



Universal Logic and Aristotelian Logic: Formality and Essence of Logic

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Abstract. The rediscovery of Aristotle’s works on syllogisms in the Latin world, especially the *Sophistici Elenchi* and then the *Prior Analytics*, gave rise to sophisticated views on the nature of syllogistic form and syllogistic matter in the thirteenth century. It led to debates on the ontology of the syllogism as studied in the *Prior Analytics*, i.e. the syllogism made of letters and the four logical constants a/e/i/o, with deep consequences on the definition of logic as a universal method for all sciences and as a science itself.

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1. Introduction

The notion of universal logic put forward by Béziau [6, 7] is obviously not to be understood as a “super-logic” encompassing all the varieties of logic. If it were so, one could consider that the Aristotelian logic was, up to the nineteenth century, a “realized universal” in the Western and Mediterranean world, except, maybe, for one serious challenger, Plato’s dialectic. The only utterly alternative variety of logic, born in the Hellenistic period, is Stoic logic—and its ancestor, Megaric logic. But it was soon included by peripatetic logicians, after some dramatic transformations, into the empire of Aristotelian logic, as a sub-part of syllogistic, namely “hypothetical syllogistic”, and this lasted until the beginning of the twentieth century. The original aspects of Roman logic were overlooked: Ciceronian topics and rhetoric were also considered as parts of this empire, in accordance with Cicero’s own declaration at the beginning of his *Topica* about his project of clarifying Aristotle’s *Topics*. Some medieval authors, such as William of Ockham in the fourteenth century, or Avicenna, in the twelfth century, did bring important logical novelties one could characterize as “extra-Aristotelian” or even “non-Aristotelian”. But they were never historically formulated in such a way, nor did they generally challenge the

Aristotelian paradigm. Renaissance logics did not substitute Aristotelian logic despite the harsh criticisms addressed to syllogistic; Modern logics inspired by Descartes, such as Port Royal logic, all included a chapter on syllogistic, among many other remnants of Aristotelian logic.

The project of universal logic is in fact an invitation to investigate into common concepts and tools the existing and future logics can share, a program that obviously has a strong comparative dimension. History of logic can fit in this program when conceived as a philosophical inquiry into the past varieties of logic. Among the fundamental features that could be dealt with, formality is acknowledged as a prominent one. The possibility of demarcating logical form on analytical (non pragmatic) grounds, especially through the demarcation of logical constants, has been questioned (see [25] for a recent synthesis); the very interest of notion of logical form has been put into question [8]. The various approaches to formality have also been historically discussed. Some scholars have challenged the very idea that arguments were considered valid “in virtue of their form” in Ancient logic (see [21]), some have suggested that late ancient logicians such as Alexander of Aphrodisias did not have a coherent notion of logical form ([4], while others have upheld that he had, on the contrary, an alternative conception of logical form, based on “logical matter” [20]. A “material logic” in the Syriac tradition of the *Organon* has even been delineated [22]. The historical varieties of the notion of logical form in Western logic has been recently detailed by MacFarlane [24], Dutilh Novaes [14], and Thom [35,36]. The aim of this paper is to elaborate on those reflections, focusing on a peculiar variety of logic, medieval syllogistic in the thirteenth century. The issue of logical form was at the time to be understood within the general framework of logic conceived as a universal method—an underlying logic of sciences—and as a science itself. This will be addressed in the conclusion.

The choice of this period relies on the fact that we find here a “Golden Age” of Aristotle’s syllogistic and epistemology. This extends from the rediscovery and systematic study of the *Prior* and *Posterior Analytics* (respectively at the end of the twelfth century and in the first decades of the thirteenth century), and the emergence of a new paradigm around 1340, with William of Ockham and John Buridan.

The idea is not to give here a detailed presentation of the thirteenth century debates on syllogistic form (see [9–11]), but to delineate some general features of this logic and its objects: syllogism (or argumentation) and, ultimately, proof and demonstration. The questions here addressed are the following:

- What is logic?
- Is logic a norm? Is it the underlying structure of rational discourse, whether consciously followed or not, whether targeted as such in an independent theory or not?
- Is logic essentially a method? Is it a science? Can it be to itself its own method?
- What are the consequences for the definition of the syllogism?
- What is a syllogism?

