to motion

37. PLATO, *Republic* VI (509d4-511e2). Aristotle: see ARISTOTLE, *On the Soul*, On sensation: II.3 (414a28-415a15), II.6 (418a7-26), III. 2-3 (426b7-429a8). On intellectual knowledge, see chart: 1-15Ar. Also, *On the Soul*, III.4-5 (530126).

and matter; but his other criterion was whether our *knowledge* of them includes sensible matter and motion. Thomas takes Avicenna's 'inner turn' even further. In order to conclude that the objective or extrinsic criterion for distinguishing the sciences must be "separation from matter and motion" (2cAq), for premises proving this conclusion he turns to the subjective side, inside the intellect, in a section (2a, b, cAq) that has no parallel in Aristotle, or even Avicenna.

> Now in the object of speculation—which is the object of a speculative power—one thing is taken from the side of the intellectual power, and another thing is taken from the habit of science that perfects the intellect. From the side of the intellect is taken the fact that it [the object] is immaterial, *since the intellect itself is immaterial*; while from the side of the science is taken the fact that it [the object] is necessary, since science concerns necessary things. (2bAq)[38]

The first reason Aquinas gives here is not objective but subjective: the fact that the *intellect itself* is a *power* that is immaterial is what justifies using 'material vs. immaterial' as a criterion for determining the subjects of the theoretical sciences. And the second reason is equally subjective: a science is a *habit* developed in the intellect. Now the habit of scientific knowledge, as distinct from opinions or sensations, is "necessary"; and since "everything that is necessary, as necessary, is immobile" (2cAq), because necessity eliminates the possibility of change, it follows that 'mobility vs. immobility' is a second criterion for determining the subjects of the theoretical sciences. Here Br. Thomas was clearly inspired by Avicenna's inward turn, even though this argument is his own.

To this point in his "response," Br. Thomas has distinguished the practical from the theoretical sciences, arguing from their ends

38. AQUINAS, *Super Boethii de trinitate*, q. 5, art. 2c: Speculabili autem, quod est obiectum speculativae potentiae, aliquid competit ex parte intellectivae potentiae et aliquid ex parte habitus scientiae quo intellectus perficitur. Ex parte siquidem intellectus competit ei quod sit immateriale, quia et ipse intellectus immaterialis est; ex parte vero scientiae competit ei quod sit necessarium, quia scientia de necessariis est.

and their subject-matters, he has defended using the criteria of 'mobility vs. immobility' and 'material vs. immaterial in the division of the theoretical sciences, and he has done so in an un-Aristotelian but Avicennian manner. He is now ready to return to Avicenna's *Introduction* and follow it closely, distinguishing the three theoretical sciences in terms of their subjects or "matters." And since he is following Avicenna, he can return to his normal practice of clarifying and simplifying Avicenna's doctrines.

Since "the speculative sciences are distinguished based upon their level of separation from matter and motion," he begins with the objective side, the realities studied. "Now there are some objects of speculation that depend upon matter for their *existence*, because *they cannot exist except in matter*" (5Aq). Again, the language of "existence (*esse*)" shows he is following Avicenna. And he immediately proceeds to adopt Avicenna's next division:

> And these are distinguished, because some depend upon matter *both* for their *existence* and for *being understood*, such as those things in whose definition we posit sensible matter, for example, in the definition of a *human* it is necessary to include flesh and bones. Physical or natural science is about these kinds of things (7Aq).

Here Br. Thomas combines succinctly three points Avicenna had made more diffusely. First, he continues to use the Avicennian language of existence. These "objects of speculation (*speculabilium*) … depend upon matter for their existence (*secundum esse*)," using *esse* in the technical Avicennian sense he has already made his own. Second and most important, he uses two criteria to describe the things studied in physics. They depend upon matter for their existence, to be sure, but also for "being understood (*secundum … intellectum*)." It is this second, subjective criterion that is crucial in order sharply to differentiate physics from mathematics; and it is borrowed directly from Avicenna, as we have seen. Third, the point is driven home with an example, also drawn from Avicenna, not from Aristotle: a human, whose definition—even though universal—must include physical matter of a specific sort: "flesh and bones." Some of the materials for Br. Thomas's description are

found in Aristotle—matter and using an appropriate definition, like "snub" rather than "concave." But it was Avicenna, not Aristotle, who had put these materials together in just the way Thomas has, opening the way for his lapidary formulations.

