assume that they do, people generally agree that to know the cause of something, to know it as the cause of that thing and to know that such a thing cannot be otherwise, is to it know simply. The question is, how is such knowledge attained; where is it to be found? The solution of this question is the business of the Posterior Analytics, where it is shown that such knowledge is possible only as the result of a discourse whereby the necessary connection of two terms is shown by a middle or third term. The expression of this connection is a proposition forming the conclusion of a reasoning process called a demonstration. "Ubi notandum est quod cum scientia proprie sit conclusionum, intellectus autem principiorum, proprie scibilia dicuntur conclusiones demonstrationis, in quibus passiones praedicantur de propriis subiectis." 16

The object of science in the strict sense of the term is the conclusion of a demonstration in which a universal and necessary property (propria passio) is predicated of its proper subject. As known mediately, a conclusion is inferred from prior principles, immediately known, and which in this case refer to the proper principles of that which is demonstrated. The conclusion, a proposition which is not self-evident, is only known as true when seen in relation to something already known as true and self-evident. "Et ideo rationabiliter cognitio

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16. St. Thomas, In I Post. Anal., lect. 10, n. 8.

horum principiorum est causa cognitionis conclusionum: quia semper, quod est per se, est causa eius, quod est per aliud."[17] The "aliud" or the medium is that which provides the reason for the predicate's inherence in the subject. In a strict demonstration this reason is the definition of the subject, the knowledge of which is come by in a manner entirely other than syllogistic demonstration.[18] Once attained, the definition, containing the principles of the subject, serves as middle term in a demonstration by revealing the subject as cause of the property which is predicated of it in the conclusion. A conclusion or object so understood is what is scientifically known.

Heretofore the expression 'object of science' or its equivalents (speculabile, scibile, scientifically known object) was used, the word 'object' having been described simply as that which is reached by a certain activity of the mind. Its identification here as a demonstrated proposition corrects any tendency to conceive of it as something simple. Compared with the elements that compose it, the conclusion is indeed something complex. Like all intellectual knowledge, the acquisition of a conclusion depends upon pre-existing knowledge.[19] Some knowledge of both the subject and the predicate is presupposed to the scientific knowledge of the conclusion which they constitute. Of the subject, a rather exact understanding is presup-

17. St. Thomas, In I Post. Anal., lect. 7, n. 8.
18. Aristotle develops this point at great length in Bk. II of the Posterior Analytics.
19. Cf. St. Thomas, In I Post. Anal., lect. 1.

posed when its definition is the middle term in the reasoning process. If science or demonstration are to have any meaning at all, there must be a difference between what is known of the subject in the premises and what is said of it in the conclusion. Such is the difference between the object of a science and its subject. The subject of a science is both that which is known and about which further knowledge is sought.

What we are talking about here is science in the most perfect sense. Aristotle, however, does not reserve the word to this strict sense. As will be seen, such perfection is not always possible in each of the speculative sciences. This reference to the nature of science has been made simply to facilitate a description of the object of science with a view to determining its per se differences. Thus, to be the object of science, the speculabile must be utterly immaterial and unchangeable, i.e., a speculative science regards its object as abstracting from matter and motion or change. St. Thomas adds here: "...vel applicatio ad ea..." (The reason for this will be seen in the following article.) And so, it is according to the radically different ways in which matter and motion can be excluded that the sciences will be divided. If an object is to be characteristic of a distinct speculative science, it must reveal an exclusion from matter and motion that is essentially different from that revealed by the speculabile of another science.

### 3. The division of science is threefold

St. Thomas spells out the differences of exclusion from matter and motion in the following way:

> Quaedam ergo speculabilium sunt, quae dependent a materia secundum esse, quia non nisi in materia esse possunt. Et haec distinguuntur, quia quaedam dependent a materia secumdum esse et intellectum, sicut illa, in quorum diffinitione ponitur materia sensibilis; unde sine materia sensibili intelligi non possunt, ut in diffinitione hominis oportet accipere carnem et ossa. Et de his est physica sive scientia naturalis. Quaedam vero sunt, quae quamvis dependeant a materia secundum esse, non tamen secundum intellectum, quia in eorum diffinitionibus non ponitur materia sensibilis, sicut linea et numerus. Et de his est mathematica. Quaedam vero speculabilia sunt, quae non dependent a materia secundum esse, quia sine materia esse possunt, sive numquam sint in materia, sicut deus et angelus, sive in quibusdam sint in materia et in quibusdam non, ut substantia, qualitas, ens, potentia, actus, unum et multa et huiusmodi.

To understand what St. Thomas has done here and thereby see the relevance of this article to those that follow, the roots of this variant immateriality must be exposed. Science, like sensation, is knowledge of things and not merely of their representations.[20] Although vastly different kinds of knowledge, both are capable of the same precision in regard to what they attain as object, in that it is possible to distinguish between that which is actually known and that by which it is known. "Sicut autem formalis ratio visibilis sumitur ex lumine, per quod color videtur, ita formalis ratio scibilis accipitur secundum principia, ex quibus aliquid scitur." [21]

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20. Ia, q. 85, a. 2, c.

21. St. Thomas, In I Post. Anal., lect. 41., n. 11.

Light is, as it were, the complement of color inasmuch as, without it, the colored object is visible only in potency. Whatever duality be insinuated by this distinction, it is important to realize that there is question here of simply two aspects of the same thing that are known simultaneously.

> Si enim aliqua duo ita se habeant quod unum sit ratio intelligendi aliud, unum eorum erit quasi formale, et aliud quasi materiale; et sic illa duo sunt unum intelligibile, cum ex forma et materia unum constituatur. Unde intellectus quando intelligit aliquid per alterum, intelligit unum tantum intelligibile, sicut patet in visu: lumen enim est quo videtur color, unde se habet ad colorem quasi formale; et sic color et lumen sunt unum tantum visibile, et simul a visu videtur. 22

The relation of light to color in regard to the visible can be likened to that of principles to conclusions apropos of the speculabile. "...intellectus simul intelligit principia et conclusiones per principia, quando tamen scientiam acquisivit."23

The relation of principles to conclusions and the part this plays in the division of the sciences is implied in the text from the De Trinitate cited above. Yet St. Thomas is more explicit in other places. The following texts are quoted with a view to manifesting what is said here in the De Trinitate.

> Cum enim principium totius scientiae quam de aliqua re ratio percipit, sit intellectus substantiae ipsius, eo quod, secundum doctrinam Philosophi demonstrationis

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22. De Veritate, q. 8, a. 14, ad 6.

23. Quaestiones Disputatae De Potentia, q. 4, a. 2, ad 10.

> principium est quod quid est; oportet quod secundum modum quo substantia rei intelligitur, sit modus eorum quae de re illa cognoscuntur. 24

> ...Ad cognoscendum differentiam scientiarum speculativarum adinvicem, oportet non latere quidditatem rei, et 'rationem' idest definitionem significantem ipsam, quomodo est assignanda in unaquaque scientia. Quaerere enim differentiam praedictam 'sine hoc', idest sine cognitione modi definiendi, nihil facere est. Cum enim definitio sit medium demonstrationis, et per consequens principium sciendi, oportet quod ad diversum modum definiendi, sequatur diversitas in scientiis speculativis. 25.

> ...Cum ita sit quod necessarium sit unicuique scientiarum cognoscere aliqualiter quod quid est, et uti eo quasi principio ad demonstrandum, oportet quod secundum diversum modum definitionis diversificentur scientiae. Et ita ad cognoscendum qualiter scientia naturalis differat ab aliis, oportet non latere quem modum servet naturalis in definiendo, et qualiter sit sumenda definitio in scientia naturali; utrum scilicet sicut definitur simum, aut sicut definitur concavum. 26

The basis for the division of the sciences is, therefore, nothing other than different modes of defining, so that there are as many different sciences as there are modes of defining.27 St. Thomas says that sciences are distinguished now according to principles, now according to the modes of defining. The reason is that definition can be considered in two ways: it can be considered in itself, absolutely, and as such it is neither true nor false; or it can be considered as constituting

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24. Summa Contra Gentiles, I, c. 3, n. 16.
25. St. Thomas, In VI Metaphy, lect. 1, n. 1156.
26. Ibid., XI, lect. 7, n. 2256.
27. Cf. St. Thomas, In Octo Libros Physicorum Aristotelis Expositio, I, lect. 1, n. 1.

a virtual proposition, e.g., as predicated of the definitum when the definition is good. If the definition is to have an illative power, it must be taken as the element of an enunciation. Hence in saying that the sciences are distinguished according to the modes of defining, if we refer to definitions taken absolutely, then they are remote principles of science; if we take them as components of a proposition, they are proximate principles of scientific knowledge.

