V DEMONSTRATION

Pseudo-Thomas' Acquisition of Science

After his treatise on the proposition, Pseudo-Thomas proceeds in the last two treatises—the eighth and ninth—to the third part of logic, which concerns the third act of the intellect.[1] The process of reason from one composed or divided—that is, from one proposition—to another occurs through argumentation. Argumentation is a discourse signifying a process of reason from one known to another unknown, or from a more known to a less known.[2] Two points may be noticed with respect to this initial description. First, Pseudo-Thomas gives an alternative to describing the process of reason as from the known to an unknown, for he says, "or from a more known to a less known."[3] Second, he considers the argumentation itself, which is linguistic, to be the means by which the process of reason occurs. This view agrees with his general treatment of the relation between the significance of language and the second and third operations of reason, which I have explained previously.[4]

In explaining why a term is defined as that into which a proposition is resolved, rather than as that from which it is constituted, Pseudo-Thomas says that logic has two parts—the inventive and the judicative. Invention is an excogitation of what is true or likely, which renders one side of a contradiction probable. Two books, the Topics and the De sophisticis elenchis subserve this part of logic. Judgment is a right determination of reason in matters of which there is judgment. Reason de-

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[1] Tr. VIII, chap. i. [2] Ibid.

[3] Ibid.: "Vel ad magis cognito ad minus cognitum."

[4] Supra, pp. 139-146.

termines rightly when it resolves what follows from principles back to the principles. Consequently, science, which is a right determination of what can be known scientifically, is through causes—that is, it comes about when reason resolves what is caused into the causes. Two books, the Prior analytics and the Posterior analytics subserve this part of logic. Pseudo-Thomas concludes that this is the reason why a term is defined here as that into which a proposition is resolved. After giving some other definitions, he goes on to say that the treatment of the syllogism considered absolutely—that is, irrespective of the probability or necessity of the premises—will be the concern of the present treatise.[1]

We have seen enough already to understand why Pseudo-Thomas chooses to treat the analytic or reductive part of logic here, to the exclusion of the inventive part. Indeed, the Proemium makes it sufficiently clear that he is interested in achieving a science of scientific knowledge, as a condition of the attainment of science itself. My treatment of the work in the second chapter showed the meaning of this intent and explained the reason for it. It is interesting to notice that Pseudo-Thomas here considers the fact that science is through causes a consequence of the fact that reason determines rightly when it resolves what follows from principles into the principles. This way of stating the relation seems to me to imply that Pseudo-Thomas considers the notion of cause derivative from the notion of resolution—that is, a cause will be merely that which is prior and more known, into which what is less known can be reduced. We shall see the results of this view shortly.

Although the treatise on the syllogism absolutely considered is interesting in itself, I shall not deal with it here. The next treatise, on demonstration, which is the last treatise of the work, can be considered sufficiently for my purposes without examining in further detail the treatment of syllogistic form.[2] Comparisons between Pseudo-Thomas' approach to the problems of syllogistic form and the procedure of Aquinas are virtually impossible, since Aquinas has no work on this material and makes few explicit statements concerning it.

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[1] Tr. VIII, chap. i.

[2] I have indicated briefly how this treatise proceeds supra p. 51.

One point in Pseudo-Thomas' treatment of the syllogism must be mentioned, however. In explaining the reasons for the names which are given to the various parts of the syllogism, Pseudo-Thomas takes as his principle that man is rational. He then explains the significance of rationality.

> Now, he is called "rational" and not "intellectual," since intellect apprehends without discursive process; while reason, although it is not a power distinct from intellect, still is called "reason," since it apprehends whatever it apprehends with process. Reason, therefore, does not come to a perfect apprehension of anything unless it proceeds from more known to less known. For example, for knowing perfectly what man is, first we understand that he is a being, then that he is a substance, then that he is a body, then that he is a living body, then animal, and then rational; and so we come into a knowledge of man by proceeding discursively. Whether such a process may occur without composition—that is, by understanding being, substance, body, not positing "is" there, so that we would not say, "This is a man,"—or whether it may occur with composition, is not to the point; it suffices that we understand by a discursive process and that such a process is from more known to less known. Now, the more universal are more known to us, as is said in Physics i, since they are more confused. Therefore, the discursive process in our knowledge is from more universal to less universal. Consequently, we know being before and better than we know substance, and substance than body, and body than animate body, and animate body than animal, and animal than man. Now, from such a discursive process is the syllogism, which is nothing other than a sentence, or group of sentences as Boethius says, in which there is such a discursive process.[1]

It seems to me that this passage reveals three things concerning Pseudo-Thomas' general action of the reasoning process. First, he considers the

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[1] Tr. VIII, chap. iv: "Dicitur autem rationalis et non intellectualis: quia intellectus apprehendit sine discursu; non ergo venit ad perfectam apprehensionem alicujus rei nisi discurrat a magis noto ad minus notum. Verbi gratia, ad cognoscendum perfecte quid sit homo, primo intelligimus quod sit ens, deinde quod sit substantia, deinde quod sit corpus, deinde quod sit animatum corpus, deinde animal, deinde rationalis; et sic venimus in cognitionem hominis discurrendo. Sive autem talis discursus fiat sine complexione, scilicet intelligendo ens, substantiam, corpus, non ponendo ibi "est" ut scilicet non dicamus "hoc est homo"; vel fiat cum complexione, nihil ad propositum; sufficit quod discurrendo intelligimus, et talis discursus est a magis noto nobis ad minus notum. Magis autem nota nobis sunt magis universalia, ut I Physicorum dicitur, quia sunt magis confusa. Discursus ergo noster in nostra cognitione est a magis universalibus ad minus universalia. Unde magis et prius cognoscimus ens quam substantiam, et substantiam quam corpus, et corpus quam animatum corpus et animatum corpus quam animal, et animal quam hominem. De tali autem discursu est syllogismus, qui nihil aliud est quam oratio, seu congregatio orationum, ut Boethius dicit, in qua est talis discursus."

syllogistic structure to be a linguistic formulation of a rational process which need not be a movement from truth to truth, but can be merely a series of apprehensions—or a progressive apprehension—of a thing's nature.[1] Second, in this description, he has abandoned reference to the movement from known to unknown, in favor of the characterization, "from more known to us, to less known." This seems to me to be in agreement with the interpretation I have given of Pseudo-Thomas' view of the process of knowledge as an explication of the content of our original possession of being, rather than as a successive realization of intellectual potentiality by a genuine addition of knowledge-content concerning things.[2] Third, at least in the example used here—which we must assume is intended to be typical, since it is introduced for the sake of explaining the names of the parts of any syllogism—Pseudo-Thomas seems to consider the rational process to be a fairly simple and direct movement from the more to the less universal. A scientific analysis of a fact, consequently, ought to be similarly simple and direct—that is, a reduction of a complex object of understanding to its more universal and better known parts.

The first chapter of Pseudo-Thomas' ninth treatise—on demonstration—serves as a general introduction. Pseudo-Thomas explains that since science is the possession of a demonstrated conclusion, acquired from the very speculation of it, to know what science is and how it is acquired, it is necessary to know scientifically what demonstration is.[3] He next defines demonstration as a syllogism from premises which are true, necessary, essential, primary, proper, known through themselves, immediate, and causes of the conclusion. This definition, he remarks, is appropriate only to demonstration of the reasoned fact, not to demonstration of the mere fact. He says he will treat first the parts of the definition which pertain to the matter of demonstration—that is, all the characteristics of the premises—and then the part which pertains to its form—that is, the figure

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[1] Cf. tr. II, chap. ii, where he begins explaining substance by noting that we understand discursively.

[2] Supra, pp. 144-146.

[3] Tr. IX, chap. i: "Cum enim scientia sit habitus conclusionis demonstratae acquisitus ex ipsius speculatione; est sciendum quid sit scientia, et quomodo acquiratur, necesse est scire quid est demonstratio."

and mode of the syllogism. He then says that it is obvious from the end of demonstration—to know scientifically—that it proceeds from premises which are true, necessary, and so on. He explains this by emphasizing two factors: first, that to know scientifically is to know the cause of something, precisely as it is the cause of that effect in act; second, that to know scientifically is to know with certitude. Consequently, it is necessary that the conclusion of demonstration, whose possession is science, should proceed from such premises.[1]

According to his plan, the treatise is divided into two parts. In chapters two to twelve, he considers demonstration; in chapters thirteen and fourteen, he considers the sciences themselves, which are effects of demonstrations.[2] In chapters two to ten, he considers demonstration of the reasoned fact; in chapters eleven and twelve, he considers demonstration of the mere fact.[3] In chapters two to eight, he explains the parts of the definition of demonstration which pertain to its matter; in chapters nine and ten, he explains what pertains to syllogistic form.[4] Chapter two contains preliminary considerations of the notions of predication true in every instance, essential, and commensurately universal.[5] On the basis of these considerations, he explains the characteristics of the material of demonstration of the reasoned fact in chapters three to eight.[6] In chapter three, he explains why demonstration must proceed from true and necessary premises.[7] In chapter four, he explains why demonstration must proceed

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[1] Ibid. In the conclusion, Pseudo-Thomas mentions only two of the conditions—true and necessary—although an "etc." appears after these two in the original statement. I think that his intention is to explain all of the requirements.

[2] Ibid., chap. xiii. The last two chapters, on the certitude and unity of sciences, correspond to Aquinas' In Post. anal., I, lect. xli.

[3] S. t. l., tr. IX, chap. xi; the two latter chapters correspond to Aquinas, op. cit., I, lect. xxiii-xxv, with some reference to I, lect. ii and II, lect. i.

[4] S. t. l., tr. IX, chaps. ii and ix. The two chapters on syllogistic form correspond to Aquinas, op. cit., I, lect. xxvi and xxxix-xl.

[5] S. t. l., tr. IX, chap. ii; cf. Aquinas, op. cit., I, lect. ix-xii.

[6] S. t. l., tr. IX, chap. iii.

[7] In part, this chapter corresponds to Aquinas, op. cit., I, lect. iv and xiii.

from premises in which there is essential, not accidental, predication.[1] In chapter five, he explains why demonstration must proceed from primary and immediate premises.[2] In chapter six, he explains why demonstration must proceed from proper, rather than from alien or common, principles.[3] In chapter seven, he explains why demonstration must proceed from premises known through themselves.[4] In chapter eight, he explains why demonstration must proceed from causes of the conclusion.[5]

Comparing Pseudo-Thomas' treatise on demonstration with Aquinas' commentary on Aristotle's Posterior analytics, the degree to which he has used the commentary is striking and obvious, as I have noted. However, Pseudo-Thomas' omissions also are interesting. He does not include a treatment of the necessity and mode of pre-existing knowledge at the beginning of the treatise;[6] he mentions it only when he explains how demonstration of the mere fact occurs in diverse sciences; then he treats it as an explanation of the statement that in every demonstration we know something before the conclusion is demonstrated and we know something about it after it is demonstrated.[7] Pseudo-Thomas does not include a treatment of the impossibility of endless or circular demonstration.[8] He does not discuss how we may be involved in ignorance and error by our effort to demonstrate.[9] He does not deal with the problem of the impossibility of an infinite regress in demonstration.[10] He does not concern himself with the comparative treatment of demonstrations, sciences, and other modes of knowing,[11] except for his final two chapters on the certitude and unity of sciences[12] and some possible references to affirmative and negative demonstration in his ninth and tenth chapters--on the form of the demonstrative syllogism.[13] Finally, he does not mention the content of the second book of the Posterior analytics, except for a reference to the four questions with which it opens; he

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[1] Cf. ibid., lect. xiv.
[2] Cf. ibid., lect. iv-v.
[3] Cf. ibid., lect. v, xv, xvii-xx.
[4] Cf. ibid., lect. iv-v.
[5] Cf. ibid., lect. iv and xiv.
[6] Cf. ibid., lect. i-iii.
[7] S. t. l., tr. IX, chap. xii.
[8] Cf. Aquinas, op. cit., lect. vii.
[9] Cf. ibid., lect. xxvii-xxx.
[10] Cf. ibid., lect. xxxi-xxxvi.
[11] Cf. ibid., lect. xxxvii-xliv.
[12] Cf. ibid., lect. xli.
[13] Cf. ibid., lect. xxxix.

uses the four questions to divide demonstration of the reasoned fact from demonstration of the mere fact.[1] Aquinas considers the second book to be a study of the principles of the demonstrative syllogism. These are the middle term and the common principles. Since demonstration comes from pre-existing knowledge, it is necessary to show how these principles become known.[2] The examination of the middle term, according to Aquinas, divides into two parts; the first explains how essence and cause are related to demonstration, while the second shows how these are to be investigated.[3]

Now, it seems to me that Pseudo-Thomas' omissions, and the pattern of his omissions, itself is significant, for it indicates how exclusive is his interest in showing what demonstration is, and what are the properties of science as an effect of demonstration. However, it might be argued that Pseudo-Thomas merely has omitted some sections in order to treat the essential material in a manner suitable to an introduction to logic. Consequently, I shall not rest my case on his omissions, but on his positive treatment of a few important points.

The first point I will consider is the relationship Pseudo-Thomas determines between definition, cause, and demonstration. The second mode of essential predication occurs when a property is predicated of its subject; the subject is placed in the definition of the property, not as an essential part of it, but as something outside its essence, without which it cannot be known. The reason Pseudo-Thomas gives for this is that since the being of the accident depends from the subject, the definition which signifies its being, contains the subject in itself.[4] Here we have the crux of the problem of demonstration as Pseudo-Thomas faces it. The property is not essential to its subject; therefore, the natures of the subject and the property are quite distinct. Nevertheless, the being of the property depends on the subject, so that the property includes the subject in its definition. But why must there be a connection? Pseudo-Thomas does not answer that question in this treatise; he has dealt with it in the treatise on the predicables. We must review that discussion in order to understand what he will say here concerning demonstration.

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[1] S. t. l., tr. IX, chap. xi.
[2] Aquinas, op. cit., II, lect. i.
[3] Ibid., lect. ii.
[4] S. t. l., tr. IX, chap. ii.