Br. Thomas then proceeds immediately to mathematical science:

> But there are some things that, even though they depend upon matter in order to *exist*, they do not depend upon matter for *being understood*, because sensible matter is not posited in their definitions, such as line and number. And mathematical science is about these kinds of things (8Aq).

Here the possibilities of Avicenna's 'inward turn' toward cognition are fully realized. Like the objects studied in physics, the things mathematics studies "depend upon matter to exist (*secundum esse*)." The language of being and the doctrine follow Avicenna. But the more important half of Br. Thomas's description of these objects is the subjective one: they can be *understood* without the "sensible matter" they require for real existence. All Thomas has done is change Avicenna's "proper matter" to "sensible matter," which makes the point more precisely. The definitions of the objects studied in mathematics do not require, indeed, they cannot include the kind of physical matter we can sense. Following Avicenna's *Introduction* closely, this is all that Thomas says here in Art. 1. But in Art. 3, devoted to a more detailed study of the subject of mathematics, he will add that they require a different, "intelligible matter," because the quantities and qualities mathematics studies, cannot be completely separated, either in reality or even in thought, from all matter, since these two categories, in their very nature, depend upon a subject in which they inhere. Finally, Br. Thomas clearly distinguishes the subjects of geometry and arithmetic with the examples of "line and number." In *Metaphysics* E.1, Aristotle had not distinguished the objects of arithmetic and geometry, nor had he given any examples. Avicenna, by contrast, had clearly distinguished the two branches of mathematics in his *Introduction*, and had offered as examples "square" and "number." On all these points, Br. Thomas follows in the footsteps of Avicenna.

Br. Thomas then turns to metaphysics, again offering a clearly Avicennian treatment, because his conception of metaphysics incorporates Avicenna's developments beyond Aristotle.

> And there are other objects of speculation that do *not* depend on matter for existence, because they *can* exist without matter, either they are *never in matter*, such as *God or an angel*, or in some things they exist in matter *and* in others not, such as substance, quality, being (*ens*), potency, act, one and many, and things like this. (11/12Aq)

We have seen how Avicenna moved well beyond Aristotle in bifurcating the contents of metaphysics into rational theology and ontology. "Being as being" Avicenna had said must somehow include the two things Aristotle's text had seemed unable to reconcile—the study of being in its universality, which must include things that *can* exist in matter, as well as the highest, purely spiritual beings. In his *Introduction*, Avicenna had divided these two parts of metaphysics by noting that it includes some things that, in their very natures, must be completely immaterial. Br. Thomas does the same thing here, and even uses Avicenna's own examples—God and an angel, the Biblical name of an Avicennian "intelligence."

In the other half of this division, Avicenna had included things that *can* exist without matter, but also can exist in matter; and Br. Thomas repeats Avicenna's all-important "can." His examples of topics taken up in ontology include two taken right out of Avicenna's *Introduction*: "one and many." But he understood that a reader unfamiliar with Avicenna's *Metaphysics* might find Avicenna's "identity" and "cause" difficult to understand, especially if the reader were familiar with the four scholastic transcendentals: being, one, true, and good. So he emended Avicenna's list, adding "being, potency, and act," all of which are transcendentals which run through the whole list of the ten categories, or beyond the categories. But why did Thomas add "substance" and "quality"? The most plausible explanation is that Avicenna's four examples in his *Introduction*—identity, unity, number, and causality—did not include any of Aristotle's ten categories, that is, anything whose extension was less

than the full extension of being. But he well knew that Avicenna had treated the categories of substance, quantity, quality, and relation in the ontology contained in Bks. 2 and 3 of his *Metaphysics*, as "quasi species" of being. So in order for his own examples to cover the full range of Avicenna's ontology, its "quasi species" as well as its "quasi essential accidents," he added these examples. What is important for our purposes is that it is inconceivable that Br. Thomas would have come up with the exact list of examples he did, unless he was basing his own writing in Art. 1 on Avicenna's *Introduction*.