In the De Trinitate we have a literal application of the criterion announced in the three texts above. Some speculabilia do in fact depend on matter for their complete being and others do not. Of those which can be only in matter, some are dependent on matter to be understood while others are not. Those which depend upon matter according to both being and understanding are considered by the science whose mode of defining is with sensible matter. Qualiter sit summenda definitio in hac scientia? Definitions with sensible matter are like the definition of animal. 'What it is to be animal' must include sensible body. The science which defines in this way is natural science.

Those speculabilia whose complete being is with matter but which can be understood without it are considered by a science whose mode of defining is without sensible matter. Such are the definitions of line and number. This is the science of mathematics.

A third science considers those things which do not depend upon matter to be and consequently are not dependent upon matter to be understood. The mode of defining of this science is thus without sensible matter. It differs from that of mathematics because it considers ea quae non dependent a materia nec secundum intellectum nec secundum esse. Such is for example, the definition of substance. This science is what was later called metaphysics.

The possibility of a fourth science is precluded by the fact that it would have no object, for it could be only on the hypothesis of a speculabile that is given independently of matter and yet requires matter in order to be understood or defined. Such a hypothesis implies a contradiction, namely, that of a definition which would have to contain and not contain something essential to it. In terms of accessibility by scientific knowledge, all reality is thus embraced in the classification according to dependence in being on matter or a denial of such dependence.

4. Definition is the medium of demonstration and consequently a principle of knowing scientifically

The diverse modes of defining provide the ultimate criterion for the division of the sciences because "definition is the medium of demonstration and consequently a principle of knowing scientifically." Demonstration is ordered to

showing that of some subject, about which we are seeking scientific knowledge, this or that property is to be predicated necessarily. This is accomplished by making known, as the reason for the predicate's inherence in the subject, the subject itself as cause of the predicate. Scientific knowledge is characterized by stability and evidence, and it is this ability to judge, to reduce things to principles that accounts for its certitude.[28] "De ratione scientiae est quod habeat firmam inhaesionem cum visione intellectiva: habet enim certitudinem procedentem ex intellectu principiorum."[29] Recalling the proportional similitude previously drawn between the speculabile and the visible together with their

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28. Judgment is not a prerogative of demonstration. Science is an act of reason ut ratio (as opposed to reason ut intellectus). As regards first truths, the intellect, from a knowledge of the terms themselves, judges immediately. Yet, since all other truths are obtained as a result of a demonstrative process which requires resolution to principles, judgment is appropriated to science. De Veritate, q. 15, a. 1, ad 4. It is in this sense that "iudicium est cum certitudine scientiae." St. Thomas, In I Post. Anal., Prooemium, n. 6.

    What this means in terms of stability can be seen from the following: "Quicumque enim aliqua cognoscit intellectuali lumine, quod est ei effectum quasi connaturale ut forma in eo consistens, oportet quod de eis fixam cognitionem habeat. Quod esse non potest, nisi ea inspiciat in principio in quo possunt cognosci: quamdiu enim non fit resolutio cognitorum in sua principia, cognitio non firmatur in uno, sed apprehendit ea quae cognoscit secundum probabilitatem quamdam utpote ab aliis dicta: unde necesse habet de singulis acceptionem ab aliis habere. Sicut si aliquis nesciret geometriae conclusiones ex principiis deducere, habitum geometriae non haberet; sed quaecumque de conclusionibus geometriae sciret, apprehenderet quasi credens docenti, et sic indigeret ut de singulis instrueretur: non posset enim ex quibusdam in alia pervenire firmiter, non facta resolutione in prima principia." De Veritate, q. 12, a. 1, c.

29. Ia IIae, q. 67, a. 3, c.

similarity in point of ability to compel their respective powers ("...scientia demonstrativa est determinate unius secundum certitudinem, sicut et sensus."[30]) the choice of the word 'de-monstratio' for signifying an intellectual discourse that determines the mind to one part of the alternative completely is a very meaningful one.

"...Omnis scientia habetur per aliqua principia per se nota et per consequens visa. Et ideo oportet quaecumque sunt scita aliquo modo esse visa."[31] In other words, a scientific conclusion is not something suspended in mid-air. It is rooted in its principles and depends upon them for its certitude. As a proposition, it may or may not have meaning depending upon the knowledge one has of its terms. But to be 'seen' by the mind, the light of its principles is required.

> ...Certitudo scientiae tota oritur ex certitudine principiorum: tunc enim conclusiones per certitudinem sciuntur quando resolvuntur in principia. ...Nos certitudinem scientiae non acciperemus, nisi inesset nobis certitudo principiorum, in quae conclusiones resolvuntur. 32

The role of principles in relation to conclusions requires that they be known in an entirely different manner than the latter. To secure the intelligibility of a proposition known mediately, the principles themselves must admit of immediate knowledge. Principles are said to be immediate because their

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30. St. Thomas, In I Post Anal., lect. 42, n. 9. Cf. also De Veritate, q. 22, a. 6, ad 4.
31. IIa IIae, q. 1, a. 5, c.
32. De Veritate, q. 11, a. 1, ad 13.

truth is known, not by means of a medium which functions as a middle term, but through a knowledge of their own composing terms. As such, they are the object, not of science, but of intellectus.

> Principia vero demonstrationis possunt seorsum considerari, absque hoc quod considerentur conclusiones. Possunt etiam considerari simul cum conclusionibus, prout principia in conclusiones deducuntur. Considerare ergo hoc secundo modo principia, pertinet ad scientiam, quae considerat etiam conclusiones: sed considerare principia secundum seipsa, pertinet ad intellectum.[33]

In stressing the function of principles in scientific discourse, it is important to realize that the cogency and rigor of a demonstrated conclusion is not due to the intellect of the knowing subject, but to the real bond that unites a property to its proper subject. For this reason, the principles of knowledge of the connection between subject and predicate of the conclusion are propositions whose terms signify proper principles of that which is demonstrated. A property belongs to or 'is in' its subject precisely because of the subject which is its cause. This becomes meaningful only when an analysis of the subject shows the property actually deriving from the subject as from its own principles. Such an analysis of the subject is nothing other than its definition: "Resolutio autem definiti in sua principia, quod definientes facere intendunt..."[34] A strict definition expresses what

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33. Ia IIae, q. 57, a. 2, ad 2.

34. St. Thomas, In VII Metaph., lect. 15, n. 1615.

a thing is; it is an answer to the question: 'What is this?' By revealing the subject as actually exercising its role as cause or reason of the property, definition establishes the intelligible connection of subject and predicate in the conclusion. It is as the middle term in the demonstration that it makes known this causal nexus. "Manifestum est enim quod principia, quae continet definitio subjecti, sunt principia passionis. Non ergo demonstratio resolvet in primam causam, nisi accipiatur ut medium demonstrationis definitio subjecti."35 As middle term appearing in the premises, the definition is predicated per se, i.e., the relation of the definition to the definitum is immediate for those who understand the definition.36

The scientific intelligibility of a conclusion represents everything that is distinctive of our rational nature. What is involved here is a process resulting in new knowledge of a truth, a proposition expressing knowledge that is certain, namely, of an attribute's or property's belonging to its subject. The conclusion is certain because of the premises leading to it; it is knowledge in terms of the cause by reason of which the property belongs to this subject.

The purpose of this rather lengthy digression has been by way of interpreting the words of St. Thomas in the text from his commentary on the Metaphysics: "definitio est medium

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35. St. Thomas, In II Post. Anal., lect. 1, n.9.