Since a property is predicated of its subject essentially, it must be related to it otherwise than are common accidents. All accidents inhere in their subjects as forms in a material cause, but such a relationship does not involve the necessity of what inheres. However, properties inhere of necessity and are predicated essentially. We see this in the case of natural things which have certain operations that always belong to the individuals of a species--for example, all magnets attract iron. Consequently, there must be a certain intrinsic principle permanently in these bodies. Nor can it be said that the necessity is only for generation and not for being, since then it would make no difference how often something was generated with the quality, it would be a common accident, not a property. It remains that the subject must be related to the property as an efficient cause. This can be explained, since properties act as instruments of substantial forms in generation; hence they must receive some power from them; however, they receive no power distinct from themselves; therefore, substantial forms of subjects are efficient causes of properties.[1]

This position, however, involves a difficulty, since the subject is both agent and patient--efficient cause and matter--with respect to the property. Pseudo-Thomas solves this difficulty by arguing that just as a thing is disposed in receiving, so a thing is disposed in acting. But a patient is a patient not only according to itself, but also according to the dispositions by which it is receptive. It follows, then, that an agent--in this case, the subject itself--can be an agent insofar as it is a disposition for the action of another agent. In the given instance, the subject is a disposition for the efficient causality of the thing which generates it with respect to the properties which inhere in it. The subject, then, is an efficient cause of its properties, but only insofar as it is an instrument of its own cause; on the other hand, it is of itself the subject in which those properties inhere.[2]

In the following chapter, Pseudo-Thomas explains that a property belongs only to one species, since each species has its own formal grade of being; in every grade, therefore, there is one specific form, which in no

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[1] Tr. I, chap. vi. [2] Ibid.

way exists or operates in the grade of being or operating of the specific form of another species. Still, in a broader sense, there are properties of subalternate species which can be genera, as well as of the lowest species. Near the end of this chapter, Pseudo-Thomas also points out that a property belonging as such to one species—for example, heat to fire—can belong to many other things by participation.[1]

In the next chapter, again, Pseudo-Thomas discusses the question of the relation between the subject and its properties. The subject does not depend on its properties as upon a cause of itself, but as upon what follows from it. When two things depend on each other, either causally or according to consequence, they can be understood separately in the first operation of the intellect, but they cannot be understood to be without one another—that is, in the second operation. Therefore, we can understand a subject simply without understanding its properties, but we cannot understand a subject to be without its properties.[2]

From this treatment of property, three points seem to me to follow. First, a simple definition of a subject in itself will not imply or lead to a knowledge of the property, for the subject by itself is either the matter in which the properties are present or it is an efficient cause of the properties only by being a disposing cause for the action of an extrinsic agent. Second, although Pseudo-Thomas gives one example—that of the magnet—where he seems to call upon experience to verify such a connection, the relationship as it is experienced hardly seems sufficient to establish the connection, since things which do not have a certain quality as a property can have it by participation. Finally, however, if the property depends on the subject, and the subject also depends on its properties as on what follows from it, then the two cannot be understood to be separately. Now, as I already have explained, this statement, viewed in the light of the treatise on the proposition, does not seem to indicate precisely that the two forms cannot exist apart; rather, it means that the two are included in the object understood which is predicated of things—since that object is a complex whose elements are necessarily connected by relations which are expressed by conditional propositions—although one may

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[1] Ibid., chap. vii.

[2] Ibid., chap. viii.

remain implicit when the other is predicated explicitly in a categorical proposition.[1]

Returning to the treatise on demonstration, we see that Pseudo-Thomas begins to treat the requirements for the premises by explaining why they must be true and necessary.[2] The reason they must be true is that they are causes of the conclusion; false premises can lead to a true conclusion, but cannot cause it. The reason they must be necessary is that science implies certitude, which is not possible concerning contingents as such, but only concerning necessary things; the conclusion, then, of which the possession is science, must be necessary. Consequently, since to know scientifically is to know a necessary cause, the premises must be necessary; for although a necessary conclusion can follow from contingent premises, it cannot do so as from a necessary cause. Pseudo-Thomas' conclusion from this is that the middle must be related necessarily to both extremes.[3]

Pseudo-Thomas applies this result at the beginning of the next chapter. The point of the chapter is to show that the premises must involve essential predication. He lays down the principle—which, indeed, is a conclusion from the preceding chapter—that in the most powerful affirmative demonstration the middle will be the definition of the subject taken together with the definition of the property.[4] I interpret this to mean that to insure the necessary unity of the subject and the property, it is necessary to make explicit the two natures, both of which are contained in a single complex object understood. In the remainder of the chapter, he does two things. First, he easily shows that the premises and conclusion will involve one or another of the modes of essential predication. Second, he gives an example of a demonstration in which the middle term is a definition of both the subject and the property. The example is as follows. All multitude measured by unity, of which there is no middle unit, is even; but four is of this kind; therefore, four is even.[5] This example shows that by "a definition of the subject taken together with the definition of the property," he means precisely an explicit formula of what each

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[1] Supra, pp. 155-156. [2] Tr. IX, chap. iii.
[3] Ibid. [4] Ibid., chap. iv. [5] Ibid.

of them is.

In the following chapter, Pseudo-Thomas uses the same principle to prove that the premises must be primary--that is, commensurately universal. He notices that the example given in the last chapter does not meet this requirement; the subject should be the unnamed class of even numbers. If the middle had been a definition of the subject with the property, all the terms would have been convertible. Similarly, with such a middle, the terms are immediate to each other.[1] By taking the subject and the property in distinction from each other as a point of departure, Pseudo-Thomas has achieved simplicity in his treatment; he can enjoy this simplicity so long as he can show how the middle unites the two extremes. He has assured their unity by making the middle define both together. In the sixth chapter, Pseudo-Thomas uses the same principle concerning the middle term to prove that the principles must be proper. He then adds a discussion of common and proper principles.[2] In the seventh chapter, he uses his principle again to prove that the premises must be known through themselves.

In the eighth chapter, he uses it to show that the premises must express the causes of the conclusion. First, he eliminates the sense in which all premises are causes of a syllogistic conclusion. Then he defines another sense: the premises contain the cause both of the subject and of the predicate of the conclusion. This is the condition necessary for scientific knowledge of the reasoned fact, and it is fulfilled since the middle is the definition of both extremes. All good definitions are through a cause; therefore, the middle has the cause of both extremes. However, it can be any of the four causes with respect to the subject, while it will express the material and efficient causes of the predicate, regardless of which cause is used to define the subject.[3]

Even when he deals with the form of the demonstration, Pseudo-Thomas uses the same principle. The most powerful affirmative demonstration must be formed in that figure and mode in which the middle is the cause of the property and of the subject; this must be the first mode of the first figure.[4] In negative demonstration, the immediacy of the affirmative premise

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[1] Ibid., chap. v.
[2] Ibid., chap. vi.
[3] Ibid., chap. viii.
[4] Ibid., chap. ix.

is assured, for the middle defines the subject and the property.[1]

It seems to me that this treatment of demonstration of the reasoned fact has two results. First, the problem of how we know the cause either of the subject or of the property themselves is not touched; that we do have such knowledge—presumably by a simple discursive process—is presupposed by the actual demonstration, since demonstration uses as its middle the definition of the property as well as the definition of the subject, and both of these are defined through their causes. What is known through the demonstration is that the property actually is in the subject—that is known either as a mere fact, or as a reasoned fact, if the demonstration contains the definition of the subject and the property.[2] Second, however, since the property is fully understood in itself before the conclusion in demonstration, the causal knowledge which is acquired merely is the resolution of the conclusion to the complexity of the thing and the object understood, which already were known, but all of whose connections were not explicit. In the major premise, a comparison is objectified between a complex in a thing and a certain understood nature—which is a property. In the minor premise, a comparison is objectified between a nature in a thing and an explicitly understood complex object. The necessary connections in both complexes, together with their perfect correspondence with each other, make explicit the connection between the nature in the thing, which is signified by the subject in the conclusion, and the nature understood, which is signified by the predicate. If the explication occurs through such a middle, the reason for the connection between the two extremes also is evident, since they are within corresponding complexes. The question concerning how the content of these complexes can become sufficiently explicit that this apprehension is possible—that is, the question concerning how causes are known, so that definitions can be given through them—is not treated. The entire content of the demonstration must be known in advance of the conclusion; all that the conclusion makes known is a truth which previously was not objectified by itself, but which now is apprehended in a context which makes its necessity evident—that is, it immediately can be reduced to the objects understood, which

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[1] Ibid., chap. x. [2] Ibid., chap. xii.

have been explained in the treatises on the predicables and the categories. Finally, it seems to me that Pseudo-Thomas' treatment of the causal reduplicative proposition, in the last chapter of his treatise on the syllogism according to its form,[1] prefigures the form of the demonstration in a propositional formulation.[2] According to my interpretation, in the reduplicative, the conditional exponent represents the internal connection between forms within a complex; the causal exponent represents the relation between the complex as a whole and the forms included in it, since the explicit complex contains the whole cause of the being of the thing with its property.

On the basis of this explanation of Pseudo-Thomas' doctrine concerning demonstration of the reasoned fact, his distinction between it and merely factual demonstration is not difficult to understand. He notes that we can know four points about a thing--what it is, whether it is, that it is, and why it is. To explain these, he points out that science is only of truths; truth and being are converted; therefore, science will be concerned with being. Being, however, is twofold--being of essence, and being of actual existence. Since being of essence is called "quiddity," or what a thing is, when we know the being of something's essence, we are said to know what it is. Being of actual existence is diverse in substance and in accident. In substance, to know the being of actual existence is merely to know that it is in act; this is to know concerning the thing whether it is. In accident, the being is inherence; therefore, to know its being of actual existence is to know that it is--that is, to know that it is in something. Sometimes something is in something because of some cause; therefore, to know that cause is to know why--that is, the reasoned fact. Demonstration of the reasoned fact, then, is that in which there is a manifestation of the reason why the predicate is in the subject in the conclusion. Demonstration of the mere fact, on the other hand, is one in which something is concluded to be in some subject, but the reason why is not shown. Since demonstration of the reasoned fact proceeds from causes which are immediate, demonstration of the mere fact will occur either because the proof proceeds from effects, or because it proceeds

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[1] Tr. VIII, chap. xviii.

[2] Cf. supra, pp. 34-35.

from causes which are not immediate. Pseudo-Thomas gives examples of both cases.[1]

In the following chapter, while he is speaking universally concerning what is known in demonstration before the conclusion, and what is known after the conclusion is demonstrated, he says that we must know in advance what the subject is, since the middle is a definition of the subject and the property, and we also must know that it is, since nothing can be demonstrated concerning what is not in act.[2] This statement agrees with his original assertion that for a demonstration of the reasoned fact it is necessary to know the cause, not merely as cause, but as cause of an effect in act.[3] However, he now introduces a significant qualification, for he says that by "being in act" he means either in itself, or in its causes, since although a rose is not in act, we still can demonstrate a property of it, for it is in its cause.[4] This alternative—that is, that the cause of the effect in act can be known if it is not in act in itself, but only in its cause—clearly applies only to demonstration of the reasoned fact, since it is only in such demonstration that the causal middle term is the means for demonstrating.

On the basis of my interpretation of Pseudo-Thomas' treatment of the demonstration of the reasoned fact, then, what he accomplishes by his distinction between it and demonstration of the mere fact is the separation of those cases in which we have a complete explication of necessary connections and truth-correspondences from the cases in which there is not a complete explication. In the former set of cases, the logical apparatus he has established can reduce the demonstrated conclusion to its ultimate principles—the natures in the things, of which being itself is the first, and the intellect itself. In the latter cases, either the necessary connections within the complexes are not explicit—in this case, the proof is through a remote cause—or the conformities we happen to know first are not those of the complex understood to the substantial nature in the thing and of the property to the thing in its complex unity, but an alternative combination—in this case, the proof is through an effect, since the mid-

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[1] Tr. IX, chap. xi.
[2] Ibid., chap. xii.
[3] Ibid., chap. i.
[4] Ibid., chap. xii.

dle is not a combined definition of the subject and property. From what he has said about relations between the four questions, it seems that Pseudo-Thomas considers demonstration of the reasoned fact to depend completely on essential being, so that the cause can be known as cause of the effect in act, even when it is not in act in itself, but only in its cause; demonstration of the mere fact, on the other hand, would require the actual existence in itself of the thing signified by the subject of the conclusion, since the unity of the natures must be seen in some thing.

Pseudo-Thomas next takes up the problem concerning how demonstration of the fact occurs in diverse sciences. He says that to understand this, it is necessary to explain what is known in the demonstration before the conclusion, and what is known after it is reached. With respect to the first, he explains that we must known in advance that the axioms, which do not formally enter demonstration, are true.[1] He previously has distinguished these principles, which are formed of such terms that they cannot be unknown then the terms are known, from principles which contain definitions. The axioms do not formally enter any demonstration, but they are present virtually, as the principle of contradiction is involved in the statement that Peter runs, since it is certain either since he is a man, or not.[2] He explains that we must know what the property is, but not that it is, and both what and that the subject is, since the definition of the subject and property is the middle term, but that the property is, is to be demonstrated.[3]

The explanation continues by saying what we know after the conclusion is demonstrated. In a demonstration, there are premises and a conclusion. The premises are first in a science or secondary. If they are secondary, they can be demonstrated through those which are primary--that is, within the science, at a certain point they will be conclusions. Primary premises cannot be known in the same science by demonstration of the reasoned fact, for there are no principles except the axioms by which they could be demonstrated. For this reason, it is said that no science proves its own principles. However, if they must be proved, they will be proved by a superior science, as natural science proves the principles of the science

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[1] Ibid., chap. xii. [2] Ibid., chap. vi. [3] Ibid., chap. xii.

concerning animals. Or, at least, they can be proved by mathematics or dialectics, which are sciences common to all, and which prove the principles of all the sciences, although mathematics does so demonstratively, while dialectics does so with probability.[1] It is not clear here whether Pseudo-Thomas means that mathematics demonstrates the mere truth of the principles of particular sciences, or whether he means that it can give a demonstration of the reasoned fact concerning them. It seems, however, from what he has said, that the demonstration he intends is merely of the truth of the principles of the particular sciences. He concludes this statement concerning what is known after the conclusion is demonstrated by saying that we know either the reasoned fact or the mere fact of the conclusion.