* * *

We have seen Br. Thomas follow the language and manner of argument of Avicenna. In distinguishing physics from mathematics, Br. Thomas has taken Avicenna's introduction of subjective criteria for distinguishing them, and improved upon it. His two criteria—whether the thing studied must exist in matter or not, and how knowledge of it incorporates matter—open up a very precise understanding of the "subjects" of the natural and mathematical sciences. Even more importantly, Br. Thomas also followed Avicenna when it comes to metaphysics, dividing the things studied in metaphysics into two kinds. The first are those that *can* exist in separation from matter: being, its quasi-species (the ten categories) and its quasi properties (the transcendentals). The second are things that *must* exist in separation from matter: the ontological causes of physical things, God and the angels. By following Avicenna, Br. Thomas could accept Aristotle's conception of the "subject" of physics, improve on Aristotle's description of the "subject" of mathematics, and transform Aristotle's conception of what metaphysics studies. And most important of all, following the Vizier in holding that "being" is the "subject" of metaphysics, while God is its cause and end, opened the way for a new "divine science," the "theology that is taught in sacred scripture."[39] For a full picture

39. AQUINAS, *Super Boethii de trinitate*, q. 5, art. 4c. Let me here add my thanks to my colleagues in the international "Aquinas and the 'Arabs'" project. www.AquinasAndTheArabs.org

of Thomas's accomplishment, however, we must turn to Art. 2-4; but that is a task for another day.

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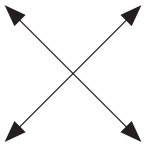
Appendix

Note: All three texts follow the order of presentation in their respective authors. The text numbers, however, follow the order of Avicenna, in order to show parallels.

TRANSLATION FROM GREEK **Aristotle, *Met.* VI, 1** (Greek: ed. Ross, Oxford, 1958)	TRANSLATION FROM LATIN with latin and arabic terms in parenthese s **Avicenna, *Logica*, "Introduction to Logic"** (Latin: ed. Venice, 1488; Arabic: ed. Cairo, 1952, Logic, Eisagoge, c. 2; p. 12-16)	TRANSLATION FROM LATIN **Aquinas, *Super Boetii de trintate*, 5.1c** (3d. Leonina, vol. 50, ed. 1995)
[*A. Theoretical vs. practical science*]	[*A. Theoretical vs. practical science*]	[*A. Theoretical vs. practical science*]
1Ar) Now we are seeking the principles and causes of *beings*, *and clearly as beings*. For there is a cause of health and fitness, and there are principles and elements and causes of mathematicals, and in general every deductive science or one that shares in deduction is about causes and principles, more or less precise. But all these mark off some being or genus, dealing with it, but they are not about being absolutely or as being, nor do they give an account of the quiddity. …	1Av) We say: the purpose of philosophy is to comprehend the truth of *all things*, in so far as it is possible for a human to understand.	

2Av) Now the things that are either have existence *not* owing to our choice or operation, or they have existence *owing* to our choice or operation. Knowledge of the first type is called *speculative philosophy*, while knowledge of the second type is called *active philosophy*.

3Aq) The theoretical or *speculative* intellect is properly distinguished from the *operative or practical* intellect from the fact that the speculative intellect has for its <u>*end*</u> the truth it considers, while the practical intellect orders the truth it considers to operation as to its end. Therefore, the Philosopher says in *On the Soul* 3 that they differ from each other in their ends, and in *Metaphysics* 2 that "the end of speculative science is truth, but the end of operative science is action."



3Ar) Now since natural science turns out to be about some genus of being, for it is about the kind of substance in which there is a principle of motion and rest in itself, it is clear that it is not practical or productive. For of things made the principle is in the maker, either understanding or art or some power, while of things done it is in the doer, choice; for what is done and what is chosen are the same. Therefore, if all intellectual knowledge is practical or productive or theoretical, natural science is a *theoretical science*; but it is a theoretical science about the kind of being which is able to be *moved*, and about the kind of substance that in definition is for the most part only *inseparable*.

3Av) The *end* of speculative philosophy is nothing other than the perfection of the soul *as* simply knowing; while the end of practical philosophy is not as simply knowing but *as* knowing what one ought to do and doing it. Therefore, the end of speculative philosophy is apprehending a proposition (*sententiae*) that does not lead to operation, while the end of practical science is knowing a proposition that does lead to an operation. Therefore, the speculative is the more valuable kind of science.