36. St. Thomas, In I Post, Anal., lect. 5, n.9.

demonstrationis et per consequens principium sciendi," the text itself having been enlisted in investigating the role played by definition in dividing the speculative sciences. Until the relation of definition to demonstration had been determined, its designation as a principle of science begged clarification. This brief analysis of the function of definition as a means or middle term allows us to see more clearly why a difference in the manner of defining is the reason for different sciences. "Tota autem virtus demonstrationis, quae est syllogismus faciens scire, ut dicitur in I. Poster., dependet ex medio. Et ideo diversa media sunt sicut diversa principia activa, secundum quae habitus scientiarum diversificantur."[37] The speculabile has its formality, its determination from the definition as from the principle that

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37. Ia IIae, q. 54, a. 2, ad 2. In III Sent., dist. XXIII, q. 2, a. 1, ad 4, St. Thomas elaborates on the function of the middle term in argumentation. In so doing, he provides a good example of the manner in which the several meanings of a word are ordered. "...Argumentum proprie dicitur processus rationis de notis ad ignota manifestanda, secundum quod dicit Boetius quod 'est ratio rei dubiae faciens fidem'. Et quia tota vis argumenti consistit in medio termino, ex quo ad ignotorum probationem proceditur; ideo dicitur ipsum medium argumentum sive sit signum sive causa sive effectus. Et quia in medio termino vel in principio ex quo argumentando proceditur continetur virtute totus processus argumentationis; ideo tractum est nomen argumenti ad hoc quod quaelibet brevis praelibatio futurae narrationis dicatur argumentum, sicut in epistolis Pauli singulis praemittuntur argumenta. Et quia medium vel principium dicitur argumentum inquantum habet virtutem manifestandi conclusionem, et hoc verius inest et ex lumine intellectus agentis, cujus est instrumentum, quia 'omnia quae arguuntur a lumine manifestantur', ut dicitur Ephes., V, 13; ideo ipsum lumen quo manifestantur principia, sicut principiis manifestantur conclusiones, potest dici argumentum ipsorum principiorum."

manifests it as a conclusion. The determination of a speculabile, its ratio objecti, is, as we have seen, reasoned intelligibility. So, different modes of defining are responsible for the different types of immateriality.

> Et ideo diversitas materiae vel objecti in ordine ad ea quae faciunt facilitatem in actu, facit diversitatem habitus....
>
> Et inde est quod in speculativis diversitas materiae, secundum quod est determinabilis per diversa media et principia ex quibus est facilitas considerationis, facit diversas scientias, sicut naturalis quae ex effectibus et his quae apparent in sensu demonstrat, a mathematica differt quae circa suam materiam ex eisdem principiis et mediis procedere non potest. 38

## 5. Science and sciences

This mention of particulars concerning the various ways of defining anticipates the discussion of the articles to follow by implicitly raising the question: If sciences are distinguished according to their ways of defining, what distinguishes the modes of defining? Before moving on, however, certain observations are in order, lest it appear that in all that has been said we are attributing to St. Thomas an unwarranted naïveté. Thus far, we have stressed the rigor of St. Thomas's division of the sciences as treated in article one. It would be extremely inaccurate if emphasis on this division were interpreted as no more than a contrivance to satisfy the exigencies of a purely logical construction. The matter treated inthis first article has not been suggested by apriori considerations.

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38. In III Sent., dist. XXXIII, q. I, a. I, qua I, sol.

On the contrary, it is a synthesis of the results drawn from the whole range of scientific endeavor. And while science in the sense described is an ideal, to confine the word to such rigor would be to ignore nearly all that we call science. As will become increasingly evident in the discussions to follow, it would be a gross oversimplification to imagine that any science is a mere collectio of propter quid demonstrations, albeit interconnected. It is true that from a cursory reading of the work under study one could possibly form the opinion that in any science demonstration, as described, is not only simply but also frequently attained.[39] Yet a realization of the general character of the work should preclude this possibility, if the warning of St. Thomas himself does not: "...Demonstratio, per quam etsi numquam falsum concludatur, frequenter tamen in hoc homo fallitur, quod putat esse demonstrationem quae non est."[40] This is the cautious observation of a man who knows whereof he speaks. No better proof can be adduced in favor of St. Thomas's realistic approach to science than his own expositions. To study any one of them is to appreciate that demonstration is the culmination of complex and detailed, often long and elaborate, preparation.

> ...in accipiendo scientiam, non semper principia et elementa sunt priora: quia quandoque ex effectibus sensibilibus devenimus in cognitionem

39. See, for example, q. 6, a. 4, ad 2.

40. St. Thomas, In Boeth. de Trin. q. 3, a. 1, ad 4.

> principiorum et causarum intelligibilium. Sed in complemento scientiae, semper scientia effectuum dependet ex cognitione principiorum et elementorum: quia, ut ibidem dicit Philosophus, tunc opinamur nos scire, cum principia possumus in causas resolvere.41

If the human mind came to know all things about which it has science in the same manner, the situation would not be nearly so complicated. But the fact of the matter is that it is forced to take quite disparate routes in approaching knowledge of the intelligible causes and principles which in their turn are responsible for the division of the sciences. Diverse modes of defining distinguish sciences because things defined are themselves known in different ways. Science is not the creation but the generation of new knowledge. It proceeds from preexisting knowledge in virtue of which the intellect moves itself to the acquisition of further knowledge. If the intellect were able to begin its reasoning about effects from a knowledge of their principles and causes, the situation would be quite different. In such reasoning the cause of our knowledge of conclusions would at the same time be the cause in re of the truth. Such is, in fact, the case of mathematics: "...quia quandoque eadem sunt magis nota et quo ad naturam et secundum nos, sicut in mathematicis, quae abstrahunt a materia sensibili. Et ideo ibi semper proceditur a notioribus secundum naturam, quia eadem sunt notiora quo

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41. Ia, q. 85, a. 8, ad 1. Cf. Aristotle, Physics, I, c.1. 184a9 ff.

ad nos." [42] From the notion of a subject, which from the beginning of an inquisition can be known distinctly, properties, laws or relations of mathematical quantities can be deduced without reference to experience. In geometry, for example, through its definition, the flat triangle is manifested as both the subject and the reason for the property (to have the sum of its angles equal to two right angles) which is necessarily predicated of it in the conclusion. Here the proper principles of the property are those through which we first know the subject and by means of which we define it.

That such a happy situation is not general is evinced by St. Thomas's readiness to point out that "In his autem (demonstrativis) principaliores sunt Mathematicae scientiae, propter certissimum modum demonstrationis." [43] The awareness that the notion of demonstrative science is most perfectly realized in mathematics should prepare us to find it realized differently in the other sciences. It should caution us against being dissatisfied with whatever realization our knowledge of the respective subjects admits, and it should advise us to dispose this knowledge accordingly.[44] If, unlike its procedure in mathematics, the intellect is required to start from effects, accidents or attributes, but which are, nevertheless, adequate to manifest the nature of their cause, then,

42. St. Thomas, In VII Metaph., lect. 2, n. 1305.
43. St. Thomas, In I Post. Anal., lect. 1, n. 10.
44. Cf. St. Thomas, In II Metaph., lect. 5, nn. 335-37.

in that measure, strict causal knowledge is subsequently possible. The prospective area for this kind of knowledge in the philosophy of nature, and, a fortiori, in metaphysics, is relatively meager. In natural philosophy, for example, given the condition of its subject, namely, changeable reality, and given the implications of a knowledge that is not merely the establishment of universal attributes of such a subject, but, even more properly, an intrinsic causal justification of them, how much of the world of nature can be so understood?

Before it can serve as principle of science in the strict sense, the definition itself must be properly achieved in that science. For anything known directly, this will require discovery of its essential nature as subject of certain attributes. In the absence of direct observation, its very existence as the cause of some effect will require proof. The accomplishment of either or both of these tasks is already considerable progress. At times no more than this is looked for. More often, no more is possible. The point is that definitions, such as are possible, are not easily come by. The definition of the soul is a case in point.