This entire treatment of what is known in the demonstration has prepared for an explanation of how demonstration of the mere fact occurs in diverse sciences. He explains that two sciences can have the same subject, one formally, the other naturally. One example is geometry and perspective, since geometry concerns lines as such, and perspective concerns lines as visual. Therefore, whenever anyone demonstrates something of a line which is visual through principles of the lines as such, the geometrician knows the reasoned fact, while the scientist of perspective knows only the fact.[2] For me, this chapter is a puzzling one, since Pseudo-Thomas does not clearly state why the long introduction is necessary in order to state the relation between the two sciences—one of which is subalternate, knowing the fact, and the other subalternating, knowing the reasoned fact with respect to the same conclusion. It seems to me that what he is trying to do—by discussing the proof of principles and then the subalternation of sciences—is to reduce at least some cases of demonstration of the mere fact to demonstration of the reasoned fact. This cannot be achieved directly, since the principles of the higher science are not appropriate—that is, they do not give the middle which defines the terms of the principles of the lower sciences. However, if the principles of mathematics can prove the principles of the lower sciences as to the fact, they also can give mathematical reasons for what belongs to the subjects of the lower

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[1] Ibid. [2] Ibid.

sciences, insofar as those subjects include mathematical forms. I do not think Pseudo-Thomas' statements here make clear what he is trying to do, but if my previous interpretation is correct, it is appropriate that he should attempt to eliminate as much as possible the merely factual in favor of reasoned facts, which are susceptible to full logical reduction.

That this is the point of his argument seems to be borne out by his procedure in the following chapter, where he treats the requirements for the certainty of a science. Again, however, what he wishes to say is not altogether clear. He explains that there are two ways in which one thing can be more known absolutely than another—the cause is more known than the effect, and the form is more known than the matter. After distinguishing these two, he combines them in a single statement, concluding that those sciences which give the cause and the reasoned fact, as has been shown with the subalternating sciences, are more certain than those which indicate the matter; consequently, geometry is more certain than perspective. Next, he distinguishes between sensible or natural matter and intelligible matter or continuity. He places natural science on the lowest degree, for it does not abstract from either matter; geometry is on the next degree, for it abstracts from sensible matter; arithmetic is on the highest degree, since it abstracts from matter altogether. Finally, he concludes that sciences are more certain in a threefold classification. First, those which give the reasoned fact are more certain than those which give the mere fact. Second, those which indicate form are more certain than those which indicate sensible matter. Third, those which indicate form and do not concern intelligible matter are more certain than those which concern such matter.[1] The final classification is not clearly aligned with what has preceded it; I am not sure, but Pseudo-Thomas seems to say here that within natural science, greater certainty is had when the reasoned fact is demonstrated, but there is a hierarchy among the three kinds of sciences such that the less material sciences produce even greater certainty. In any case, it seems to me that he is trying to order the sciences in a single hierarchy, such that the higher sciences will provide the means for completing the reduction to ultimate principles begun by the lower sciences.

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[1] Ibid., chap. xiii.

In the final chapter, Pseudo-Thomas explains the unity of science. The process of a science involves as it were a certain motion of reason. A motion has two terms. In a science, likewise, there is the subject, at the knowledge of which the science terminates, and the principles, from which it begins. The first principles of a science are the proper parts of the subject. Consequently, for us to have science of anything, it must have prior to itself integral parts; these are the principles from which the process of the science begins. Its term is the subject, not merely in itself, but that the property be manifested of the subject. A science is unified which has a single class of subjects formally considered--that is, things which have the same parts and properties, and can be known by the same appropriate principles. He illustrates this point with analogies and examples, which include the point that although mathematics and natural science both deal with body, which is the same in the subject, they are different sciences, since mathematics considers the principles of quantity, while natural science considers the principles of motion. He concludes from this that the unity and diversity of sciences is precisely from the unity and diversity of principles. However, he points out that the principles which he has mentioned are those which are first in a science; according to the community of these principles, sciences are more or less common. The first principles within a science are known by the definition of the subject.[1]

This final chapter, again, is not wholly clear. On the one hand, Pseudo-Thomas preserves distinctions among sciences according to their proper principles, which are reduced here to proper integral parts. This notion agrees with his treatment of scientific knowledge itself in this whole work, for he has successively developed an explanation of science by examining its parts; here he is showing the properties of science itself. On the other hand, he seems again to indicate that all the sciences fall into a single hierarchy, the one having the most common principles being the most general. From what he has said, this would seem to be arithmetic; however, the community of arithmetic extends to all subjects either insofar as they are considered according to the principles of arithmetic, or insofar as they indirectly depend on it to prove their prin-

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[1] Ibid., chap. xiv.

ciples factually true. It seems to me that Pseudo-Thomas is aiming at a close relationship among the sciences and that he wishes to make scientific conclusions uniformly reducible, but that the mode of the reduction is not clear.

We have seen enough of Pseudo-Thomas' positive treatment of demonstration and science in this treatise to understand the reasons for the omissions which I mentioned previously. A treatment of the knowledge prior to demonstration seems unnecessary, since the previous treatises of this logic have dealt with knowledge prior in reduction, and Pseudo-Thomas is interested only in reduction. For the same reason, he omits consideration of how the definition and cause are made known, since he assumes that they are known, and intends to reduce this knowledge; in other words, his treatment of analytics is a very exclusive one. His position has simplified the relations between definition, demonstration, and cause to such an extent that no treatment of these questions is necessary. On the other hand, his previous work makes unnecessary an explanation of why demonstration must be limited, for he relates demonstration to the objects understood in such a way that it clearly is limited, if the reduction of natures in the first part itself is limited. He is not interested in problems concerning how we become involved in ignorance or error when we attempt to demonstrate, or how demonstration is related to other modes of knowing, since these considerations do not help to transform a demonstrated conclusion into a permanent intellectual possession by logical reduction.

In sum, Pseudo-Thomas has explained demonstration by showing how it makes explicit a certain relationship which already was known implicitly. This relationship, in perfect demonstration, unifies various categories and also unifies the objects understood with the natures in things. The entire explicit unity is reduced by the explanation of demonstration to prior principles, for it depends on the content first received from things, and on the subsequent acts of the intellect with respect to that content. His treatment of the properties of science seems to be an attempt to bring about a further and final systematic unity of all objective content, in correspondence with the initial unity of being.

Ockham's Comprehension of Mediate Necessity

The second section of the third part of Ockham's Summary of Logic is concerned with demonstration. The first point to be known, he tells us, is that according to the doctrine of Aristotle demonstration is a syllogism productive of scientific knowledge. This definition is of the word "demonstration;" it depends merely on ordinary usage. Nevertheless, it is constituted as the foundation on which everything said in the treatise is based.[1] Thus, the word "demonstration" is connotative, not absolute; it indicates a certain complex of signs which naturally has a certain result, but a result distinct from itself. It is not the case that demonstration is merely conventional, nor that the propositions in it are true by convention, nor that the result of demonstration is conventional; however, it is the case that the choice of a certain form of signification with a certain effect as an object for consideration is contingent on ordinary usage. Consequently, the word "demonstration" means "syllogismus faciens scire" by the use of those who talk about it, and this nominal definition is the foundation of the entire treatise.

"To know scientifically" itself is equivocal. It can mean the evident comprehension of any truth, whether necessary or contingent. It can mean the evident comprehension of a necessary truth. Third, it can mean the evident comprehension of one necessary truth through the evident comprehension of two necessary truths arranged in syllogistic form, such that the latter two truths make the former one known evidently, whereas otherwise it would remain unknown. It is in this last sense that the phrase is used in the definition of "demonstration."[2] If we take "to know scientifically" in the appropriate sense, we have Ockham's complete explication of the meaning of "demonstration," which is established as a foundation for the treatise.

It is notable that Ockham uses "necessary" and "evident" in establishing this foundation, but "necessary" applies to truths—that is, to propositions which are true—and "evident" applies to the comprehension of those truths. Neither expression is directly applied to things or causes; in fact, things and causes are not even mentioned at this point. In the

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[1] Ockham, Sum. log., III-II, chap. i. [2] Ibid.

Proemium to his exposition of Aristotle's Physics, Ockham states and explains as clearly as possible that all science is in respect to one or more complexes; these are not composed of sensible things or substances, but of intentions or concepts of the soul common to such things. Properly speaking, natural science is concerned with intentions, standing for natural things, composed in many propositions. This is what it means to say that science concerns universals; it is concerned only metaphorically with corruptible and movable things for which intentions stand.[1]

In constituting his foundation, then, what Ockham does is to select or point out for consideration a certain complex form of signification. The treatment of demonstration is a statement of the conditions required of terms and propositions in order that they may enter this form, and a statement of the cases in which the requirements set by the form and its constituents can be fulfilled; this latter statement must be made in terms of differences among terms and propositions. Consequently, while the notions of definition and cause occur in the treatise, they are not immediately relevant; they become relevant only to the extent that some term in a demonstration in some cases must be some type of definition, or some propositions in a demonstration in some cases express a cause; or, alternatively, insofar as some proposition in which a definition is predicated or a causal relation is expressed is examined as to its demonstrability or indemonstrability.

Ockham begins, then, by considering the term.[2] All terms can enter somehow into some demonstration, but fictive terms—for example—must be in negative propositions and connotative terms must be in propositions of possibility. In the most powerful demonstration, the terms are the subject, the definition, and the property.[3] As for the pre-existing knowledge of

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[1] Ockham, "Prologue to the Expositio super viii libros Physicorum," ed. and trans. by Philotheus Boehner, O. F. M., Ockham: Philosophical Writings, (London; Thomas Nelson & Sons Ltd., 1957), p. 11.

[2] Ockham, Sum. log., III-II, chaps. ii-iii.

[3] Ibid., chap. ii. A demonstration is potissima if the following conditions are fulfilled: it is of the reasoned fact, universal with both modes of universality—that is, true in every instance and prime—and it is affirmative. It follows that it is in barbara and is ostensive. Cf. Damascene Webering, O. F. M., Theory of Demonstration according to William

the terms, two things are necessary. First, the nominal definitions of every term must be known; otherwise, the word could not be used meaningfully. Second, if the term is used significatively in a categorical proposition, the fact that there can be something for which it can stand must be known; however, if it appears in a hypothetical proposition, this condition need not be fulfilled.[1] The second condition is required because the terms in a proposition of possibility must be able to be satisfied by something, while the terms in a conditional supposing there is something for which they can stand, need not be satisfied by anything in fact or even in possibility.

In chapters four to sixteen, Ockham treats the conditions required of the propositions necessary for demonstration. In chapter four, he gives several divisions of such propositions, paying particular attention to the distinction between propositions which can enter a demonstration, and those which cannot be either premises or conclusions, but are required as extrinsic principles. In chapters five to eight, he treats the conditions necessary for all the propositions required for demonstration, or for the most powerful demonstration. In all demonstrations, all the required propositions must be necessary truths.[2] He explains the conditions indicated by "true in every instance," "essential," and "prime or universal," without saying that the last must be fulfilled by all the propositions necessary for demonstration; obviously, according to Ockham's definition of "demonstration," it need not be.[3] "Definition" enters the explanation of "essential predication," for this condition is fulfilled in two ways: 1) if the predicate defines the subject or some term directly superior to the subject; 2) if the subject defines the predicate or some

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Ockham (St. Bonaventure, N. Y.; The Franciscan Institute, 1953), pp. 14-19. Moody (op. cit., pp. 222-223) explains that the subject of such demonstration in the strict sense must signify substances absolutely, although in a weaker sense, mathematical demonstrations can be potissima; as a matter of fact, almost all such demonstrations are mathematical (Ockham, Sum. log., III-II, chap. xii).

[1] Ibid., chap. iii. Ockham appears at first-reading to distinguish the conditions for the three terms; on closer examination, it becomes evident that he is not doing so, except insofar as one premise may be hypothetical and the other categorical.

[2] Ibid., chap. v; cf. supra, pp. 173-174. [3] Ibid., chaps. vi-viii.

term directly superior to the predicate; in either case, the definition may be complete or only partial.[1]

In chapters nine to twelve, Ockham deals with the conditions required of the conclusion. Chief among these is that the conclusion must be able to be doubted,[2] and doubted in such a way that primary knowledge of its evidence can be gained from two other propositions that already are known evidently.[3] However, it is not necessary that the conclusion be knowable only by demonstration, since some conclusions also can be known by experience.[4] When a conclusion which could be demonstrated is known by experience, the comprehension of its evidence is the same in kind as it would be had it been demonstrated.[5] What specifies knowledge, for Ockham, is not how it is gotten, but precisely what is known and what that knowledge makes evident. Consequently, since the evident knowledge of a proposition, considered just in itself, is of the same object whether it is demonstrated or known by experience, and since the knowledge of that proposition has the same evidential force in either case, the knowledge of it is the same in kind.

In consequence of these considerations, Ockham concludes that not every property can be demonstrated of its primary subject. "Property" is a second-intentional term signifying any first-intentional term that can be predicated in the second mode of essential predication.[6] Properties are of four kinds. First, some denote the same thing as the subject and connote an inherent quality. Second, some denote the same thing as the subject and connote something neither inherent nor essential to that thing. Third, some denote the same thing as the subject and connote the parts of the thing and something not inherent in it. Fourth, some denote the same thing as the subject and connote its parts negatively.[7] The first two

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[1] Ibid., chap. vii. [2] Ibid., chap. ix. [3] Ibid., chap. xi.

[4] Ibid., chap. ix. Knowledge by experience: chap. x; cf. supra, pp. 168-170.

[5] Ibid., chap. xi; cf. Quod. V, qu. 2 (McKeon, Selections . . . , II, pp. 375-380).

[6] Sum. log., III-II, chap. ii: property is a term predicable of a subject; it is distinct from the subject, but it denotes the same as it, connoting something else or denoting in a different way; cf. I, chap. xxxvii.

[7] Ibid., III-II, chap. xii.

kinds of properties cannot be demonstrated of their primary subjects, since propositions in which they are predicated cannot be unknown if the meanings of their terms are known, while an attempt to demonstrate by a merely nominal definition of the property is mere question-begging. The latter two kinds can be demonstrated, since the meanings of the terms can be known, although the parts connoted are unknown; when these become known, a definition of the subject expressing these parts can be a middle for strict demonstration. Such strict demonstrations occur mainly in mathematics, and it is only in them that a property is demonstrable of its primary subject through a definition of the subject as a middle term—in other cases, the middle need not be a definition.[1]

In chapters thirteen to sixteen, Ockham treats the characteristics of propositions which enter demonstrations that cannot be conclusions. Such principles must not be demonstrable themselves, although they can have some propositions that cannot enter demonstration prior to them.[2] Such principles also must be prior to other propositions that can enter demonstration. Priority means either that the prior proposition has a term defining one of the terms in the posterior proposition, or that it has some more general term in it, or that it implies the other by an irreversible natural consequence.[3] Such principles also are causes of the conclusion. This means either that the knowledge of the premises brings about knowledge of the conclusion, or that the premises express the cause on account of which the thing is as it is denoted to be in the conclusion, or that the premises imply the conclusion by an irreversible natural consequence, or that the conclusion is composed of terms derived from the premises.[4] Such premises also must be better known than the conclusion; any premise can be known before the conclusion temporally, considered by itself, although if one is known, the other may not be able to be known without the conclusion becoming known simultaneously.[5] In considering these conditions, Ockham is not describing conditions necessary for all premises; rather, he begins in

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[1] Ibid. [2] Ibid., chap. xiii.