2Aq) Therefore, since matter must be proportionate to the end, it is necessary that the *[subject] matter* of the practical sciences is those things that *can* be done by our operation, so that knowledge of them can be ordered to operation as to an end. But it is necessary that the [subject] matter of the speculative sciences is those things that are *not* done by our operation, so that consideration of them cannot be ordered to operation as to an end.

	[*A.1: Why the sciences are distinguished using mobility and matter*]
	2aAq) Now we should know that when habits or powers are distinguished by their objects, they are not distinguished by just any differences among their objects, but by those that are *essential to the objects as objects*. For to be an animal or plant is accidental to an object of sense, taken as object. This is why distinctions among the senses are not based on this difference, but rather on the difference between color and sound. Therefore, the speculative sciences must be *divided based on differences among the objects of speculation*, taken as objects of speculation. 2bAq) Now in the object of speculation—which is the object of a speculative power—one thing is taken from the side of the intellectual power, and another thing is taken from the habit of science that perfects the intellect. From the side of the intellect is taken the fact that it [the object] is immaterial, since the intellect itself is immaterial; while from the side of the science is taken the fact that it [the object] is necessary, since science concerns necessary things, as is shown in *Posterior Analytics* 1 [6, 74b5-75a37].

		2cAq) Now everything that is necessary, as necessary, is immobile, because for everything that is moved, as moved, it is possible that it exist or not exist, either absolutely or in some respect, as is said in *Metaphysics* IX [8, 1050b11-15]. This is why to the object of speculation, so far as it is the object of speculative science, *essentially involves separation from matter and motion or application to them*. Therefore, the speculative sciences are distinguished based upon their level of separation from matter and motion.
4Ar) Now how the essence and the definition are must not escape us, since without this our search accomplishes nothing. Now of the things defined and of quiddities some are like snub and others are like concave. For these differ in that snub is connected with *matter*, for the snub thing is a concave nose, while concavity is lacking sensible matter.	4Av) The things of the first type whose existence does *not* come from our will or operation are divided into two, into things mixed with motion and things not mixed with motion.	
	5Av) Now things *mixed with motion* are divided into two: into things that do *not* have existence unless it is possible that they be mixed with motion, such are *humanity* and *square* and similar things; or into things that *have* existence without this [possibility of motion].	5Aq) Now there are some objects of speculation that *depend upon matter for their existence*, because they cannot exist except in matter. And these are distinguished,

	6Av) Now things that do *not* have existence unless it is possible that they be mixed with motion are again divided into two:	
[*B) Natural Science*]	[*B) Natural Science*]	[*B) Natural Science*]
7Ar) So if all natural things are said in a way like snub, for example, nose, eye, face, flesh, bone, and in general animal, leaf, root, bark, and in general plant—for the definition of none of these is without motion—it is clear how one must seek and define the quiddity for natural things, and why to look even at soul in a way belongs to the naturalist, so much of it that is not without matter. From these points, then, it is clear that natural science is a theoretical science.	7Av) for they are such that they can *neither exist nor be understood* without their proper matter, for example, the form of a *human* or an ass;	7Aq) because some depend upon matter both *for their existence and for being understood*, such as those things in whose definition we posit sensible matter, for example, in the definition of a *human* it is necessary to include flesh and bones. Physical or natural science is about these kinds of things.
[*C. Mathematics*]	[*C. Mathematics*]	[*C. Mathematics*]
8Ar) But mathematical science is also a theoretical science. But whether it is about immobile and separate things is not now clear. But it is clear that it studies some mathematicals *as immobile and as separate*.	8Av) or such that they *can be understood* but they cannot exist without matter, for example, *square*, since to understand this it is not absolutely necessary to connect it to some species of [substantial] form, nor must one consider it in relation to some aspect of motion.	8Aq) But there are some things that, even though they depend upon matter in order to exist, they do not depend upon matter for being understood, because sensible matter is not posited in their definitions, such as *line and number*. And mathematical science is about these kinds of things.