> Quia in definitione oportet non solum cognoscere principia essentialia, sed etiam accidentalia. Si enim recte definirentur et possent cognosci principia essentialia, definitio non indigeret accidentibus. Sed quia principia essentialia rerum sunt

> nibis ignota, ideo oportet quod utamur differentiis accidentalibus in designatione essentialium: bipes enim non est essentiale, sed ponitur in designatione essentialis. Et per eas, scilicet per differentias accidentales, devenimus in cognitionem essentialium. Et ideo difficile est, quia oportet nos prius cognoscere quod quid est animae, ad cognoscendum facilius accidentia animae: sicut in mathematicis valde utile est praeaccipere quodquid erat esse recti et curvi et plani ad cognoscendum quod tres anguli trianguli sint aequales duobus rectis. E converso etiam accidentia, si praeaccipiantur, multum conferunt ad cognoscendum quod quid erat esse, ut dictum est. Si quis ergo assignet definitionem, per quam non deveniatur in cognitionem accidentium rei definitae, illa definitio non est realis, sed remota et dialectica. Sed illa definitio per quam devenitur in cognitionem accidentium, est realis, et ex propriis, et essentialibus rei. 45

Dialectical definition, as distinguished in this place from real definition, is explained later on in the same commentary.[46] There St. Thomas exemplifies it by a definition of something natural that would not contain sensible matter, as when the passion of anger is defined simply as 'desire for revenge'. Even though it may be very certain in itself, a definition by form alone is intrinsically inadequate, and hence dialectical, as the definition of something that cannot be without matter. An explanation for this insufficiency is the attempt to define without recourse to experience, an omission for which St. Thomas finds Plato wanting.[47]

Physical definitions, derived from experience, do

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45. St. Thomas, In Aristotelis Librum de Anima Commentarium, I, lect. 1, n. 15.
46. Ibid., lect. 2, n. 24 ff.
47. St. Thomas, In Librum Primum Aristotelis de Generatione et Corruptione Expositio, lect. 3, n. 8.

contain sensible matter, and yet most of them are dialectical in another sense. As will be seen, definition in metaphysics again presents its own particular problems. A real definition represents, from one point of view, a term for human knowing.

> ...Substantia rei, quae est essentia et definitio significans quod quid est res, dicitur terminus. Est enim terminus cognitionis. Incipit enim cognitio rei ab aliquibus signis exterioribus quibus pervenitur ad cognoscendum rei definitionem; quo cum perventum fuerit, habetur perfecta cognitio de re. Vel dicitur terminus cognitionis definitio, quia infra ipsam continentur ea, per quae scitur res. Si autem mutetur una differentia, vel addatur, vel subtrahatur, iam non erit eadem definitio. 48

When the mind reaches this term it attains a definition of what the thing is, the quid rei. Until this term is reached, the most it does in fact know is the quid nominis, i.e., what we express in naming things. The ratio quam significat nomen in this case is not the definition but something either vaguely known or merely descriptive. And until the mind is assured that it has reached a term beyond which it cannot go, nothing can be predicated of its subject with the certitude that characterizes the immediate knowledge of scientific principles taken in the narrower sense.

To infer from all this that the greater part of natural philosophy is not science at all would be to demand that all science vindicate the status of mathematics. There is still

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48. St. Thomas, In V Metaph., lect., 19, n. 1048.

science, though in a diminished sense, when a quid nominis is taken as middle term. But even those physical definitions which are 'only' dialectical are still definitions that explain what the words stand for. They are sufficient for tentative inference. In modern terminology, this too is called scientific.

Our study of St. Thomas has shown a division of the sciences made according to the differences of their respective objects. By object, we have seen, he means conclusion. But we have also come to see that any given science embraces many conclusions. A habit of science, it is true, can be engendered, at least incipiently, by one demonstration. Unlike moral virtues, however, such a habit is perfected by an extensive development, in achieving more and more conclusions.[49] In what sense then do many conclusions constitute an object for any one member encountered in the division? The answer to this question has been implied already when, in comparing the object of a single demonstrction with that of the sense of sight, a distinction was made between what is known and that in virtue of which it is known. Applied now more explicitly to an entire science, the result is the distinction between its formal and material object. As that which is known, the material object of a science includes all conclu-

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49. Cf. Ia IIae, q. 54, a. 4, ad 3.

sions, all inferred propositions known as true, in that science. The formal object is the particular aspect under which all of these conclusions are reached, this aspect deriving from the manner of defining which is proper to the science.

John of St. Thomas provides the reason for the growth and development which a habit of science must undergo to attain the multitude of truths, materially many but formally one, that make up its object. The acquisition of new conclusions is an extensive growth, not merely by the extrinsic addition of new matter, but according to an intrinsic perfection of the habit itself. The fact that a particular science encounters more difficulty in reaching some conclusions than others can result, not only from extrinsic difficulties on the part of its matter and the mode after which it is known, but also from a deficiency on the part of the habit itself which, unless intrinsically perfected, lacks sufficient force to effect many conclusions. John of St. Thomas explains why it is that, apart from the determination afforded by things known, development is still required within the habit itself. He does so in terms of the relationship between principles and conclusions that has been emphasized in the foregoing pages.

> Constat enim quotidiana experientia scientias crescere extensive, quia per primam demonstrationem acquirit quidem intellectus habitum et facilitatem circa illam, quia convincitur et totaliter subjicitur illi veritati, sed circa alias veritates et conclusiones nihil omnino facilitatur, nec potest ex vi primae,

sed indiget nova explicatione et extensione.

Et hoc ideo quia scientia dependet in universalitate et extensione et assensu ad diversas veritates seu objecta a speciebus repraesentantibus illo, et a coordinatione illarum et dispositione inter se: sine speciebus enim caret manifestatione objectorum, et sine coordinatione caret medio et dispositione illativa, sine quibus non potest lumen scientificum assentiri, quia est lumen collativum et illativum.

Quare licet idem sit lumen et idem habitus quo quis assentitur primae et secundae conclusioni, tatem ut applicetur secundae et tertiae conclusioni requiritur diversa ordinatio specierum, et sic indiget habitus nova extensione.... 50

By way of conclusion to the first article it can be stated that the division herein effected is a division of the speculative sciences according to their objects. This is to say that the basis for the division is not the differences of things as they exist outside the mind,[51] but rather the differences of these things precisely as they are known in a scientific way, ut scibiles.[52] The division is a generic one, each single science having a single kind or genus of subject with its own basic principles and causes, and which includes all the species that may be contained within the genus, together with their proper principles, causes, elements, properties and relations. Knowledge of a scibile is attained in and through these principles. "...Sicut etiam corpus mobile

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50. John of St. Thomas, Cursus Theologicus, In Iam-IIae, "De Habitibus", ed. A. Mathieu et H. Gagné, Collectio Lavallensis, Sectio Theologica (Quebec, 1949) nn. 633-35.

51. Cf. St. Thomas, In II Physic., lect. II, n. 3.

52. St. Thomas, In Boeth. de Trin., q. 5, a. 1, ad 1 and ad 8.

est subjectum naturalis Philosophiae, nec tamen omnia enuntiabilia quae de corpore mobili possunt formari sunt scibilia, sed illa solum quae ex principiis naturalis Philosophiae manifestantur." [53] Definition as the medium of demonstration provides the proper principles of this knowledge which is characterized by exclusion from matter and motion. A difference in the manner of defining results from a difference in the principles of things that can be known without matter and change. Thus there are as many speculative sciences as there are different modes of defining. There are three such modes: to define with sensible matter things which cannot be otherwise defined--this is proper to natural science; to define without sensible matter things which have their being with matter--this is proper to mathematics; to define without sensible matter those things which can be without matter--this is proper to metaphysics.

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53. De Veritate, q. 14, a. 8, ad 16.

## ARTICLE TWO

### Utrum naturalis philosophia sit de his quae sunt in motu et materia

According to the division established in article one, natural philosophy is the science of things depending on matter both to be and to be understood. Although the division was precisely stated, a serious difficulty arises immediately this first of its members is more carefully considered, namely, in regard to the subject about which natural philosophy is to provide scientific knowledge. Briefly stated, this difficulty is as follows: In the concrete conditions of his own existence, the natural scientist is first of all confronted by the changeable, the material, the contingent. His intellect is such that it is quickened by and first attracted to things wanting in determination. What is least knowable in itself is most familiar to him. It is because things are that he attains them at all, but it is their most obvious conditions that first occur to him to be explained. The initial stage of his scientific development is thus to treat of reality precisely as mobile or changeable. But in the text we are examining, unchangeableness (necessity) has already been established as an essential condition of science. We are, therefore, faced with the problem of a science that purports to provide universal and necessary knowledge about things existing in matter subject to change and variation of all kinds. In other words, science is about the necessary,

which is immobile; but natural science is about mobile things. These assertions seem to be contradictory.