[3] Ibid., chap. xiv. "Natural consequence" means the relation holding between two propositions of which one can be a premise in the syllogistic deduction of the other.

[4] Ibid., chap. xv. [5] Ibid., chap. xvi.

chapter thirteen by explicitly saying that he is concerned with principles that cannot be conclusions. Of course, the last condition must hold in every demonstration, and the first condition need not hold except in ultimate demonstrations. The problem occurs with respect to the conditions of priority and causality; clearly, in some sense the premises must be causes of the conclusion. It is not necessary that the premises be prior to the conclusion in every demonstration, as we shall see. However, Ockham does not distinguish which conditions are necessary and which are not at this point.

From following Ockham's procedure in making these initial distinctions, we can understand the relation between definition and demonstration, so far as definition is relevant as a principle. "Definition" first is mentioned in reference to the middle in a most powerful demonstration.[1] Next, it is mentioned in connection with essential predication, for one term is at least a partial definition of the other or a term superior to it.[2] Next, in connection with the demonstration of propositions predicating properties, Ockham points out that properties of the first two modes cannot be demonstrated and that an attempt to do so by nominal definition of the property is question-begging; he points out that properties of the third and fourth mode can be demonstrated of their subjects by definitions expressing the parts of the thing denoted by the subject, but that demonstration need not be through definition except when the conclusion predicates a property of its primary subject.[3] Finally, in discussing the mode of priority in which one proposition is prior to another because it makes the same thing more explicit or makes more things explicit, he points out that nominal definitions establish no priority, but that real difinitions do.[4]

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[1] Ibid., chap. ii. [2] Ibid., chap. vii. [3] Ibid., chap. xii.

[4] Ibid., chap. xiv. "Real definition" translates "definitio quid rei;" it is not a thing itself, but an expression or set of intentions signifying a thing. Real definition is strict if it expresses the whole nature of a thing without connoting anything apart from it, either by stating its intrinsic parts or by combining its genus and difference. In a broader sense, a descriptive real definition includes elements which connote something extrinsic to the thing joined with strictly definitory elements. (Ibid., I, chap. xxvi and xxvii.) Thus, the possible elements of real definitions are genera or differences signifying things signified

It also is clear that, for Ockham, not even in most powerful demonstration need the middle be a definition by genus and difference; it can be through a proper part of the thing.[1] Moreover, the middle cannot be a definition of the property, since the property either cannot be given a real definition, or it is defined with reference to the subject; but the extremes cannot appear in the middle.[2] Thus, Pseudo-Thomas' requirement for the middle is excluded; indeed, since many of Pseudo-Thomas' ostensible definitions of properties would be nominal, his purported demonstrations would be mere question-begging for Ockham.

From these points it seems to follow that what is prior, for Ockham, is not that the middle be a definition, but that the requirements of the foundation he has set should be fulfilled. From this basis, it follows that in the most powerful demonstration, the middle must make explicit the parts of the subject which are connoted by the property. It follows also that the conditions for essential predication are more easily met than might seem, since every necessary proposition is essential in some sense, and necessary propositions include those concerning possibility—such as, "Every man can be white."[3] In other words, Ockham has broadened the notion of essential predication, by allowing the terms to be not only in a direct relation of definition, but in an indirect relation by way of superiors, by allowing "definition" to mean an explicit statement of the parts of a thing, and by allowing the definitive term to be any part of the definition. When these adjustments are made, it is possible to speak of the middle term as a definition and to require the predication to be essential. What really is important, however, is that the three terms be such that they must be able to stand for the same things—or, at least,

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by a specific term, or terms signifying the parts of a thing; these elements in a description make it a real definition in the broad sense.

[1] Cf. Webering, op. cit., p. 16, n. 28.

[2] Ibid., pp. 17-18, nn. 30-31. Webering discusses the possible origins of this notion of the middle (pp. 16-17) without reaching any definite conclusion about the question.

[3] Ockham, Sum. log., III-II, chap. vii; propositions in which inferiors are predicated of superiors particularly taken, or subjects are predicated of properties, or one property is predicated of another—all these are not essential most strictly, yet they are essential predications in a less strict sense.

some of the same things--so that they can be joined in necessary propositions, and at the same time that they be such that two of the propositions which can be formed of these terms can be known while the other remains unknown; given these conditions, the third can be comprehended evidently--that is, the suppositional relations in the two cases make apparent the suppositional relation in the remaining case. Stated in this way, what I am saying may seem surprising; however, it seems to me it merely is a restatement of what Ockham said in the first chapter of the treatise, where he explained that demonstration is a syllogism productive of scientific knowledge, and that scientific knowledge is an evident comprehension of a necessary conclusion deduced syllogistically from necessary premises evidently known. There is nothing in that initial statement about definition, except about the definition of "demonstration" itself.[1]

Having treated the terms and propositions required for demonstration in the first sixteen chapters, Ockham devotes the rest of this treatise to demonstration itself. First, he treats the distinction between demonstration of the reasoned fact and demonstration of the mere fact.[2] Then, he treats demonstration of the reasoned fact, and the demonstrability of different kinds of propositions.[3]

His first distinction between the two kinds of demonstration is based on the fact that the premises either may be prior to the conclusion absolutely, or only in respect to the knowledge of a particular person. Because he is using this distinction, he initially uses "demonstration of the reasoned fact" and "a priori demonstration" interchangeably, and similarly uses "demonstration of the mere fact" and "a posteriori demonstration" interchangeably. However, in the example, he does mention that the premises of the former express the cause, while those in the latter do not.[4] Again, he distinguishes the two by saying that demonstration of the reasoned fact is from premises which are necessary and prior, so that when the conclusion is had, no further question is asked about it; demonstration of the mere fact, on the other hand, either is not from prior principles, or it can be accepted without excluding further questions with re-

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[1] Ibid., chap. i.
[2] Ibid., chaps. xvii-xxii.
[3] Ibid., chaps. xviii-xli.
[4] Ibid., chap. xvii.

spect to the conclusion.[1] Next, he distinguishes the two in terms of "cause" and "effect." Demonstration of the reasoned fact is through an immediate cause—that is, through a convertible middle; demonstration of the mere fact occurs through an effect, or through a remote cause—that is, through the negation of something. Ockham is careful to point out here that the cause itself does not enter the demonstration, but that in demonstration of the reasoned fact the premises denote that on account of which the thing is as the conclusion indicates it to be.[2] Later, Ockham explains the relations between the questions, "Is it the case?" and, "Why is it the case?" when they are asked with respect to the same proposition. The former question asks for the truth of the proposition and for any middle through which it can be known. The latter question asks for the most proximate middle.[3]

As with "definition," the way in which "cause" enters these explanations is significant with respect to Ockham's position. He does not exclude a consideration in terms of "cause," but his primary requirement for demonstration of the reasoned fact is the priority and immediacy of the premises; given this, one can say that such premises indicate the cause on account of which what is denoted by the conclusion holds true. Previously, Ockham has defined "primary and universal" in such a way that proximate genera are predicated in this way of their species, and indemonstrable properties also are predicated in this way of their subjects.[4] A predicate need not be commensurate with its subject in order to be "primary and universal." Hence, when a demonstration is given through prior principles, it always is of the reasoned fact if it is affirmative, since if it were not, the premises would not be sufficient by themselves to make the conclusion known. Consequently, Ockham restricts demonstration of the mere fact to cases in which the premises are not prior or the demonstration is negative.[5] Now, "cause" is a connotative term; used first-intentionally, it means the same as the phrase, "a thing upon whose being another follows."[6] Ockham by no means denies causality, but he treats it as a simple relationship between things, which is known immediately by ex-

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[1] Ibid., chap. xix. [2] Ibid., chap. xx. [3] Ibid., chap. xxiii.
[4] Ibid., chap. viii. [5] Ibid., chap. xx. [6] Ibid., I, chap. x.

perience.[1] The middle cannot be present in propositions which are prior to a demonstrable conclusion without signifying something which also can be signified by "cause" in relation to one of the two extremes, since it either expresses more explicitly—indicating parts—what is expressed by one of the extremes, or it is necessarily connected—as an absolute term with an indemonstrable connotative predicate—with one of the extremes, or it signifies something else which grounds the irreversibility of the natural consequence.[2] However, if the middle signifies something that also is signified by "cause" with respect to what is signified by either extreme, it also can be said to indicate the cause of the fact denoted by the conclusion, since the two terms in the conclusion form a necessary proposition. On this basis, what is said about demonstration of the reasoned fact and knowledge of causes is true enough, but it is not very important, since the important point is that the premises are prior and affirmative, prior and negative, or not prior.[3] Cause enters Ockham's theory of demonstration most fundamentally not with respect to things signified, but with respect to knowledge, since demonstration is a syllogism causing scientific knowledge.[4]

To understand Ockham's doctrine concerning subalternating and subalternated sciences, and the relation of demonstration of the reasoned fact and demonstration of the mere fact to them, it is necessary to see how he thinks sciences are divided and unified. Science is a quality or group

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[1] Cf. Gilson, History of Christian Philosophy, pp. 496-497 and 789.

[2] These alternatives are based on the three meanings of "prior" for propositions which Ockham distinguishes: Sum. log., III-II, chap. xiv.

[3] Notice, once again, that Ockham does not mention "cause" in the constitution of the foundation of the treatise: ibid., chap. i.

[4] Webering (op. cit., pp. 66-69) devotes more than three pages to explaining Ockham's distinctions of "the premises are causes of the conclusion" (op. cit., chap. xv) with only a mention of the sense: "the premises indicate that on account of which what is denoted by the conclusion is the case." In his remark on this sense, Webering (p. 68) says that this is verified not only in demonstration of the reasoned fact, but also in demonstration of the mere fact. This seems evidently incorrect according to Ockham's remarks (chap. xx); however, I mention it not to take Webering to task for this slip, but only to emphasize how little is the importance of this point for Ockham, when so excellent a commentator as Webering can miss it.

of qualities in the soul.[1] Ockham is thinking here of "science" used to designate not merely the actual knowing of a scientific conclusion, but also the habit of knowing it, which remains when the scientist is not thinking about what he habitually knows. Therefore, he goes on to argue that the habit is a quality just as is the act.[2] "Science" refers to one such habit, or to many distinct habits having a certain order to each other; in this sense, the whole philosophy of nature is said to be a "science," including principles, conclusions, concepts, answers to errors, and so on.[3] It follows from this that the unity of a science does not depend on the unity of the habits that compose it, for they are many.[4] If "subject of a science" refers to what is known, it means the subject of a proposition which is known scientifically; in this sense, no science such as philosophy of nature has a subject, for it has many subjects.[5] When some authors say that a science has one subject, they mean that there is a first subject—first either by priority of predication or of perfection.[6] A science of things concerns precisely terms standing for things; hence, a science of natural things is possible since there is one term common to all such things.[7] Finally, the philosophy of nature is distinguished from other sciences either by its subjects or by its predicates, for a distinction of either is sufficient to distinguish sciences; the same proposition can belong to different sciences.[8] Now, this last statement is most interesting; however, Ockham unfortunately promises to explain it in a commentary on the Metaphysics that he never wrote. Apparently, he intended to distinguish terms into groups according to their significance and modes of signifying in such a way that each group would have a principle of unity, but that some terms could be included in more than one group—that is, the principles distinguishing the groups would not be exclusive. For example, if "being" and all the terms of which it can be predicated directly were allotted to metaphysics, if all second-intentional terms were allotted to logic, if all terms of which "natural body" is directly predicable and

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[1] "Prologue to the Expositio super viii libros Physicorum," Ockham: Philosophical Writings, p. 4.

[2] Ibid., pp. 3-4. [3] Ibid., pp. 5-6.

[4] Ibid., pp. 6-7. [5] Ibid., pp. 8-10.

[6] Ibid., p. 10. [7] Ibid., pp. 11-13. [8] Ibid., p. 15.

their essential predicates were allotted to natural philosophy—then each of these would form a science, but with considerable community of terms and propositions.[1]

Bearing in mind this view of the unity and distinction of sciences, we can understand what Ockham says about subalternating and subalternated sciences. The two types of sciences are not thus related because one knows the mere truth of a conclusion, while the other knows the same conclusion as a reasoned fact, since the same conclusion is not known by two different sciences except accidentally.[2] The subalternated science, rather, knows a certain proposition, while the subalternating science knows the universal principles of that proposition. Only he who has both sciences can demonstrate the conclusion.[3] It follows that one whole science can be subalternated according to the same or different conclusions to different subalternating sciences; it also follows that two whole sciences can have opposite relations to each other in respect to diverse conclusions. It is impossible, however, that the same science can be both subalternating and subalternated in respect to the same conclusion. In making all of these statements, Ockham has been taking "subalternating-subalternated" in a broad sense. In this broad sense, the relationship holds whenever one science as a whole or with respect to some one conclusion knows the universal principles of a conclusion in another science, yet the two are not together one science as a whole. The latter would be the case with the particular conclusions falling directly under general principles. The common case is that the subalternated science adds some term to the more universal terms of the subalternating science, but this condition need not be fulfilled in every case. In a stricter sense, the subject of the subalternated science must be accidentally inferior to the subject of the subalternating science, or it must signify some part of what is signified by the subject of the subalternating science. On this broader definition, logic and metaphysics can subalternate some parts of particular sciences; but on this stricter definition, they probably do not.[4]

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[1] I do not mean that this would be Ockham's division; I suggest it only for the sake of example.

[2] Sum. log., III-II, chap. xxi. [3] Ibid. [4] Ibid.

After finishing his discussion of demonstration of the mere fact and the subalternating-subalternated relationship, Ockham devotes the rest of the treatise to a consideration of demonstration of the reasoned fact.[1] To make his treatment systematic, he begins by indicating again that everything demonstrable is capable of being doubted, but not vice versa. Consequently, it is necessary to state in the first place how many questionable propositions there are that are relevant to demonstration, in order to see what is demonstrable by demonstration of the reasoned fact and what is not. For this purpose, and at this precise point, Ockham introduces Aristotle's four questions.[2] He relates them to pairs of propositions which are divided according to whether the subject and predicate signify anything distinct or according to a distinct mode—that a thing is such and why it is such—or do not signify with any distinction—whether a thing is or what it is. He indicates how the propositions in each pair can be understood to answer a request for a middle; he also indicates how all four questions could be asked with respect to a single proposition.[3] However, the real point of the distinction is to divide the possible conclusions for systematic consideration.[4] Of course, the discussion of the relation of the middle to the four questions is not wholly useless, since the answer to one problem can lead to the solution of others; however, this appears not to be Ockham's chief interest in the questions.