[*D. Metaphysics*]	[*D. Metaphysics*]	[*D. Metaphysics*]
	9Av) Things that *can* be mixed with motion, but also have existence without it, are things like *identity*, *unity*, *multiplicity*, *and causality*.	
[*D1. Rational theology*]	[*D1. Rational theology*]	[*D1. Rational theology*]
10Ar) Now if there is something *eternal and immobile and separate*, it is clear that knowing this belongs to theoretical science; but not to natural science, for natural science is about things moved, nor to mathematical science, but to a science prior to both. For natural science is about things that are *[not] separate* and are *not immobile*, and mathematical science is about some things that are *immobile* but also *not separate*, but that are *in matter*. But the first science is about things that are *separate* and *immobile*. Now it is necessary that all the causes be eternal, and especially these, for these are the causes for what appears of the divine.	10Av) Among the things that *can* be denuded (*denudari ; tajarrad*) of motion is truth, which takes two forms: either *necessary truth*, such as *God* and an *intelligence*,	10Aq) And there are other objects of speculation that do not depend on matter for existence, because they *can* exist without matter, either they are *never in matter*, such as *God* or an *angel*,

	[*D2. Ontology*]	[*D2. Ontology*]
	11Av) or truth that is not necessary but is truth for things that are not impossible, for example, the disposition of *identity*, *unity*, *causality*, *and the kind of number that is multiplicity*.	11Aq) or in some things they exist in matter and in others not, such as *substance*, *quality*, *being (ens)*, *potency*, *act*, *one and many*, and things like this.
	12Av) Now these things are considered in so far as they are what they are and consideration of them does not change when they are despoiled (*spoliatae sunt* ; *mujarradat)* [from matter]. But they will then be part of the consideration about things in so far as they are *not in matter*, because these things *as such* are not in matter.	
	13Av) Alternately, these things are considered in so far as it accrues to them to have existence only in matter. Now this consideration is again divided into two: one of which is that they can be understood only *in relation to specific matter and motion*. For example, consideration of the *one* in so far as it is *air or fire*; consideration of the *many* in so far as they are the *elements*; consideration of cause in so far as it is cold or heat; and consideration of a second, intelligible [act], in so far as it belongs to animals, namely, a principle of bodily motion, even if, when *separated* [*mufāraqa*; *separata]* from it, it can exist on its own.	

14Av) Now even though this only occurs in relation to matter and with admixture of motion, nevertheless, sometimes their dispositions can be understood and verified *without consideration of their proper matter and motion*. This kind of consideration happens, for example, concerning addition and subtraction (*al-tafrīq; segregatione)*, multiplication and division, and the finding of a root, and in the other *dispositions that follow on number*. For these follow on number and exist in the intellect of humans *or* in existing moving things that are divided, subtracted (*mutafarriqat*, *segretatis*) or added. But understanding these things sometimes can be *abstracted* (*abstrahi ; tajarrada*) in a certain way, so that it is not necessary to assign specific matter to them.

	[*E. Three theoretical philosophies*]	[*E. Three names of metaphysics*]
	15Av) Therefore, the parts of the sciences are speculative knowledge about understanding those things that have existence and reality in motion and depend on the matter of their proper species, or speculative knowledge about what is *separate* (*mufāraqāt, separata*) from the matter of their proper species only in thought , or about things *separate* (*mufāraqāt, separata*) from these conditions both in existence and in understanding. Now the first division is *natural science*. The second is pure *mathematics* and the science of number, namely, what is better known, for knowledge of the matter of number as number does not pertain to mathematics. And the third part is *divine science*, which comes after those natural things taken up in the manner of physical science. Now these are the speculative sciences.	15Aq) And about all these sorts of things is *theology*, that is, *divine science*, so named because in it the premier object of cognition is God. By another name it is called *metaphysics*, that is, beyond physics, because we learn it after physics, since we proceed from sensible things to the things that cannot be sensed. And it is also called *first philosophy*, to the extent that all the other sciences, taking their principles from it, follow it.
		16Aq) Now it is not possible that there are other things, that depend upon matter for being understood but not for their existence, since the intellect, taken in itself, is immaterial. Therefore, there is no fourth genus of philosophy, beyond the ones indicated.