## I. The solution of Plato

The problem is introduced by referring to its history and the solution proposed by Plato, as Aristotle and St. Thomas understood it. Plato, in his approach, was straitened by qualified concessions to the opinions of Heraclitus and Cratylus.[1] According to Heraclitus, all things are in a state of perpetual flux; nothing is stable and consequently, nothing is determinately true. In this view of continual agitation there was no possibility of science. Cratylus, a disciple of Haraclitus and one of the first teachers of Plato, carried the position of his master to its extreme and insisted on the impossibility of sustaining even one true assertion. Any assertion, since it is verbal, takes time. From the beginning of an enunciation to its end the thing itself changes. As a result, Cratylus confined himself to wiggling his finger.[2]

Plato, however, did strive to maintain scientific knowledge of changeable being. His efforts in this direction led to the theory of ideas or separated forms as seemingly the only way out if there was to be science about natural things qua changeable. Natural things in themselves he regarded as objects of opinion. But besides the world of the

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1. Cf. Aristotle, Metaph., I, c. 6, 987a 33.

2. Ibid., IV, c. 5, 1010a 10 ff.

sensible, the mobile, the non-separated, he posited another order of beings called forms, separated from matter and motion not only in mind but in reality as well. These two orders, though distinct, were not completely separated one from the other because sensible things existed and were known as participations of separated forms. For each species there was a separated form which was the exemplary and productive cause of singulars. Between these two orders Plato posited a third--that of mathematics. A third order was necessary because the mathematicalia differed both from sensible substances, in that they were immobile and incorruptible, and from the separated forms, due to the possibility of mathematical individuals within the same species.[3]

Plato's solution then was that science of natural things is possible, but only on the supposition of separated forms. Aristotle, on the contrary, affirmed the possibility without the necessity of positing such forms.[4] By distinguishing

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3. Ibid., I, c. 6, 987b 4 ff.

4. St. Thomas succinctly explains the basic point of disagreement as follows: "Non enim est differentia inter Aristotelem et Platonem, nisi in hoc quod Plato posuit quod res quae intelligitur eodem modo habet esse extra animam quo modo eam intellectus intelligit, idest ut abstracta et communis; Aristoteles vero posuit rem quae intelligitur esse extra animem, sed alio modo, quia intelligitur abstracte et habet esse concrete. Et sicut secundum Platonem ipsa res quae intelligitur est extra ipsam animam, ita secundum Aristotelem: quod patet ex hoc quod neuter eorum posuit scientias

between the thing known and the manner in which it is known, Aristotle discovered a more moderate and reasonable way to resolve the difficulty. He realized that 'what a natural thing is' is itself not changeable, so that it is possible to consider the essential natures of changeable things apart from the concrete conditions in which they are found. By reason of the intellect's ability to grasp the particularized what in things outside the mind, the material and changeable can be known in a way that is universal and necessary; and all this without violence to reality. This is the solution proposed by St. Thomas.

## 2. An important distinction

Keenly intelligent as he was, Plato was hard pressed to "make sense" out of sensation that disclosed a buzzing, booming world, churning with constant change; generation and corruption, growth and decay, life and death. And so,

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esse de his quae sunt in intellectu nostro, sicut de substantiis; sed Plato quidem dixit scientias esse de formis separatis, Aristoteles vero de quidditatibus rerum in eis existentibus. Sed ratio universalitatis, quae consistit in communitate et abstractione, sequitur solum modum intelligendi, in quantum intelligimus abstracte et communiter; secundum Platonem vero sequitur etiam modum existendi formarum abstractarum: et ideo Plato posuit universalia subsistere, Aristoteles autem non." Quaestio Disputata De Spiritualibus Creaturis, q. un., a. 9, ad 6.

St. Thomas tells us, he was betrayed into taking the accidental for the essential and ended by rejecting the two as one in favor of separated forms. St. Thomas attributes the source of this confusion to a failure to distinguish in sensible things between the notion (ratio, idest forma) and the composite. "Notion" here means the object expressed by its definition. "Composite" means this notion as it is shared and exists in the singular. When in this place St. Thomas equates notion (which is our present translation of the Latin 'ratio') and form, by form he does not mean the principle inhering in and substantially perfecting the thing known, but what the intellect grasps of the thing known. It is called form, not as intrinsic cause, but in its reference to the act of the knowing intellect, as that in whose image an intelligible similitude is conceived.[5] "Nam intelligere importat solam habitudinem intelligentis ad rem intellectam; in qua nulla ratio originis importatur, sed solum informatio quaedam in intellectu nostro, prout intellectus noster fit in actu per formam rei intellectae."[6]

The distinction between notion and composite is found in the Metaphysics, Bk. VII, chapter 15. When commenting on this text, St. Thomas paraphrases Aristotle saying: "Dico autem eas esse alteras 'quia hoc quidem', scilicet substantia, quae est totum, sic est substantia sicut habens rationem conceptam cum materia; illa vero, quae est sicut forma et ratio

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5. Cf. Contra Gentiles, IV, c. 11, n. 3474.

6. Ia, q. 34, a. 1, ad 3.

et quod quid erat esse, est totaliter ratio et forma non habens materiam individualem adiunctam."[7] He goes on to say that the distinction is necessary because it is the composite which is the proper subject of motion and not the notion. "Quaecumque igitur dicuntur substantiae hoc modo sicut composita, eorum potest esse corruptio. Ostensum est enim supra, [Aristotle, VII, c. 8; St. Thomas, lect. 7] quod eorum solum est generatio, quae ex materia et forma componuntur. Corruptio autem et generatio sunt circa idem."[8] Generation has for its term <u>esse</u> in the sense that the term of generation is the existent. Now in nature it is the composite singular that properly exists.[9] Consequently, it is the composite singular, as the term of generation, which is the proper subject of motion and becoming. The notion of changeable being is not changeable, at least not per se. A particular builder, from these materials, is responsible for <u>this</u> house but not for 'what a house is'. This father generates this <u>man</u> who is his son, but not 'what it is to be man'. Generation and

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7. Aristotle, <u>Metaph.</u>, VII, c. 15, 1039b 20-21; St. Thomas, <u>In VII Metaph.</u>, lect. 15, n. 1606.
8. Aristotle, <u>ibid.</u>, 1039b 22; St. Thomas, <u>ibid.</u>, n. 1607.
9. "Omne quod fit, ad hoc fit quod sit: est enim fieri via in esse. Sic igitur unicuique causato convenit fieri sicut sibi convenit esse. Esse autem non convenit formae tantum nec materiae tantum, sed composito: materia enim non est nisi in potentia; forma vero est qua aliquid est, est enim actus. Unde restat quod compositum proprie sit." <u>Contra Gentiles</u>, II, c. 43, n. 1196.

corruption pertain to the notion of what is subject to change and yet the notions of generation and corruption are not subject to generation and corruption except per accidens. "Sed tamen huiusmodi formae et quidditates aliquando sunt, et aliquando non sunt 'sine generatione et corruptione', idest sine hoc quod ipsa generentur vel corrumpantur per se, sed incipiunt esse et non esse aliis generatis et corruptis." 10 As I watch it, a piece of white paper thrown into the fire scorches and turns black. But the notion of white does not change into black nor is that of paper turned to ash. In not making this distinction, Plato would not appreciate that while the notion or form of natural things is found in things existing subject to change, this is accidental to the notion considered in itself. Considered in itself, such a notion is without change, and of subjects so taken there can be both definition and science.

3. The notions of changeable things are without matter and motion

Since it is one thing to point out the error in another's position and something else again to establish the truth, St. Thomas goes on to explain how it is possible for the science of things that are mobile to consider something about them without motion or change. How can the intellect lay hold of such things in point of the immateriality and immobility that

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10. St. Thomas, In VII Metaph., lect. 15, n. 1608.

science requires ? Basically the task is to determine precisely what is involved in considering the notions of changeable things, disengaging them from the things that exist in matter and motion.