Ockham's treatments of propositions predicating existence, definition, property, and cause are interesting and actually form the substantive part of the work. They introduce many new distinctions and clarify his position with respect to many important points. However, I do not think it necessary for my purposes to discuss them in detail.[5]

In sum, Ockham treats demonstration as a complex of signs meeting certain conditions. That we select these conditions for special consideration is arbitrary, but the demonstrations themselves are not. The demonstration is a syllogism in which the evident knowledge of the premises

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[1] Ibid., chaps. xxiii-xli. [2] Ibid., chap. xxiii. [3] Ibid.

[4] Webering (op. cit., p. 84 ff.) understands the use of the questions in the same way I do.

[5] Webering (op. cit., pp. 85-172) treats them thoroughly.

naturally causes an evident knowledge of the conclusion, when all the propositions involved are necessarily true. The notions of definition and cause can be fitted into the explanation of the conditions required for demonstration; however, the definitive conditions refer to the possibility of three terms that can stand for things in such a way that the basic requirement is fulfilled. Demonstration of the reasoned fact and of the mere fact can be said to differ in that the premises of the first express the cause on account of which the fact denoted by the conclusion holds true, but the cause does not precisely become known as such in demonstrating, since the causal relation must be known in at least one of the premises; in any case, this point is less important than that the premises must be prior and the syllogism affirmative for demonstration of the reasoned fact, while one of these conditions is unfulfilled in demonstration of the mere fact. The same conclusion is not known in the two ways in diverse sciences; rather, sciences are in subalternating-subalternated relations with one another when the first knows a universal principle and the second knows a proposition that can be demonstrated from it. Finally, Ockham uses the four questions to make a systematic division of the possible candidates for demonstration, to see which can be answered by demonstration of the reasoned fact and which must be answered in other ways.

In contrast with Pseudo-Thomas, Ockham does not consider demonstration to reduce science to principles beyond its principles, but to indicate the conditions required for demonstration. Again, he does not permit definition of the property to enter the middle term, and he is not using definition and cause as principles of his treatment. Again, Ockham's view of the unity of sciences makes them basically as many as are demonstrable propositions; there is no need to draw all sciences into a single system. Finally, while Pseudo-Thomas uses Aristotle's four questions to distinguish demonstration of the reasoned fact and of the mere fact, Ockham draws this distinction by the relation of premises to conclusion, and the affirmative or negative form of the syllogism, and uses the four questions to divide propositions that can be doubted. In common with Pseudo-Thomas, but for different reasons, Ockham does not consider demonstration to be a process precisely in and through which we come to know causes.

Aquinas' Knowledge of Causal Order

Some propositions are known through themselves, but many are not; in fact, so common is the need for reasoning in order to know a truth that "judgment" tends to be appropriated to reason as it divides against understanding, although understanding too judges without reasoning.[1] In the case of contingent propositions, their immediate truth depends on sense experience, for there can be no certitude with respect to them except when the things fall under sense.[2] In the case of necessary propositions, sense experience also is presupposed.[3] However, Aquinas characterizes the knowledge of necessary propositions which are known through themselves by saying that they are known as soon as their terms are known, since the predicate belongs to the definition of the subject.[4] It is obvious that the necessary truth of such propositions is not properly known by experience, for experience as such lacks necessity;[5] however, experience does provide the potentially intelligible material which the intellect actually understands and judges.[6] The relationship between predicate and subject which is indicated by saying that the predicate pertains to the definition of the subject, or is contained in it, might be misunderstood to be an analytic relationship between a complex whole and its parts. However, that Aquinas does not intend this is indicated by the fact that he considers the intelligibilities attained by the first act of the intellect to be simples; moreover, it is clearly shown by his use of the same expressions even when the intelligibility in which another is said to be contained is the first and simplest one—that of being.[7]

The notion of analysis has an important role in Aquinas' theory of knowledge, since "analysis" or "resolution" indicates the rational process

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[1] De ver., qu. 15, art. 1, ad 4; art. 3, c.; Sum. theol., I-II, qu. 57, art. 2, c.

[2] In Eth., VI, lect. iii.

[3] In Sent., I, dist. 3, qu. 1, art. 2, c.; De ver., qu. 12, art. 3, ad 2.

[4] De ver., qu. 14, art. 1, c.; Sum. theol., I, qu. 17, art. 3, ad 2.

[5] In Post. anal., I, lect. xlii. [6] Ibid., II, lect. xx.

[7] Sum. theol., I-II, qu. 65, art. 5, ad 4.

by which we reduce effects to causes.[1] These expressions of the mode in which necessary propositions are known through themselves, then, must be understood to mean precisely this—that the truth of the proposition is known simply through the judgment of the intellect understanding its terms, since the understanding of the subject includes in itself its grounding of the intelligibility which is predicated.[2] It seems to me that the difficulties which Aquinas' statements with respect to this point may cause for us derive mainly from the fact that his notion of the three acts of the intellect—that they are actuations of a potentiality which add to knowledge—is not always accepted; rather, it often is replaced by the notion that nothing can become known which was not known already.[3] If the second act of the intellect does contribute anything to our knowledge of things, then those propositions which are known through themselves are known through themselves; such knowledge is human, not angelic—it presupposes experience. Not all propositions are known in this way—it presupposes that the terms of propositions known through themselves are sufficient, without the introduction of any further terms, for these propositions to be known by the immediate judgment of the intellect alone.[4] For this very reason, Aquinas often distinguishes propositions which are known to us through themselves, from those which are known in themselves through themselves. The latter include propositions which we do not know through themselves, since we do not understand their terms.[5]

Since not all propositions are known through themselves, a third act

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[1] *In Post. anal.*, Procm. and *passim*. That analysis has no place in Aquinas' doctrine on knowledge of necessary truths known through themselves is indicated by the fact that he does not use his appropriate terminology for analysis with respect to them.

[2] *De ver.*, qu. 15, art. 1, c.; cf. *In Sent.*, III, dist. 17, art. 2, qu'la. 1, c. To understand the subject is not merely to understand the intelligibility which is subjected, but is to understand it within the unity of the proposition; cf. *supra*, p. 182.

[3] Aquinas gives a brief but telling analysis of positions which do not allow a genuine advance in the progress of knowledge from potency to full act—*De ver.*, qu. 11, art. 1, c.

[4] *Ibid.*, qu. 15, art. 1, c., ad 4, and ad 5.

[5] *In Sent.*, I, dist. 3, qu. 1, art. 2, c. and *passim*; one example is the proposition, "God is;" we do not know what He is.

of the intellect—reasoning—is necessary.[1] Reasoning itself belongs to the intellect; the linguistic expression of argumentation signifies this act.[2] In reasoning, the conclusion is not known in the principles, but becomes known from the principles.[3] Consequently, there are distinct apprehensions of the principles in themselves, and of the conclusion.[4] But in that case, how is it possible to know the conclusion as such—that is, to know it as following from the principles? Occasionally, Aquinas speaks as though there were a distinct term of intellectual activity which included the entire argument.[5] However, generally he seems to indicate that reasoning is a distinct process, but that it terminates in a single proposition—the conclusion or the principles to which a proposition under investigation is resolved.[6] Reason is related to understanding—that is, the term—as movement to rest.[7] Reason proceeds from one to another, from the known to the unknown.[8] Aquinas is quite consistent in this characterization of reason; he seems to consider it evident that the discursive process of the intellect is precisely for the sake of coming to know what otherwise would remain unknown.[9] He does speak of a process of reason from the better known;[10] however, this is not said when the act of reason is characterized, but when the direction of a process of investigation is under discussion. The opposite of the more known in such a context is the more knowable in itself which is less known—that is, initially unknown—to us. Moreover, the process of reason is not merely a succession of acts; rather, it presupposes succession but requires causal determination.[11] The

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[1] De ver., qu. 8, art. 15, c.

[2] In Sent., IV, dist. 15, qu. 4, art. 1, qu'la. 1, c.

[3] Sum. theol., I, qu. 58, art. 3, ad 1; art. 4, c.; qu. 85, art. 4, c.; De ver., qu. 8, art. 15, c.

[4] Cont. gent., I, chap. lvii; Sum. theol., I-II, qu. 8, art. 3, c.; De ver., qu. 2, art. 3, ad 3.

[5] E. g., Sum. theol., I-II, qu. 90, art. 1, ad 2.

[6] Ibid., qu. 57, art. 2, c.

[7] Ibid., I, qu. 79, art. 8, c.

[8] The expression occurs passim; in In de an., III, lect. xiv and In Div. nom., chap. i, lect. i, among other places, Aquinas characterizes the function of the discourse—it is precisely for knowing, for coming to know.

[9] In Post. anal., Proem.

[10] In Phys., I, lect. i.

[11] Sum. theol., I, qu. 14, art. 7, c.

principles are the causes of the conclusion; they are distinct from the conclusion, but they bring its knowledge about.[1] The solution to the question—how is it possible to know the conclusion as such—seems to be that the knowledge of the proposition which is the conclusion includes the principles from which it follows as modes of its own predication. Aquinas explicitly says that diversity in principles constitutes a diversity in the mode of knowing; sciences are diversified because certain basic differences among their principles establish diverse modes for knowing the things.[2] Comparing a proposition including such modes with one that does not include them, we can distinguish the terminations of the two intellectual acts; however, since the termination is a proposition in either case, the principle of the distinction is not the same as that between the terms of the first and second acts of the intellect.

In contrast with Pseudo-Thomas, then, Aquinas treats the process of reasoning as a succession of distinct acts dependent on causal determination within knowledge, as a movement from the known to the unknown, and as a means for achieving knowledge of propositions which are not known through themselves and which would remain unknown were it not for reason.

Aquinas' primary distinction among processes of reasoning is on the principle of the necessity induced or the certitude acquired. There is one process which leads to truth in such a way that failure is impossible. There is one which frequently leads to truth, but without necessity. There is a third in which reason falls short of truth because of some defect of principle which should have been observed in reasoning, but was ignored.

> The part of logic which subserves the first process is called "the judicative part," because the judgment has the certitude of science. And since certain judgment of effects cannot be had without resolving them into first principles, this part is called "analytics"—that is, resolutive. Now, the certitude of judgment which is had by resolution either is from the mere form of the syllogism—to this the book of Prior analytics, which concerns the syllogism absolutely, is ordained—or it is also from the matter, since premises which are essential and also necessary are used, and the book of Posterior analytics, which concerns the demonstrative syllogism, is ordained to this. Now, an-

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[1] In Phys., II, lect. v; De ver., qu. 11, art. 1, c.

[2] In Post. anal., I, lect. xli.

> other part of logic, which is called "inventive," subserves the second process of reason, for invention does not always occur with certitude. Consequently, judgment is required concerning those which are discovered in order that certitude may be had.[1]

Aquinas continues this analysis by distributing the field of inventive logic among dialectical, rhetorical, and poetic arguments; finally, he allots the treatment of sophistic arguments to the third part.[2]

Now, while it might seem that Aquinas here uses judgment and invention, analytic and synthetic—he does not mention the last—to divide logic, a closer inspection of the text shows that this is not so. The three designations are introduced as expressions which are applied to parts of logic which he is dividing on other principles—namely, certitude or necessity and non-certitude or probability, and truth or error. The judgment which the Analytics subserve has the certitude of science; therefore, this part of logic is called "judicative." The attribution of the name to one part of logic is based on its superiority in this respect, for every process of reasoning aims at judgment as a term.[3] This part is called "analytic," since a certain judgment of effects cannot be had without reducing them to first principles. Now the reduction of effects to their principles is the more common order of reasoning, since usually effects are better known to us than causes.[4] However, sometimes the principle of reasoning is prior both in knowledge and in being; in such a case, the movement is not analytic but synthetic, since causes are more simple than their effects.[5]

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[1] In Post. anal., Proem.: "Pars autem Logicae, quae primo deservit processui, pars iudicativa dicitur, eo quod iudicium est cum certitudine scientiae. Et quia iudicium certum de effectibus haberi non potest nisi resolvendo in prima principia, ideo pars haec analytica vocatur, idest resolutoria. Certitudo autem iudicii, quae per resolutionem habetur, est, vel ex ipsa forma syllogismi tantum, et ad hoc ordinatur liber Priorum analyticorum, qui est de syllogismo simpliciter; vel etiam cum hoc ex materia, quia sumuntur propositiones per se et necessarine, et ad hoc ordinatur liber Posteriorum analyticorum, qui est de syllogismo demonstrativo. Secundo autem rationis processui deservit alia pars Logicae, quae dicitur inventiva. Nam inventio non semper est cum certitudine. Unde de his, quae inventa sunt, iudicium requiritur, ad hoc quod certitudo habeatur."

[2] Ibid.

[3] In de Trin., qu. 6, art. 2, c.

[4] Ibid., art. 1, qu'la. 1, c.

[5] Sum. theol., I-II, qu. 14, art. 5, c.

If we look at Aquinas' explanation of the distinction between demonstration of the reasoned fact and demonstration of the mere fact, we discover that the latter, not the former, is analytic; demonstration of the reasoned fact proceeds from causes.[1] This part of logic is called "analytic," then, not from the more perfect kind of demonstration, but from the kind which is more common. Moreover, while science generally is acquired by analysis, it is completed by synthesis,[2] for when a cause becomes adequately known, it serves as the principle for knowing its properties.[3] Unlike Pseudo-Thomas, then, Aquinas does not permit demonstration to become wholly a matter of reduction; he insists on the distinction between what is better known to us and what is better known--that is, more knowable--in itself. The part of logic which subserves the second process of reasoning--that which is not certain and necessary--is called "inventive," since discovery does not always occur with certainty.[4] Again, far from eliminating all consideration of the discovery of new truths from the part of logic concerned with demonstration, Aquinas is merely acknowledging the appropriation of "invention" to other parts of logic and explaining it on his own principles. Consequently, he can maintain that the entire second book of the Posterior analytics concerns the manner in which the principles of demonstration become known[5] and that a substantial portion of it is devoted precisely to the question of how essential nature and cause can be investigated.[6]

Considering Aquinas' initial emphasis on necessity and certitude in his remarks about demonstration, and considering that he consistently treats the third act of reason as a movement from the known to the unknown, it might be supposed that he requires nothing more for demonstration than that these conditions be fulfilled. In other words, if Aquinas' position is in the first instance clearly distinct from that of Pseudo-Thomas, it is not clearly distinct from that of Ockham. However, while the condi-

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[1] In Post. anal., I, lect. xxiii.