- Are there other necessary inferences than syllogisms?
- Is there something as a pure and simple syllogism (syllogism *simpliciter*) distinct from any given real reasoning?
- What is syllogistic form? What is syllogistic matter?
- Is syllogistic disposition according to mood and figure the sole dimension of syllogistic form? How is the substitution test to be understood and used?

I will use in the present study “syllogism” not only for the *Prior Analytics*, but also *everywhere* there is “syllogismos” in Greek (“syllogismus” in Latin), *Topics*, *Posterior Analytics* and *Sophistici Elenchi* included. This choice is justified from a historical point of view. Late ancient and medieval commentators were “pre-jaegerian”;¹ they considered the *Organon* as the coherent work of one and the same philosopher, written in one piece, where key words such as “syllogismos/syllogismus” are supposed to signify more or less the same thing. I generally avoid to use the term “valid”, not so much for doctrinal reason, but because another term existed at the time for syllogistic, namely “useful”. A useful combination is a syllogistic combination of a/e/i/o propositions where the two premises necessarily yield a conclusion, that is, “produce” something (with some extra requirements, as we shall see). Issues in assertoric and modal syllogistics as well as the puzzles raised by eristic syllogisms show that not all argument following a “useful combination” listed in the *Prior Analytics* would obviously be called “valid”.

This leads to the first part of this paper, where some preliminary observations about the initial Latin reception of the *Prior Analytics* are provided, thereby clarifying the methodology here followed. The second part deals with the nature of the syllogism. The third part is concerned with the way the first commentators of the *Sophistici Elenchi* and the *Prior Analytics* understood the notions of logical form and logical matter. The fourth part is devoted to the properly logical hylomorphism displayed by thirteenth century masters, among which Robert Kilwardby² emerges as a leading figure. The last part of the paper studies the difficulties raised by the Kilwardbian approach to logical form. In the conclusion, the problem of logical form is addressed in connexion with the definition of logic as a universal method and as a science of its own.

¹ For a presentation and discussion of Jaeger and Somlsen’s chronology of Aristotle’s logical works see [5]. The *Topics*, the *Sophistici Elenchi* and a first version of the *Posterior Analytics* (which subject matter is then called “apodictic science” as contrasted to scientific syllogism) are generally seen as prior to the *Prior Analytics*.

² Robert Kilwardby (ca 1215–1279) was a Dominican, a very important master both in arts (philosophy) and theology in the thirteenth century, who taught in Paris and in Oxford. As a bishop of Canterbury, he was instrumental in the Oxford condemnations of 1277 (10 days after those of Paris) that signified a rejection of some novelties introduced by Aristotelian philosophy (or some interpretations of it), judged dangerous for Christian faith. His logical works were very influential. For recent synthesis on various aspects of his thought see [34].

2. The First Latin Reception of the *Prior Analytics* in Context

As well known, Apuleius and Boethius have transmitted Aristotle's list of useful syllogistic combinations all through the Early Middle Ages (respectively with the *Peri Hermeneias* and the *De Syllogismis Categoricalis*). They gave an idea of the content of the first seven chapters of Aristotle's treatise, leaving out of sight modal syllogistic. The arrival of the *Prior Analytics* in the Latin world in the twelfth century might be considered a "non event" (but for the recovery of modal syllogistic), that is, if one thinks that syllogistic equates the formulation of the canonical syllogistic formulas. But this represents a very small portion of the text—only a part of the threefold program announced in *Prior Analytics* I, 32. The first part is the description of how syllogisms are built (the "generation" of syllogisms), the second one is the discovery (*inventio*) of syllogisms starting from a desired conclusion, and the third one is "analysis" proper, that is, the reduction of all necessary inferences and imperfect syllogisms to canonical syllogistic formulations. Even if only assertoric syllogistic combinations were taken into account, Apuleius's and Boethius's presentations are far from reflecting the exact theory of Aristotle; they rather depend on a very sketchy lost late ancient Greek manual that probably was the common source of Apuleius and Porphyry (then of Boethius) on categorical syllogisms.