The danger at this point is the possibility of interpreting St. Thomas as saying that we really don't know things themselves at all, but only their mental representations. Nothing could be further from the truth as he understands it. For this reason we quote the following passage at some length to emphasize that to know something means to know that thing.

> Sed inquirendum restat quid sit ipsum intellectum. Si enim dicant quod intellectum est una species immaterialis existens in intellectu, latet ipsos quod quodammodo transeunt in dogma Platonis, qui posuit quod de rebus sensibilibus nulla scientia potest haberi, sed omnis scientia habetur de forma una separata. Nihil enim refert ad propositum, utrum aliquis dicat quod scientia quae habetur de lapide, habetur de una forma lapidis separata, an de una forma lapidis quae est in intellectu: utrobique enim sequitur quod scientiae non sunt de rebus quae sunt hic sed de rebus separatis solum....
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> Est ergo dicendum secundum sententiam Aristotelis quod intellectum, quod est unum, est ipsa natura vel quidditas rei. De rebus enim est scientia naturalis et aliae scientiae, non de speciebus intellectis. Si enim intellectum esset non ipsa natura lapidis quae est in rebus, sed species quae est in intellectu, sequeretur quod ego non intelligerem rem quae est lapis, sed solum intentionem quae est abstracta a lapide. Sed verum est quod natura lapidis prout est in singularibus, est intellecta in potentia; sed fit intellecta in actu per hoc quod species a rebus sensibilibus, mediantibus sensibus, usque ad phantasiam perveniunt, et per virtutem intellectus agentis species intelligibiles abstrahuntur, quae sunt in intellectu possibili. Hae autem

> species non se habent ad intellectum possibilem ut intellecta, sed sicut species quibus intellectus intelligit...nisi in quantum intellectus reflectitur supra seipsum, quod in sensu accidere non potest.
>
> Si autem intelligere esset actio transiens in exteriorem materiam, sicut comburere et movere, sequeretur quod intelligere esset secundum modum quo natura rerum habet esse in singularibus, sicut combustio ignis est secundum modum combustibilis. Sed quia intelligere est actio in ipso intelligente manens...sequitur quod intelligere sit secundum modum intelligentis, i.e. secundum exigentiam speciei qua intelligens intelligit.
>
> Haec autem, cum sit abstracta a principiis individualibus, non repraesentat rem secundum conditiones individuales, sed secundum naturam universalem tantum. Nihil enim prohibet, si aliqua duo coniunguntur in re, quin unum eorum repraesentari possit etiam in sensu sine altero: unde color mellis vel pomi videtur a visu sine eius sapore. Sic igitur intellectus intelligit naturam universalem per abstractionem ab individualibus principiis. 11

What are the individual conditions of the mobile that must be disregarded to accommodate the demands of universal intellectual knowledge? As is pointed out here in the text of the De Trinitate, they are circumstances attending the mobile as actually subject to motion. All motion is measured by time and implies at least movement according to place inasmuch as without local motion there is no other motion. 12

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11. De Unitate Intellectus Contra Averroistas, c. 5, nn. 255-257 (In Opuscula Philosophica).

12. "...Tempus est quoddam accidens motus, quia est numerus eius...unde ubicumque est motus oportet quod sit tempus. Omnia autem corpora sunt mobilia, etsi non aliis motibus, saltem motu locali; quia omnia sunt in loco." St. Thomas, In IV Physic., lect. 23, n. 2.

Local motion supposes place in the sense that a body moves locally in beginning to be in one place while ceasing to be in another place in which it previously had been.[13] As so determined to the present according to time and place, the subject of motion is a singular composite substance, a hoc aliquid[14] whose conditions are that it is this, here, and now. As such, it is known directly only in sensation.

> Manifestum est enim quod sensus cognoscit aliquid tale, et non hoc. Non enim objectum per se sensus est substantia et quod quid est, sed aliqua sensibilis qualitas, puta calidum, frigidum, album, nigrum, et alia huiusmodi. Huiusmodi autem qualitates afficiunt singulares quasdam substantias in determinato loco et tempore existentes: unde necesse est quod id quod sentitur, sit hoc aliquid, scilicet singularis substantia, et sit alicubi et nunc, idest in determinato loco et tempore. Ex quo patet quod id quod est universale, non potest cadere sub sensu. Non enim quod est universale determinatur ad hic et nunc quia iam non esset universale. 15

Where does this determination come from? Not from the fact that the mobile is singular. "...Singularium quae sunt in rebus corporalibus, non est intellectus, apud nos, non ratione singularitatis, sed ratione materiae, quae est

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13. "...Nunquam fuisset inquisitum de loco, nisi esset aliquis motus secundum locum. Ex hoc enim necesse fuit ponere locum aliud a locato, quia inveniuntur in eodem loco successive duo corpora, et similiter unum corpus in duobus locis..." St. Thomas, In IV Physic., lect. 5, n. 5.
14. Cf. St. Thomas, In II De Anima, lect. 1, n. 215.
15. St. Thomas, In I Post Anal., lect. 42, n. 5.

in eis individuationis principium"[16] The problem of individuation is one to be solved later on in the course of natural philosophy. Suffice it to say here that however matter be the principle of individuation, it makes the subject, as individuated, unattainable directly by the intellect and knowable only by reflection upon the act of sensation. Accordingly, it is rendered impossible of definition and demonstration. The reason is that such a principle of individuation is undetermined, a quid infinitum. "...Infinitum congruit materiae, quae est individuationis principium."[17] By induction we know that whatever exists in such matter is in potency to be and not-be. Thus the individual, the this, is corruptible, bereft of the necessity whereby it would be accessible to demonstration and also to definition. In can be accounted for in sensation but even then the accounting is liable to the same vagaries that affect sensation itself and may be of an equally fleeting duration. The contingency of the individual in regard to science is most clearly brought out by the fact that while it may serve as a remote principle of definition and demonstration, definition and demonstration are not of the individual but can be brought to bear upon it

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16. Ia, q. 56, a. 1, ad 2.

17. St. Thomas, In I Post Anal., lect. 38, n. 4.

only by what St. Thomas calls "application". 18

Unintelligible by reason of its indetermination as a principle of indefinite multiplicity, matter is the reason this world is intelligible only in potency. To compensate for this, our intellect naturally resorts to abstraction. Scientific knowledge of the changeable world is possible only in so far as it remains confined to the notions of changeable things without individuating matter and its conditions. St. Thomas is quick to add: "non autem absque materia non signata quia ex eius notione dependet notio formae quae determinat sibi materiam."

4. The notions of natural things are not without matter absolutely

At this point a digression from the text of St. Thomas, which we have endeavored to follow heretofore, appears advisable. It is prompted by this reference to non signate (common) matter as essential to the understanding of form with determinate matter. Up to now, St. Thomas has used the terms 'form' and 'notion' interchangeably. With a view to the mode of defining in natural philosophy it would seem that a further examination of the meanings of these terms, making more precise the reason for their convertibility, would be helpful.

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18. Cf. Aristotle, Metaph., VII, c. 15, 1040a 1-10; St. Thomas, In VII Metaph., lect. 15, n. 1611.

The Latin word *ratio* has many more meanings than the word we have used to translate it, namely, 'notion'.[19] It commonly signifies that which the intellect grasps of a thing and which is nameable. When the intellect is able to attain distinct knowledge by defining, the word *ratio* signifies the definition itself, although the verification of the word's meaning is not dependent upon the possibility of defining what the thing meant is. *Ratio* can be said of what is understood of the signification of the names quantity, quality and the other supreme genera; and even of the names of the Divine attributes, despite, the fact that none of these can be stricly defined.[20] The term *ratio* can also be extended to that which is signified by the definition and it is in this sense that St. Thomas speaks of *ratio, idest forma eius*.

Mention has been made above of the fact that the thing known informs the intellect, being somehow a principle of the intellect's operation. To understand this last meaning of *ratio* we should now consider this more closely.

> ...Res exterior intellecta a nobis in intellectu nostro non existit secundum propriam naturam, sed oportet quod species eius sit in intellectu nostro, per quam fit intellectus in actu. Existens autem in actu per huiusmodi speciem sicut per propriam formam, intelligit rem ipsam. Non autem ita quod ipsum intelligere

19. For some of these meanings cf. St. Thomas, *In Librum Beati Dionysii de Divinis Nominibus Expositio*, c. VII, lect. 5, n. 735. Of the four senses mentioned there, it is the last that pertains to the present consideration.
20. Cf. *In I sent.*, dist. 2, q. 1, a. 3, c.