[2] Sum. theol., I, qu. 85, art. 8, ad 1.

[3] In de Trin., qu. 6, art. 4.

[4] In Post. anal., Proem.

[5] In Post. anal., I, lect. i; II, lect. i.

[6] Aristotle, Posterior analytics ii, chaps. xii-xiv; Aquinas, In Post. anal., II, lect. xiii-xix.

tions of necessity and an advance in knowledge are required for demonstration, they are not its sufficient conditions, nor does Aquinas treat them as its primary characteristeristics.

Sometimes Aquinas characterizes the distinction of composition and division from reasoning by saying that this operation is to proceed discursively from one to another, making known a cause.[1] In this characterization, two factors must be noticed. First, it is precisely through reasoning that a cause is known. Second, the characterization is applied to reasoning in general, not only to special cases of it. Just as a third act of the intellect is necessary, because without it the potentiality of the intellect to know things would not be fulfilled,[2] so the correlative potentiality of the object to be known would not be fulfilled. It is the property of reason to know order, not merely absolute things.[3] Order in things is their final perfection; nothing can be wholly without it.[4] Now, although not all order is immediately causal order, every other order is reduced to the order of dependence in being, and thus to causes.[5] Just as we attain some intelligible aspect of things by simply understanding them, and know the very existence of things by composition and division, so we know the causal order of things by reasoning. The third act of the intellect is not merely a certification of a truth which would not otherwise be known, but the certification of a truth whose attainment involves a dimension of the being of things which otherwise could not be known.

It also must be noticed that Aquinas excludes hypothetical propositions from scientific knowledge, since such propositions do not posit an absolute truth.[6] Hypothetical propositions play a role in knowledge which falls short of demonstration; most problems, for example, are a disjunction of contradictory propositions,[7] and the solution to any problem con-

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[1] In Sent., IV, dist. 15, qu. 4, art. 1, c.

[2] Sum. theol., I, qu. 58, art. 3, c.; art. 4, c.; qu. 85, art. 5, c.

[3] In Eth., I, lect. i.

[4] In Sent., III, dist. 27, qu. 1, art. 4, c.; II, dist. 37, qu. 1, art. 1, ad 5.

[5] In Meta., V, lect. xiii; Quod. V, qu. 10, art. 1, c.; In Sent., I, dist. 20, qu. 1, art. 3, qu'la. 1, c.

[6] In Peri herm., I, lect. i.

[7] In Post. anal., I, lect. v.

sists in determination to one of the two.[1] A further notable point is that although Aquinas emphasizes that only a proposition is questionable and knowable by scientific knowledge,[2] he does not oppose the knowledge of propositions to the knowledge of things. As we have seen, the knowledge of propositions is a knowledge of things, for Aquinas, since to know the truth of the proposition is to know the existence of things.[3] The exclusion in the statement refers rather to incomplex understanding; we question and have scientific knowledge only of propositions—that is, not of simple intelligibilities.[4]

In explaining the definition of demonstration, Aquinas begins by explaining the expression "to know scientifically." Scientific knowledge is a perfect knowledge; it requires that we know not only what happens to be a cause, but that we know the cause precisely as such; moreover, since science is a certain knowledge, it must be concerned with what cannot be otherwise.[5] Elsewhere, Aquinas explains that created things are not wholly without necessity;[6] in fact, everything involves some necessity.[7] Consequently, the necessity required of the object of scientific knowledge does not imply that such knowledge is not concerned with the things we experience, but that it is concerned with these things insofar as they are understood and known in propositions whose necessity derives from the things themselves.[8] The definition of demonstration as a syllogism productive of scientific knowledge is useful for determining the character of its

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[1] Thus, Aquinas constantly states questions with the particle "utrum," indicating that the problem itself disjoins the contradictory responses. In this sense, there is a proposition prior to judgment when the judgment concerns a truth which is not known through itself, but the prior proposition is a hypothetical one, while the categorical proposition known through judgment also is formed through it; the intellect composes and divides "per suum iudicium." (In Peri herm., I, lect. iii.)

[2] In Post. anal., II, lect. i. [3] Supra, pp. 189-195.

[4] Contexts in which Aquinas treats assent indicate that this is the opposition intended (e. g., De ver., qu. 14, art. 1, c.), for he uses the same oppositions in that context.

[5] In Post. anal., I, lect. iv. [6] Cont. gent., II, chap. xxx.

[7] Sum. theol., I, qu. 86, art. 3, c.

[8] In de Trin., qu. 5, art. 2, c., ad 4, and ad 7. The universality of the scientific object is only negative—In Post. anal., I, lect. xlii.

premises precisely because it indicates that demonstration attains a certain and proper knowledge of causes, and that it is the precise means for attaining such knowledge.[1] For this reason, too, Aquinas says that the various questions which can be asked with respect to something—for example, whether and why it is such and such—are not formally requests for a middle, nor are they questions to be answered in a proposition formulating the fact or reason, but they are inquiries concerning that which is a middle, for when this is had, demonstration can occur.[2]

In explaining the definition of "to know scientifically," Aquinas points out that this definition is of the meaning of the word "scire," not of science itself. The reason he gives for this is that the definition does not make known science, of which a definition properly can be given, but the very act of knowing (ipsum scire).[3] Nevertheless, he does not use this distinction with respect to the definitions of demonstration; he says that one of them is given from the final cause, the other from the material cause, and he seems to consider both of them to be definitions of demonstration, not merely explanations of the meaning of the word "demonstration."[4]

The distinction Aquinas makes between the explanation of the meaning of a word and a definition properly so-called corresponds to Ockham's distinction between nominal and real definition.[5] However, the way in which Aquinas makes this distinction is interesting and important for his theory of demonstration. In this case, Aquinas makes the distinction because the term defined is concrete, rather than abstract. This agrees with his position that accidents properly are defined only in the abstract.[6] Elsewhere, Aquinas explains the distinction by pointing out that every formulation can be taken as an explanation of the meaning of a word, but that a definition precisely expresses the essence of the thing it signifies.[7] An explanation of the meaning of the word, then, is a formula expressing conditions under which the word is used; there are hundreds of examples of such definitions in Aquinas' works, usually given in a formula—"Things are called 'x' under such and such conditions,"—which indicates the conditions

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[1] In Post. anal., I, lect. iv. [2] Ibid., II, lect. i.
[3] Ibid., I, lect. iv. [4] Ibid. [5] Supra, p. 230.
[6] De ente, chap. vi. [7] In Post. anal., II, lect. iv.

required for the predication of the word in question.[1] The definition of "to know scientifically" is similar, for it indicates the conditions under which people would say that they know scientifically.[2] This mode of definition is appropriate for the verb form, since verbs signify in the concrete[3] and the concreteness of the term accrues to it insofar as it is predicated.[4] It is possible to have an explanation of the meaning of a word without having a definition of the thing, since it is possible to use the word correctly on the basis of a generic understanding of the thing joined with a positive description of its observable accidents, or even a negative and relative characterization of the thing.[5]

In his analysis of the knowledge presupposed by demonstration,[6] Aquinas begins by discussing the necessity for such knowledge, emphasizing the processive character of reasoning.[7] The analysis is terminated with a careful discussion of the way in which the conclusion itself is known in advance—it is known potentially, but not actually.[8] The middle part of this analysis, in which the manner and order of presupposed knowledge is explained, is the section which is interesting for my present purpose.[9]

Aquinas begins by making a simple distinction between the principles and the extremes—the subject and the property. With respect to these, the mode of pre-cognition is twofold—knowledge that-it-is and knowledge what-it-is. The principles, being complex, are not defined; consequently, we know only that they are true. The terms, on the other hand, are definable, and we must know their definitions in advance. The property is not known in advance as to the fact that it is, since its being is inherence in its subject; this is known through the demonstration. The subject, however, has being independently of its property, and its own being must be understood before the property can be known to inhere in it. Concerning the subject, therefore, it is necessary to presuppose both what and

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[1] E. g., Sum. theol., I, qu. 5, art. 4, ad 1: "Those things are called 'beautiful' which please when they are seen."

[2] In Post. anal., I, lect. iv.

[3] In Peri herm., I, lect. v.

[4] Supra, p. 179.

[5] In de Trin., qu. 6, art. 3, c.

[6] In Post. anal., I, lect. i-iii.

[7] Ibid., lect. i.

[8] Ibid., lect. iii.

[9] Ibid., lect. ii.

that it is, especially since the middle of demonstration is taken from the definition of the subject and the property.[1]

Now, to this point, Aquinas has said only what Pseudo-Thomas could accept. From the last statement, Pseudo-Thomas developed his entire doctrine of demonstration, making everything depend on the definition of the subject and the property.[2] Moreover, from the implication that the property can be defined without knowing that it is, there follows his distinction between demonstration of the reasoned fact and demonstration of the mere fact, which makes the former independent of the latter and definable in terms of essential being in distinction against the being of actual existence.[3] At this point, however, Aquinas begins making distinctions which Pseudo-Thomas did not follow.

First, Aquinas distinguishes between definition properly so-called and the expression of the meaning of a word. The property is defined only in the latter sense, since it is necessary to know this much before asking whether it is or not. Second, Aquinas distinguishes between terms which can be subjects or properties in different demonstrations, and the ultimate terms which always are subjects and never are properties--there is nothing prior to them of which they could be demonstrated. The terms which may be either subjects or properties are defined differently in different contexts, and it is not necessary that a proper definition of them be had before every demonstration in which they appear. The terms which never are properties, however, cannot occur in a demonstration without presupposing what the thing they signify is; consequently, the fact that such a thing is, always is presupposed.[4] In this context, to say that it is necessary to know both what and that the subject is, especially when the middle should be taken from the definition of the subject and the property, is to indicate that this condition must be fulfilled when the subject of a demonstration includes what has been a property--in other words, the order of demonstration in such cases must be such that the term must be demonstrated of a subject as a property before it can be used as a subject of which an ulterior property is demonstrated. The condition must

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[1] Ibid.
[2] Supra, pp. 215-217.
[3] Supra, pp. 218-220.
[4] In Post. anal., I, lect. ii.

be fulfilled especially in such as case, for it can be unfulfilled—that is, the property which can be a subject may not yet have been demonstrated of its own subject; in that case, it cannot be taken as a demonstrative subject itself.

This interpretation of Aquinas' position on the definitional relation of the middle term—that it properly defines only the subject—is supported by an examination of his distinction of the modes in which "essential" is said. "Through" indicates a relationship of a cause; therefore, when a subject or something pertaining to it is the cause of what is attributed to it, this relationship is indicated by "through itself" or "essential."[1] The first mode of essential predication occurs when the predicate is related to the subject as a formal cause, expressing its definition in whole or in part. The second mode of essential predication occurs when the predicate is related to the subject as to its material cause and the subject is included in the definition of the predicate, which is its property. The third mode in which "essential" or "through itself" is said, is not a mode of predication, but of existence. The fourth mode of essential predication occurs when "through" expresses the relation of an efficient or any other cause; in this mode, whatever belongs to something on account of itself is said to be essential.[2]

Now, it must be noticed that the fourth mode is not explained by a relationship of definition, but only by a relationship of causality, while the first and second modes are explained by both relationships. In allotting the modes of predication to the principles and conclusion, however, Aquinas says that the major premise is essential predication in the fourth mode, the minor—which predicates the middle of the subject—is essential predication in the first mode, and the conclusion is essential predication in the second mode.[3] The middle is related to the extremes as they occur

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[1] Ibid., lect. x. The expression "per se" may be translated by "essential;" however, to indicate the causal relations, it is necessary to bear in mind the more literal, "through itself."

[2] Ibid.

[3] Ibid., lect. xiii. He has indicated (lect. x) that the conclusion also is essential in the fourth mode, since the subject is the cause of its property.

in the premises, then, in two different ways. It expresses the definition of the subject, but some cause of the property. The property is not essentially predicated in one of the modes involving a relationship of definition until it appears in the conclusion, since the precise involvement of the subject in the being of the property is not presupposed by demonstration, but becomes known through it.

This rather simple statement of the relationships between definition, demonstration, and cause, however, leads to a number of difficulties and complications. In the first place, it seems that the cause does not become known through demonstration, but already is known in the major premise, since that predication is essential in the fourth mode, according to which the predicate belongs to the subject through itself by the determination of an efficient or other cause. It seems to me that this difficulty can be removed, however, if two points are observed. First, the middle expresses the cause of what is concluded in the demonstration—that is, the reason why the predicate belongs to the subject.[1] Second, the knowledge of cause which is sought is not accidental, but a knowledge precisely of the cause as such.[2] In the major premise, the property is known to belong to something understood by means of a definitive intelligibility, but what the something is, is not included in the major premise, for it is the subject that the middle defines. That the subject is defined by this middle, however, is known only in the minor premise, and that is not known with certainty except in the very process of demonstrating.

Consequently, Aquinas explains that there is a difference between the presupposed knowledge that we can have of the two premises. The major can be known in advance of the demonstration, not only with a priority of nature, but even with a priority of time. However, if something is induced or assumed in the minor proposition which is not manifestly included under the major, knowledge of the conclusion is not had, since certain knowledge of that minor is not yet attained.[3] Although in this case, Aquinas is discussing an instance of particular demonstration, the point is not limited to such a case. The definition of a subject which cannot be a property is an immediate and indemonstrable principle; however, even

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[1] Ibid., lect. xiv. [2] Ibid., lect. iv. [3] Ibid., lect. ii.

in this case, the essential nature of the subject expressed by the definition is manifested inasmuch as the definition is taken as a middle.[1]

The relationship among the three terms, therefore, is considerably more complex than it might be thought to be. The middle expresses a definition of the subject; however, while this is an immediate knowledge, it is had with certainty only insofar as it is taken as a principle of demonstration—the knowledge of the minor proposition is prior in nature, but not in time, to the conclusion. The middle expresses a cause of the predicate; however, although the major premise is an essential predication for that reason and can be known with temporal priority to the conclusion, the knowledge of the cause as such is achieved only in the conclusion.