> sit actio transiens in intellectum, sicut calefactio transit in calefactum, sed manet in intelligente: sed habet relationem ad rem quae intelligitur, ex eo quod species praedicta, quae est principium intellectualis operationis ut forma, est similitudo illius. 21

St. Thomas goes on in this place to explain the relation between this form and the sense of ratio that concerns us here.

> Ulterius autem considerandum est quod intellectus, per speciem rei formatus, intelligendo format in seipso quandam intentionem rei intellectae, quae est ratio ipsius, quam significat definitio. Et hoc quidem necessarium est: eo quod intellectus intelligit indifferenter rem absentem et praesentem, in quo cum intellectu imaginatio convenit; sed intellectus hoc amplius habet, quod etiam intelligit rem ut separatam a conditionibus materialibus, sine quibus in rerum natura non existit; et hoc non posset esse nisi intellectus sibi intentionem praedictam formaret. 22

When St. Thomas says "ratio, idest forma," the expletive is not merely an afterthought. The reason why these terms can be used one for another is therein indicated. "Forma vero, quae et ratio nominatur quia ex ipsa sumitur ratio speciei, dicitur substantia quasi ens aliquid actu, et quasi ens separabile secundum rationem a materia licet non secundum rem."[23] Form is called ratio because it is that which is signified by the definition. But our concern here

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21. Contra Gentiles, I, c. 53, n. 442.

22. Ibid., n. 443.

23. St. Thomas, In VIII Metaph., lect. I, n. 1687.

is with a particular kind of form, namely, a natural form, to which it is proper to be in matter--quae determinat sibi materiam. "Proprie enim formam in materia habent naturalia..."[24] Consequently, it cannot be a ratio, it cannot be adequately defined without matter. But this poses a difficulty. Matter, as we have seen, is the reason for individuality. It would therefore seem that a notion demanding matter together with form would itself be individual. But definition is only of the universal, not of the individual. St. Thomas provides the solution to this difficulty in the distinction between individual (signate) matter and common (non signate) matter. The notion of man, signified by the definition and, as such, a subject of science, does not include this flesh and these bones but it does include flesh and bones.

## 5. Individual matter and common matter

If the individual cannot be defined and if there are definitions of natural things whose forms are enmattered, then the universal notions in natural philosophy in some way include matter but not individuating matter. If they included individual matter or excluded even common matter, they could not be defined. Obviously, we are dealing here with an analogical word that can lead to hopeless confusion if its

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24. St. Thomas, In VII Metaph., lect. 11, n. 1517.

various meanings are not respected. When mention is made of common matter and individual matter, that which the word 'matter' signifies in each case is quite different. The two meanings, different among themselves, are also different from that which the word signified in its first imposition. They are, however, related to this first meaning according to an order of intermediary but proper impositions.[25] Matter in so far as it is responsible for individuation is a principle of numerical difference among things within the same species, a principle of sheer multiplicity. Such matter does not form part of a definition. In defining we must abstract from this matter which, as such, is called "part of the individual" or "part of the matter". The definition does, however, contain common matter; in defining we cannot abstract from it, for what the thing is cannot be understood without it. The definition, therefore, must signify not only form but form and matter. Common matter is called "part of the species" or "part of the form". As part of the species, such matter must be included in the definition which answers the question: What is this?

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25. Prior to its use by the philosopher, the term 'matter' already had a host of meanings. It meant timber, lumber and building material, in that order. Thus it proved an apt word to designate 'that of which anything is composed'. It was further extended to signify individual instances of a certain kind, a principle of numerical difference and eventually a part of natural definitions. Cf. C. De Koninck, "Abstraction From Matter", Laval théologique et philosophique, XIII, 1957, No. 2, pp. 157-167. It is with the latter two senses that we are presently concerned.

When, in its quest for knowledge about anything, the intellect frames this question, it proceeds toward an answer in a comparative way. That is, it comes to know it first in common with other things and only later as distinct from them. "Unde et in rebus quarum definitiones cognoscimus, primo eas in genere collocamus, per quod scimus in communi quid est; et postmodum differentias addimus, quibus a rebus aliis distinguatur; et sic perficitur substantiae rei completa notitia."[26] The unity of the genus is a work of the mind in the measure that it is a result of our way of knowing.[27] An equality is established by the mind in attending to that which many things have in common. There is no such thing in nature as animal taken as a genus. There are men and horses and cows but there is no animal that is only animal. This common notion according to which something is arranged within a genus is a confused knowledge susceptible of further determination.

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26. Contra Gentiles, I, c. 14, n. 112.

27. "Et huius ratio est, quia species sumitur a forma ultima, quae simpliciter una est in rerum natura: genus autem non sumitur a forma aliqua quae sit una in rerum natura, sed secundum rationem tantum; non est enim aliqua forma ex qua homo sit animal, praeter illam ex qua homo est homo. Omnes igitur homines, qui sunt unius speciei, conveniunt in forma quae constituit speciem, quia quilibet habet animam rationalem: sed non est in homine, equo aut asino aliqua anima communis, quae constituit hominem, vel equum aut asinum (quod si esset, tunc genus esset unum et comparabile, sicut et species); sed in sola consideratione accipitur forma generis, per abstractionem intellectus a differentiis. Sic igitur species est unum quid a forma una in rerum natura existente: genus autem non est unum; quia secundum diversas formas in rerum natura existentes, diversae species generis praedicationem suscipiunt. Et sic genus est unum logice, sed non physice." St. Thomas, In VII Physic., lect. 8, n.8.

It receives such determination from its differences which render it more and more distinct. Compared to that whence each is derived, genus is related to its differences as matter to form in the sense that that from which the genus is taken is matter for the form from which the difference constituting the species is taken.

> Intellectus enim humani proprium objectum est quidditas rei materialis, quae sub sensu et imaginatione cadit. Invenitur autem duplex compositio in re materiali. Prima quidem, formae ad materiam: et huic respondet compositio intellectus qua totum universale de sua parte praedicatur; nam genus sumitur a materia communi, differentia vero completiva speciei a forma...[28]

Although genus is said to be taken from matter, it must be remembered that it is knowledge nonetheless and there can never be knowledge of matter pure and simple. Hence the matter whence the genus is taken is already matter and form. "Sciendum tamen quod cum illud materiale, unde sumitur genus, habeat in se materiam et formam, logicus considerat genus solum ex parte eius quod formale est, unde et eius diffinitiones dicuntur formales, sed naturalis considerat genus ex parte utriusque."[29] Committed to a study of things in nature, the natural scientist cannot neglect this

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28. Ia, q. 85, a. 5, ad 3.

29. St. Thomas, In Boeth. de Trin., q. 4, a. 2, c. The entire first half of this article is given to a discussion of the cause of generic diversity and merits more attention than is allowed here.

matter. If he did he would be neglecting a fundamental principle upon which his knowledge depends. Thus even though the unity of the genus is a work of the mind, the community of natural philosophy is not one based on things as known. This is a freedom of the logicus that the natural scientist dare not share. It allows the former to equate stones with angels by simply affirming that both are subjects of which something may be said while neither is predicated of anything else. For the naturalist, who attends to things as they are and not as they are in the knower, such equality is inconceivable. "Naturalis vero et metaphysicus, qui considerant omnia principia rei, non invenientes convenientiam in materia dicunt genere differe secundum hoc quod dicitur in X Metaphysicae quod corruptibile et incorruptibile differunt genere et quod illa conveniunt genere, quorum materia est una et generatio ad invicem."[30]

In Bk. X of the Metaphysics[31] Aristotle makes the point that unlike contraries which divide a genus into its species and, as such, are not of the substance of that genus, corruptibility and incorruptibility are contraries belonging necessarily to things to which they are attributed. Since

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30. Ibid.