Moreover, the seemingly simple statement—that the middle defines the subject and expresses the cause of the conclusion—is involved in still further complexities because of the relationships between definition and cause themselves. On the one hand, a strict definition is an understanding of essential nature; it is a grasp of the intrinsic principles required for the being of something. Thus, it is through the intrinsic cause of the thing, since a cause is anything which influences the being of another.[2] However, logically speaking, any proper cause can serve to define a thing, since any proper cause is a means for giving a precise answer to the question: "What is the thing?"[3] For this reason, when the subject has a cause which is proper to it besides its essential nature, it may be defined by means of any of the causes. On the other hand, the middle which expresses the cause of the property also may express its definition, for once given demonstration, the cause of the property defines it.[4] For this reason, if there are two middles between a certain subject and some of its properties, the demonstration of a proposition in which the property is predicated and the definition of the subject is subjected seems to be through

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[1] Ibid., II, lect. viii. His analysis here is difficult and highly complex; it deserves a more careful treatment than I can give to it. However, this seems to me to be one of the points that Aquinas maintains.

[2] In Meta., V, lect. i; VII, lect. xvii. [3] Ibid., lect. xvii.

[4] In Post. anal., II, lect. viii. Aquinas explains senses here in which even subjects that have no prior subjects have other causes; however, these are not definitive, since they are not proper.

the definition of the property; however, analysis is not complete unless the definition of the property is demonstrated of the subject through the definition of the subject.[1]

The analysis of the relations between definition, cause, and demonstration, then, is complex and difficult.[2] However, this analysis is carried out as an attempt to explain how the principle of demonstration, which is the middle, becomes known.[3] It is precisely because the definition of the subject is the cause of the conclusion in any given demonstration of the reasoned fact that the analysis becomes complex, since in different demonstrations, the terms shift positions.

According to my interpretation of Aquinas' doctrine concerning simple intelligibilities and propositions, his theory of demonstration implies that causes, as they are known in and through demonstration, are objects to which a certain intelligibility belongs according to another intelligibility which grounds the first one. That a thing really has aspects of its being from things extrinsic to itself--in relation and the last six categories--makes it possible for demonstration to move from one thing to another in reality, not only in reason. Thus, Aquinas explains that natural science typically moves from an effect to an extrinsic cause.[4] That propositional knowledge is existential--that is, a knowledge of the very being of things--makes it possible for demonstration to concern objective causal order, not merely the order of intentions, since Aquinas does not divide existence from essence according to the distinction between individual and universal, but according to the distinction between object and intelligible aspect.[5] According to Aquinas' view, attempts to discover causes in single intelligibilities or single propositions are bound to fail, since reason proceeds from one to another, making causes known.[6]

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[1] Ibid., lect. i. Notice Aquinas' qualifications: "quasi definitio" and "definitionem passionis, ut hic dicitur."

[2] Ibid., lect. ii-xii.

[3] Ibid., lect. i-ii.

[4] In de Trin., qu. 6, art. 1, c.

[5] In Post. anal., II, lect. vi, Aquinas explains the what and the that in demonstration in the same terms he used to explain the distinction between essence and existence in De ente, chap. iv.

[6] In Sent., IV, dist. 15, qu. 4, art. 1, c.

Reasoning makes a genuine addition to our knowledge: it moves from the known to the unknown, not only making known another proposition, but sometimes making known a proposition in which predicating occurs according to a mode which is the causal middle.[1]

If Aquinas considers the logical treatment of demonstration to be an examination of certain modes of predicating, it is understandable why he considered important the points which Pseudo-Thomas, taking demonstration to be a reduction of the obvious to its origins, could omit--quite apart from the fact that Aquinas was writing a commentary while Pseudo-Thomas was writing a summary. The treatment of the knowledge which is presupposed by demonstration[2] is necessary, since the relationship between pre-existing knowledge and the precise knowledge which is acquired through demonstration is complex; a proper understanding of it is needed at the outset. The treatment of the necessary limits of demonstration is needed, because Aquinas' doctrine of the categories, demonstration, and their relations to each other have not settled the question in advance. The comparative treatment of demonstrations, sciences, and other modes of knowing[4] is useful, for it clarifies the modes of predication in demonstration by contrast and comparison. Finally, the investigation of the manner in which principles of demonstration become known[5] is necessary to indicate how the elements of knowledge derived in different ways can enter the demonstrative mode of knowing. Aquinas considers the four questions which open this investigation neither as principles for the division of kinds of demonstration, nor as principles for the division of propositions to be considered with respect to their demonstrability, but as questions which can be scientifically considered, divided for the purpose of relating them all to the middle term; however, they are neither questions precisely concerning the middle term, nor questions whose answers are simple propositions.

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[1] Compare his statements on the principles as modes of knowing (In Post. anal., I, lect. xli) with his statements concerning the mode of definition (In Phys., I, lect. i) and his treatment of almost the whole second book of the Posterior analytics as an investigation of one principle of demonstration--the middle (In Post. anal., II, lect. i).

[2] Ibid., I, lect. i-iii.

[3] Ibid., lect vii-viii and xxxi-xxxvi.

[4] Ibid., lect. xxxvii-xliv.

[5] Ibid., II.

but questions asked, with respect to propositions, which are answered in and by demonstrating.[1]

Aquinas grounds the distinction between demonstration of the reasoned fact and demonstration of the mere fact on the principle that the former is through an immediate cause, while the latter either is through what is not immediate or through an immediate effect. In the former case, the argument may be affirmative or negative and may be through a remote cause or effect. In the latter case, the argument is through an immediate effect which is convertible with the cause. Nevertheless, such demonstration is through what is more known—that is, to us—for otherwise it would not make us know scientifically. The reason this can occur is that often the effect is more known to us, according to our experience, although the cause always is more known in itself, according to nature.[2] In other contexts, Aquinas considers only the relationship between cause and effect, neglecting the question of immediacy, and he explains that demonstration can proceed from either the cause or effect, depending upon which happens to be better known to us.[3] There are, consequently, two ways in which the distinction is considered. On the one hand, demonstration of the reasoned fact is causal knowledge and demonstration of the mere fact is not, since the former is through the cause—that is, it makes known the cause of the fact concluded—while the other is not. On the other hand, both kinds of demonstration are knowledge of causes and effects, since the former makes both the cause and the effect known as such in making the effect known through the cause; while the latter—at least, when it is through an immediate effect—makes both the effect and cause known as such in making the cause known through its effect. Since scientific knowledge is a knowledge of the cause simply, not in an accidental way,[4] it cannot be had except insofar as demonstration makes the cause known as such—that is, makes both the cause and the effect known. However, since this condition is fulfilled both in demonstration of the reasoned fact and in merely factual proof, both are demonstrations and each causes scientific knowledge,

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[1] Ibid., lect. i. [2] Ibid., I, lect. xviii.

[3] In de an., II, lect. iii; In Sent., I, dist. 2, qu. 1, art. 1, qu'la. 1, ad 5; Sum. theol., I, qu. 2, art. 2, c., ad 2, and ad 3.

[4] In Post. anal., I, lect. iv.

although the science achieved in the two cases differs.[1] Consequently, Aquinas considers natural science a true science, and even a science most appropriate to human modes of knowing, precisely because—among other reasons—it usually proceeds from effects to causes.[2] To speak of the cause and effect as more or less known to us, then, does not denominate them as cause and effect—since both are known equally as correlatives—but as objects more or less attainable by our cognitive processes which depend on experience and which proceed in understanding from general and indeterminate knowledge to specific and appropriate knowledge.[3] Once knowledge of cause and effect as such are attained by demonstration of the mere fact, the demonstration can be converted, if they are appropriate to each other;[4] in fact, in the completion of science, such a conversion is required in order that the effects may be known in reduction to their causes.[5]

In explaining how demonstration of the reasoned fact and demonstration of the mere fact occur in diverse sciences, Aquinas begins by distinguishing between the specific parts of a general science and the relation of subalternating-subalternated which holds between certain distinct sciences. The distinction is made to exclude the former from consideration. In the subalternating-subalternated relationship, the subalternated science does not have as its subject a species of the subject of the other, but the subject of the subalternated science is related to the subject of the subalternating science as material to formal. The subalternating science is mathematical; the subalternated science applies mathematical principles to sensible things. The subalternating science knows the reasoned fact; the subalternated science knows the mere fact. This is not true in the sense that the two sciences know the same conclusion, however, since the knowledge of the reasoned fact, which the mathematician has, concerns his own science, for he does not consider non-mathematical subjects to which his principles may apply. Finally, the principles of one science sometimes are used to prove a conclusion in a diverse science even though the two are not related as subalternating and subalternated.[6]

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[1] Ibid., lect. xxiii. [2] In de Trin., qu. 6, art. 1, qu'lo. 1, c.
[3] In Post. anal., I, lect. iv. [4] Ibid., lect. xxiii.
[5] Sum. theol., I, qu. 85, art. 8, ad 1.
[6] In Post. anal., I, lect. xxv.

The formal-material relationship involved here must be understood in terms of the abstraction of mathematical intelligibilities. Aquinas explains that mathematics depends on abstracted simple intelligibilities; these are abstracted in that they include an understanding of subjects only according to quantitative characteristics, omitting the consideration of qualities on which action and motion depend.[1] Aquinas maintains that mathematics gets its data from imagination[2] and that it also verifies its conclusions in imagination.[3] Sometimes he explains mathematical abstraction by saying that mathematics abstracts from sensible matter, but not from intelligible matter—that is, the continuum, which is perceived by the imagination, but not by the exterior senses.[4] The distinction depends on this, then, that we can imagine a continuum and a multiplicity without qualities—except those which directly follow quantity, such as figure—and hence without motion. Understanding of things dependent on such images is mathematically abstract, not by a separation of one intelligibility from another, but by the simple consideration of things. Such intelligibilities are neither properly substantial or quantitative, for they are abstracted; consequently, they can function in demonstration quasi-substantially.[5]

From this account of mathematical abstraction, it seems to me to follow that the formal-material relationship between the subjects of subalternating and subalternated sciences is precisely the relationship between a mathematically abstracted intelligibility and an intelligibility which is not thus abstract. The difference between the two is not in the things known, but in the mode of consideration—geometry treats lines and perspective treats visible lines. The application in question, since two distinct intelligibilities are involved, must be by predicating the mathematical intelligibility of the physical one; mathematical entities can-

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[1] In de Trin., qu. 5, art. 3, c.

[2] Ibid., qu. 6, art. 1, qu'la. 2, ad 4. [3] Ibid., art. 2, c.

[4] In Meta., VII, lect. x; In de an., III, lect. x.

[5] If mathematical entities belonged in any of the categories, they would posit something in reality (De ente, chap. 1); however, mathematics precisely considers things in a manner in which they cannot exist (In de Trin., qu. 5, art. 1, c.). However, these things do exist otherwise than they are considered—that is, they exist in subjects with qualities.

not exist as subjects, as mathematics considers them, but they do exist in sensible things.

The demonstration in a subalternated science applies mathematical principles to sensible things.[1] The major of the syllogism, therefore, must be drawn from mathematics; for this reason, it can be said that the subalternating science knows the reasoned fact, since the major is the causal proposition. The minor predicates the mathematical middle of its non-mathematical subject; because of the difference in intelligibility, the middle is not appropriate, even though it may be commensurate; consequently, the subalternated science—which concerns the conclusion[2]—knows the mere fact. Such sciences are sui generis; they are neither physical nor mathematical.[3] Natural sciences themselves are not subalternated to mathematics, for they have their own principles, even though some conclusions can be proved both by an intermediate science and by a natural science.[4] The subalternation relation, consequently, does not establish a hierarchy of all the sciences for Aquinas, since natural science properly is not subalternated; moreover, the mere use of mathematical principles to prove a conclusion in natural science does not establish subalternation, since the subject of natural science is not merely the object of mathematics with the conditions necessary for existence, but is the complete physical object—that is, the object considered according to motion and the extrinsic causes.[5]

When Aquinas explains Aristotle's distinction of sciences according to certitude,[6] he treats the entire discussion as a consideration of the relative certitude of the mathematical and the intermediate sciences. Three modes are distinguished. According to the first, the mathematical sciences are more certain than the intermediate sciences, because they

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[1] In Post. anal., I, lect. xxv. [2] De ver., qu. 14, art. 10, ad 3.

[3] In de Trin., qu. 5, art. 3, ad 6.

[4] Ibid., ad 7; cf. In de caelo, II, lect. xxvii-xxviii.

[5] Thus, Aquinas does not say (In de Trin., qu. 5, art. 3, ad 7) that the intermediate sciences and natural science have the same subject, but that they "communicate" according to subjects, since the subjects are not altogether the same; cf. In Post. anal., I, lect. xxv.

[6] Aristotle Posterior analytics i, chap. xxvii; Aquinas, In Post. anal., I, lect. xli.

have knowledge of the reasoned fact. According to the second, the mathematical sciences are more certain than the intermediate sciences, because they abstract altogether from sensible matter--that is, from qualities and motion. According to the third, geometry is less certain than arithmetic, since geometry is related to arithmetic by addition. The last mode, Aquinas explains, is stated according to Platonic positions, since Plato did not distinguish the one which is a principle of number from the one which is convertible with being, which signifies the substance of things. However, Aquinas says that this mode also can be understood according to Aristotle's position, since according to his opinion too, the point adds to unity, since the point abstracts from sensible matter, while unity abstracts both from sensible and from intelligible matter.[1]

Elsewhere, Aquinas defines "certitude." It is nothing else than the determination of the intellect to unity, whether this is determined immediately or through principles or through an extra-cognitive motive.[2] "Certitude" in Aquinas' terminology, then, does not refer to the subjective feeling of certainty, as it does for us, but to the determination of an unconditional proposition. Comparing natural science, mathematics, and metaphysics as to certitude, he explains that mathematics is more certain than either of the others, but for different reasons. Mathematics is more certain than natural science because it involves fewer factors and has a subject matter which is altogether necessary, while natural science considers many factors and its determinations often hold only for the most part. For the same reasons, practical knowledge is much less certain still. Mathematics is more certain than metaphysics, on the other hand, because its objects are imaginable; thus, it is proportionate to the human mode of knowing, which proceeds from images.[3] The sciences are not fixed in a simple hierarchy of subject matters according to certitude, then, but are

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[1] Ibid. Elsewhere (e. g., Sum. theol., I, qu. 11, art. 3, ad 2) Aquinas seems to say that the one which is a principle of number includes intelligible matter. I think that the present statement must be taken to mean that the unit as opposed to the point does not include even those qualities which follow continuous quantity--for example, shape--and hence is more abstract than the point, which involves lacuna in the continuum.

[2] In Sent., III, dist. 23, qu. 2, art. 2, qu'la. 3, c.