31. Aristotle, Metaph., X, c. 10, 1058b 26-29, 1059a 9; St. Thomas in X Metaph., lect. 12, nn. 2139-42.

whatever is accidental (as opposed to necessary) can not-be, if corruptibility were accidental to a substance then one and the same thing would at times be corruptible and at other times incorruptible, which, as St. Thomas observes, "est impossible secundum naturam." 'Corruptible', like 'incorruptible', expresses the substance, or something of the substance, of that of which it is predicated. At this juncture in his commentary St. Thomas adds: "Est unumquodque corruptible per materiam quae est de substantia rei." As being of the very notion of whatever substance they are predicated, it is impossible for the corruptible and the incorruptible to communicate in any genus. Earlier in the same book[32] Aristotle had established community in the same kind of matter as the source of unity for physical genus. Thus common matter is said to be a genus, not that it expresses indeterminately the whole essence of something of which it is predicated but as the essential component which is subject to contrary forms as the extremes of physical change. Things are said to be in the same physical genus which communicate in this same subject or matter.
So it is that when he defines, the natural scientist must attempt a determinate account of the matter in which the form is found. What something is made of is part of its definition; man, for instance, cannot be fully defined without flesh and bones.

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32. Aristotle, Metaph., X, c. 3, 1054b 27-29.

The necessity of defining in this way comes from the very nature of what natural philosophy is about. No science proves its subject. This is the first thing given in any science.[33] The subject of natural science is given or made known through the senses. "In scientia naturali supponitur quod naturalia moveantur.... Et quod naturalia moveantur, potest manifestum esse ex induatione; quia ad sensum apparet quod res naturales moventur."[34] This is not to say that the senses know the subject as such. Only the intellect does. But the intellect comes to know this subject with dependence on the senses.[35] Natural things are presented as changing, mobile things having within themselves the primary and proper principles of their own typical motion and rest. As thus given, the subject is known in an extremely confused way. "Naturam autem esse, est per se notum, inquantum naturalia sunt manifesta sensui. Sed quid sit uniuscuiusque rei natura, vel quod principium motus, hoc non est manifestum."[36] It is with the purpose of making this manifest that the scientist,

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33. "In qualibet enim scientia supponitur pro principio definitio subjecti: unde et in scientia quae est de natura, supponitur quasi principium, quod natura sit principium motus." St. Thomas, In VIII Physic., lect. 5, n. 3. Cf. In I Post. Anal., lect. 18, n. 9.

34. St. Thomas, In I Physic., lect. 2, n. 7.

35. Cf. De Veritate, q. 10, a. 6, ad 2.

36. St. Thomas, In II Physic., lect. 1, n. 8.

following an order of concretion, investigates every change and process of natural things in an endeavor to discover their proper principles, causes, properties and relations. At no time is he free to assert independence of the contact with reality provided by the senses. Throughout, all things considered by him are intelligible and definable with or in relation to common sensible matter.

It is true that in this way he will not be able to grasp things as clearly and distinctly as, for example, triangle is known in mathematics. As will be seen, mathematical subjects are understood apart from sensible matter. This is, in fact, the point at issue. Just as the common mode of demonstration, taught in the Posterior Analytics, must be applied according to the mode proper to each science in its turn, so too in the application of the common mode of definition, it is the particular science in relation to its own subject matter that is decisive.

## 6. Common sensible matter and the unity of natural science

In affirming that the natural scientist is forced to undertake an indirect approach to definition we do not mean to say that the natures of things remain entirely hidden from him. Rather they are manifested through their sensible qualities, their properties in so far as these are attainable,

and their operations. How efficacious this approach is in reaching a term in the sense of strict definition depends, of course, upon the degree of generality at which the investigation is being conducted. When considering things simply as mobile it may suffice to know them confusedly in terms of matter and form. Passing from this less determined subject to more determined subjects, i.e., in going from what is more known to us to what is more knowable in itself, the difficulty in attaining definition increases proportionately. Natural definitions, as we have seen, must include matter. But they must also include form as the reason for the determination which the matter is known to have. When there is question, for example, of things mobile according to quantity, the typical structure and function of living things demand considerable explanation.

> ...Cum quaerimus quid est homo, idem est ac si quaereretur propter quid hoc, scilicet Socrates, est homo? quia scilicet inest ei quidditas hominis. Aut etiam idem est, ac si quaereretur propter quid corpus sic se habens, ut puta organicum, est homo? Haec enim est materia hominis, sicut lapides et lateres domus. 37

The 'what it is' of material things, at least according to distinct knowledge of their specific nature, is not intuited or apprehended immediately. On the contrary, it is attained as the result of a mental process which consists in a certain

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37. St. Thomas, In VII Metaph., lect. 17, n. 1667.

reconstruction of this quiddity from its sensible attributes and effects. "...Cum volo concipere rationem lapidis, oportet quod ad ipsam ratiocinando perveniam; et sic est in omnibus aliis, quae a nobis intelliguntur.... Quamdiu ergo sic ratiocinando, intellectus iactatur hac atque illac, nec dum formatio perfecta est, nisi quando ipsam rationem rei perfecte conceperit...." [38] In this connection, St. Thomas, in article

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38. St. Thomas, Super Evangelium S. Ioannis Lectura, c. I, n. 26. Ratiocination in this place does not mean reasoning as accomplished in the third operation of the mind in uniting two things by means of a third. Rather it refers to a process of division and composition within the first operation. Since it is a movement from something known to something unknown it can be called reasoning. In this regard, the following is most informative: "In nobis falsitas accidit in operatione intellectus componentis et dividentis, ex hoc quod non absolute rei quidditatem apprehendit, sed rei apprehensae aliquid componit. In operatione autem intellectus qua apprehendit quod quid est, non accidit falsum nisi per accidens, secundum quod in hac etiam operatione permiscetur aliquid de operatione intellectus componentis et dividentis. Quod quidem contingit inquantum intellectus noster non statim, sed cum quodam inquisitionis ordine ad cognoscendam quidditatem alicuius rei pertingit: sicut cum primo apprehendimus animal, et dividentes per oppositas differentias, altera relicta, unam generi apponimus, quousque perveniamus ad definitionem speciei. In quo quidem processu potest falsitas accidere, si accipiatur ut differentia generis quod non est generis differentia. Sic autem procedere ad cognoscendum de aliquo quid est, est intellectus ratiocinando discurrentis de uno ad aliud." Contra Gentiles, III, c. 108, n. 2836.

three, will say that the first operation of the mind is "...qua formantur quidditates rerum...."

Because of the difficulties encountered in this formatio, most definitions in natural science are dialectical in the sense described in the discussion of article one. Proceeding, as he must, from the attributes and operations of things when seeking their explanation, the naturalist is aware that these attributes and operations may well be the effects of a plurality of causes, which plurality is not necessarily known to him in an exhaustive fashion. The desire for ultimate truth not withstanding, a point is quickly reached where it becomes apparent that this plurality frustrates any of hope of establishing the necessity required by science in the strict sense. When nature proves inscrutable it is the scrutator himself who must adapt by changing his method.

What then of the unity of natural science? In view of the varying levels of generality at which the philosophy of nature studies its subjects--that of the mobile in all its community and movement according to quantity have been mentioned in passing, but the ensemble of Aristotle's physics is structured according to the progressive particularization of subjects--and the need to supplement direct analysis by a more limited but more refined method of measurement, would it not seem that the science of nature comprises in actual fact a multitude of generically different sciences? Can there

be a fundamental oneness in the study of elements and compounds, organic and inorganic bodies, plants and animals? If the basic principles upon which our knowledge of them depends are irreducibly different, then they pertain to different sciences. But if their principles are the same, they pertain to the same science. It would be rather foolhardy to refuse to acknowledge the tremendous diversity on the part of natural things or to imagine that all are similarly amenable to scientific investigation. But it would be equally erroneous to suppose that this compromises the formal unity of natural science. Whatever be the divisions within the science, and they are many, they are only material. All natural things are parts of one and the same physical world; all are investigated by naturalist for the single purpose of understanding nature; all are intelligible and definable in the same manner, i.e., with common sensible matter.

Because of the way in which natural things are known, the common matter that is included in their definitions is called sensible matter. This will be discussed in article three. But before ending what has already become a lengthy digression, one final observation. It is this: We should distinguish between that which has sensible matter and sensible matter itself. According to St. Thomas, ens mobile and not ens sensibile is the subject of natural philosophy. What is the reason for this? The sensible qua sensible refers to