[3] In de Trin., qu. 6, art. 1, qu'la. 2, c.

ranged according to the two factors of simplicity of principles and the proportion of objects to our mode of cognition.

In explaining Aristotle's remarks on the unity and distinction of sciences,[1] Aquinas shows how the unity of a science depends on the unity of its subject genus—that is, the scientific subject matter. The subject matter is the term of the science; therefore, it is necessary to consider the unity of the science with respect to it. Aquinas explains that the unity of one subject matter is more common than that of another; however, he emphasizes the community of metaphysics, rather than of mathematics, as Pseudo-Thomas does. Moreover, the aim here again is not to establish a hierarchy of sciences, as Pseudo-Thomas seems to try to do,[2] but merely to indicate how one science is more common than another, from the wider community of the unity of its subject matter; Aquinas, accordingly, does not relate this point to the consideration of the principles of the sciences in this context.[3]

The parts which a subject must have in order to be scientifically knowable are not integral parts of the object, but definable parts—that is, it must be possible for us to know it by an essential definition. This is required for a perfect scientific knowledge of the object; Aquinas, however, points out that we can know the separated substances from their effects, which are known to us, when we do so, they are composed as they enter our cognition from some principles which are primary for us.[4] While the unity of sciences is indicated by reference to the unity of scientific subject matters, the diversity of sciences is indicated by reference to diversity in the proper principles. A diversity of principles alone is sufficient to diversify sciences, since the principles provide the mode of knowing; but unity both of subject and principles is necessary for the unity of a science.[5] The last qualification agrees with the treatment of the

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[1] Aristotle Posterior analytics i, chap. xxviii; Aquinas, In Post. anal., I, lect. xli.

[2] Supra, pp. 220-224.

[3] When he does consider the question of common principles, he appropriates them to metaphysics, dialectics, and logic (In Post. anal., I, lect. xx) and insists on the appropriateness of proper principles to the special sciences (Ibid., lect. xxi).

[4] Ibid., lect. xli.

[5] Ibid.

intermediate sciences as simply diverse both from mathematics and from natural science; they differ from the former according to subject matter and from the latter both according to subject matter and according to principles. Elsewhere, Aquinas explains precisely what it is about the proper principles which leads to the diversity of theoretical sciences; it is the mode of definition.[1] The diversity of middles diversifies the sciences, since the middle is the means of demonstration and the mode of predication in the conclusion.

Throughout his consideration of these questions, then, Aquinas' attention is fixed on the principles of demonstration. The relative knowability of cause and effect determines which must be used in the principles. The application of mathematical principles to non-mathematical subjects determines the relation of subalternating and subalternated sciences. And finally, the diversity of principles determines the diversity of sciences. All the considerations of principles ultimately come to this: that the middle is the mode of scientific knowing, which is the knowledge achieved through demonstration. Because of the presence of the middle, serving as a mode of predicating in the conclusion, scientific knowledge makes a real addition to all our other knowledge of things, for it is a knowledge of causal order.

Concluding Summary

In the second chapter, "On the Nature of Logic," I examined three positions with respect to the question: "What is logic?" Having determined the question to the relation between logic and its subject matter, I argued that there are at least three theoretical positions, diversified by this basic principle. The problem which remained was to show that the oppositions between the three positions are not merely theoretical—that is, not merely with respect to theory about logic—but that they make a significant difference in the way various problems in logic are resolved.

I argued in chapter three that Pseudo-Thomas' notion of logic as a science of scientific knowledge is appropriate to his treatment of the categories, since he explains objects understood by reducing them to prior metaphysical and cognitive principles—the nature in things and in the

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[1] In Phys., I, lect. i; In Meta., VI, lect. i.

mind and the reflective operation of the intellect. I argued in chapter four that his notion of logic also is appropriate to his treatment of the proposition, since he explains truth by reducing it to a conformity or other relationship already present in cognitive content which merely is objectified by the second operation of the intellect. Similarly, I argued in this chapter that his notion of logic is appropriate to his treatment of demonstration. His general notion of inference does not emphasize progress from the known to the unknown; his description of the middle term of a demonstration is that it must express the definition and cause both of the subject and of the predicate of the conclusion. With this basic principle, it seems to me that Pseudo-Thomas' demonstration is nothing more than the explicit reduction of the obvious to its parts, a reduction which finally is concluded by the logical analysis of these parts themselves. Moreover, Pseudo-Thomas' treatment of the properties of science seems to be an effort to bring about a final systematic unity of all the objective content of the intellect; such a unity would correspond perfectly with the initial possession of the intellect—the nature of being.

In chapter three, I argued that Ockham's notion of logic as an art regulating the operations of the intellect in which propositions and arguments are formed is appropriate to his treatment of the categories, since he examines, divides, and clarifies the materials of which propositions and arguments are made. Pseudo-Thomas treated the predicables before the categories in order to show how objects suitable for classification in the categories originate in the intellect by its formation of second intentions and application of these to natures received from things. Ockham also treats the predicables, and a number of other second-intentional terms, before treating the categories; however, his purpose is not to reduce the categories to principles prior to themselves, but to clarify the terms which the logician himself uses; he begins to use them immediately in the treatment of the categories. In chapter four, I argued that Ockham's notion of logic as an art appropriately determines his treatment of the proposition, since he examines various forms in which propositions can be constructed in order to determine the formal conditions that are necessary and sufficient for the truth of such propositions. Finally, I have argued in this chapter that his treatment of demonstration also agrees with

his general theory of logic. Ockham does not treat demonstration in order to reduce demonstrated conclusions to principles beyond their proper principles, but to determine the conditions under which demonstrations can and cannot occur.

Aquinas' theory of logic does not permit it to be either a science or an art; rather, it is a knowledge of the limits of knowledge which is not attained in a distinct process of knowledge but concomitantly in the direct cognitive process. Consequently, for Aquinas, logic does not have a proper subject matter, but it considers the modes of predication which limit and determine our knowledge of things. In the third chapter, I explained Aquinas' doctrine of the categories, according to which they are simple and irreducible intelligibilities directly attained in the first act of the intellect that enter the second operation—in which the object is known as an object—to restrict the positing of the object to what we understand of it. In the fourth chapter, I argued that Aquinas' doctrine on the proposition is that it posits the thing as an object; this view of the proposition includes the reflexive knowledge of knowledge in the direct process, for the intellect judges its own judgment in forming the proposition. In this way, the modes of predicating exercise their limiting and determinative function. At the same time, the various modes according to which the terms are related to each other in the proposition itself contribute a variety of determinations in addition to the categorical modes. In this chapter, I argued that Aquinas' doctrine on demonstration depends on a notion of the reasoning process which makes it able to add to knowledge of things and to provide special modes of predicating in demonstrated conclusions.

Aquinas' theory of demonstration involves the thesis that a necessary knowledge of objective causal order is possible. For Pseudo-Thomas, knowledge can involve necessity only to the extent that it depends on essential being—the quiddity of the thing which a definition expresses—which he divides against the being of actual existence, which belongs properly and primarily to individuals. Ockham makes a place for necessity in knowledge, not by distinguishing determinate essential nature from its actual existence, but by limiting the objects of necessary knowledge to propositions which are hypothetical or concerned with possibility. For

Aquinas, however, necessary truth is existential, if it is unconditional truth, since existence is distinguished from essence as the proposition is distinguished from the simple intelligibility. Although all individual things of our experience are contingent in one relationship, they have necessary aspects and fall into necessary causal orders; these aspects are genuinely existential, and we can know them unconditionally. Such knowledge is not of the experienced individual as such; it is a knowledge which contains its own limits. However, it is a knowledge which is irreducible, appropriate to things, and unconditional within its limits, since we neither receive an absolute principle from things to initiate our knowledge of them, nor do we have an immediate intuition of absolute individuals. Our entire cognitive process, in Aquinas' view, is necessary in order to have a complete knowledge of anything; consequently, the parts of this process remain relative not only to each other but to the very being of things, the knowledge of which is the single objective of every act of knowing.

Since the difference between Pseudo-Thomas' logic and the authentic position of Aquinas is a relationship in which I am especially interested, a summary of the main points of this opposition is appropriate here. Pseudo-Thomas' logic is a science of scientific knowledge; it depends on the distinction between first and second intentions. Aquinas' logic is not a science, but a concomitant knowledge of the limits of direct knowledge; it depends on a distinction between things and intentions, but not between first and second intentions. Pseudo-Thomas' logic reduces everything posterior in the cognitive process to principles which are primary in it; it applies its own principles reflexively to itself, since logical knowledge is a knowledge of every subject matter. Aquinas' logic relates all the parts of the cognitive process to each other, but it treats each part as an irreducible contribution; its own principles are not self-applicable, since it has no proper subject matter and can be based on no merely logical reflection.

Pseudo-Thomas places the predicables before the categories, making the principles of predication--although not predication itself--prior to the ordering of objects understood. Aquinas allots the primary place in logic to the categories; however, he does not consider them as organiza-

tions of intelligibilities, but as the first simple outlines of essential determination. Pseudo-Thomas divides real being in the mind to attain an adequate logic of the categories; his principles of division are opposed pairs of terms—the modes—which are grounded in opposed relationships in things. Aquinas considers the simple categorical intelligibilities to be diverse of themselves; an adequate logical treatment of them does not reduce them to principles prior to themselves, although they may themselves be used to discover the diverse modes of being, for they divide being when it is predicated of them or according to them. From these differences, it follows that Pseudo-Thomas defines substance as a being existing through itself; Aquinas rejects this formula as a definition. Moreover, Pseudo-Thomas divides the last seven categories, as respective, from the three absolute categories, allotting the first three a superior reality, since they are more immediately reduced to natures; Aquinas does not accept such a division, although he does consider that predication according to the last six categories is by extrinsic denomination, since these are intelligibilities according to which the being of things is modified from things outside themselves.

Pseudo-Thomas' doctrine of the proposition represents it as an expression of a relationship objectified by the second reflection of the intellect; the entire content of this relationship already is present in the first act of the intellect. Propositions, consequently, are divided between those which express the conformity of an object understood to a nature in things—joining one thing to another by "is"—and those which express other necessary connections within the complex objects—the hypothetical propositions. Aquinas' doctrine of the proposition represents it as a limited knowledge of the object known, in distinction from the act of knowing; this distinction is accomplished because the intellect includes itself in its knowledge when it judges. Propositions, consequently, can be divided between those which unconditionally posit an object—that is, categorical propositions—and those which posit only relative to the act of the intellect itself—hypothetical propositions.

Finally, Pseudo-Thomas' treatment of demonstration provides the last link in the chain of means for reducing our scientific knowledge to its ultimate principles; the demonstrative syllogism itself is merely a further

objectification of the definitions and relationships already known in previous acts of knowledge, and the progression of discursive thought is merely a succession of apprehension. Aquinas' treatment of demonstration clarifies the conditions for a predication which completes knowledge of objects, by making known their causal order; the demonstrative argument is a progression from known necessary truths to the unknown causal relationships in which things are involved, and the progression of discursive knowledge is causally determined within cognition. Pseudo-Thomas divides knowledge of the reasoned fact from knowledge of the mere fact according to his distinction of essential being and the being of actual existence; Aquinas divides the two by the principle of priority in knowledge, since if what is better known in nature is not better known to us, we must begin from what we know better in order to attain what is more knowable in itself. Pseudo-Thomas treats the considerations of the subalternation of sciences and the unity and certitude of sciences in a way that seems intended to bring all sciences into a single hierarchical structure; Aquinas treats these problems according to various distinctions with respect to the principles of demonstration, which primarily divide sciences from each other and which explain the diversity of demonstrative modes of predication.

In the conclusions to previous chapters, I also have indicated some analogies between the oppositions among the medieval logics, which I have used as materials in studying the opposition of logical theories, and oppositions among certain contemporary logics. Although these analogies do not prove the applicability of my conclusions to other materials, they do seem to me sufficient to indicate the relevance of my investigation, and this suggests that the continuation of the investigation into contemporary materials could be fruitful. If my conclusions concerning the nature and reasons for the oppositions are judged unacceptable, my effort to clarify the problems and methods involved in an attempt to determine the nature of logic may be useful; at least, my work may lead to something better, for I shall have made clear some of the pitfalls to be avoided--as Aristotle pointed out his predecessors had done.

I also have pointed out certain statements of John of St. Thomas which seem to show that his logic is significantly different from that

of Aquinas and greatly influenced by that of Pseudo-Thomas. The influence is particularly noticeable in John's treatment of the predicables and the categories. The influence seems present, although it is not evidenced by citations, in his treatment of the nature and object of logic; other influences also are present there, however, for John considers logic not only a true science, but also an art. John also seems to have been influenced by Pseudo-Thomas in his treatment of the proposition; both the relation of the proposition to objects and the relation between the proposition and the judgment are similar in the two authors, although the structure of the proposition is different. In his treatment of demonstration and scientific knowledge,[1] John does not cite Pseudo-Thomas at all. Moreover, this treatise is less systematic than other parts of John's logic; it deals only with selected questions. John himself mentions the brevity of his treatment of demonstration in comparison with the length of his treatment of the predicables and the categories; he explains this by saying that often the preparations of things are much more extensive than what is involved in their final fulfillment, just as much discourse is required in intelligible matters to come to a final brief statement.[2] Apparently, then, he considers the theory of demonstration to be similar to a conclusion to which the rest of his logic leads.

Finally, I indicated in the introduction that I thought my investigation would be relevant to the problem discussed by contemporary Thomists concerning the method of metaphysics. Some have emphasized the origin of all our knowledge in experience;[3] others have argued that metaphysics must be a projection of the dynamic structure of cognitive process, known by a reflexive process of knowledge distinct from our direct knowledge of things.[4] I have pointed out that Aquinas considers it appropriate for metaphysics to proceed from logical principles.[5] Such a process cannot be directly experiential; therefore, metaphysical method will not be the same as the methods of other sciences. On the other hand, it is impossible for this process to project logical structures, for they are limits

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[1] Ioannis a Sancto Thoma, op. cit., I, 790-839.
[2] Ibid., 251[a]53-58.
[3] E. g., Wenle, op. cit.
[4] E. g., Lonergan, op. cit., chap. xiv.
[5] Supra, p. 61.

and determinants of knowledge. I do not claim that I have offered the solution to this problem; however, the clarification of Aquinas' view of logic and the operations of the intellect may be helpful in its solution. To attempt to carry my investigation into this additional area would not be a suitable end for this dissertation, but a suitable beginning for an even longer and more difficult study; consequently, I leave the question.

This work is finished; I am not so foolish as to suppose that the questions I have raised have been answered.