From Book I, chapter 8 to book II, chapter 27 of the *Prior Analytics*, a wealth of general logical reflections and principles are offered, some establishing a direct link with the *Topics* (esp. the *pons asinorum*, I, 27–31), with the *Sophistici Elenchi* (esp. the rejection of the fallacy of begging the question—*petitio principia*—and false cause—*non causa ut causa/non propter hoc*), and with the *Posterior Analytics* (esp. "inventive" logic and demonstrative syllogisms). These links are overlooked within a narrow approach to the *Prior Analytics*. They are totally ignored if *syllogismos* is translated by "syllogism" in the *Prior Analytics*³ and by "deduction" in the other logical treatises, as it often happens. The puzzles raised by the chapters on modal syllogistic, such as the famous "two Barbaras" problem, should also be taken into account for a general appraisal of Aristotle's theory of syllogism, since it shows that some "useful", i.e. syllogistically conclusive combinations, do not pass the substitution test on all types of terms (LXL) except if some extra requirements are added, while a non useful combination (XLL) can be considered as necessarily yielding a conclusion if the same extra requirements are respected, an observation for the least embarrassing (see [35]).

³ Some embarrassment can be observed in the two English translations of the *Prior Analytics* generally referred to: Striker [33] has "syllogism", but she feels compelled to change for "deduction" in some cases; Smith [32] has "deduction" everywhere, even for the "narrow" notion of *syllogismos* (i.e. *Anal pr* I, 4-22) to which all other *syllogimos* are to be reduced. This choice is probably in line with the notion that the *Prior Analytics* are not talking of something else than were the *Topics*, the *Sophistici Elenchi* or the first version of the *Posterior Analytics*, so that it is fully justified in principle. But it makes the very term "syllogism" disappear from Aristotle's logic, which is a bit puzzling for historians of logic.

When the *Prior Analytics* were first subjected to an accurate scrutiny at the end of the twelfth century, Boethius's *Topics* had been dominating the logical theory of argumentation for centuries and Aristotle's *Sophistici Elenchi* has been commented upon for almost half a century. The form-matter distinction had been introduced in the Latin logical tradition around the 1170s by an anonymous commentator called "Alexander", essentially inspired by late ancient commentators, especially Philoponus (sixth century AC). His works are now lost but they have been reconstituted by Ebbesen [19]. The form/matter device was consequently first applied to the classification of defective arguments, classified as materially or formally defective syllogisms. From late Antiquity, most of Aristotle's fallacies have been reformatted according to the canonical forms of assertoric syllogistic, often in Barbara. Some of them presented shared materials with the *Prior Analytics*, namely begging the question (*petitio principii*) and false cause (*non causa ut causa*). As for Boethius's *De Differentiis Topicis*, it developed a theory of argumentation where axiomatic topics (for instance "everything that is predicated of a genus is predicated of its species") were the foundations of all arguments, *syllogisms and even demonstrative syllogisms included*, for which the topics of definition and of cause are specialized. History of logic records Abelard's fierce attacks against this idea, and his famous distinction between consequences that beg their necessity to the topical relationship of the things signified ("it is a man, so it is an animal") and consequences that find their necessity in the nature of the combination followed regardless of the terms substituted (syllogisms)—i.e. his distinction between what will be later on called materially and formally good consequences by John Buridan (see [26]). Nonetheless Boethius's conception of axiomatic topics as the foundation of syllogistic deductions is far from being abandoned in the twelfth and the thirteenth centuries, a fact that utterly contradicts our "modern" intuitions about formally valid inferences, and which has received far less echoes in scholarship. This theory blurs the traditional distinction between the necessity of what is inferred (*necessitas consequentis*) and the necessity of the inference (*necessitas consequentiae*), or the modern difference between formally and materially valid inferences. It also makes unclear on which side of the argument, the material or the formal part, do the topics fall.

The above concepts and debates formed the very complex soil on which the medieval Latin exegesis of the *Prior Analytics* developed the end of the twelfth century and in the thirteenth century.

3. The Syllogism

Let's begin with the syllogism. Aristotle's definition of the syllogism can be read almost identically in the *Topics*, the *Sophistici Elenchi*, and the *Prior Analytics*:

A syllogism rests on certain statements such that they involve necessarily the assertion of something other than what has been stated, through what has been stated, *Sophistici Elenchi* 165 a 1-3.

A syllogism is a discourse in which, certain things being posited, something other than these necessarily comes about through them, *Topics* 100a25-27.

A syllogism is discourse in which, certain things being posited, something other than what is laid down follows of necessity from their being so. I mean by the last phrase that they produce the consequence, and by this, that no further term is required from without in order to make the consequence necessary, *Prior Analytics*, 24b18-22.

The *Prior Analytics* contains the definition as expressed in the strictest manner. It contains a series of clauses that immediately shows that a syllogism is much more than just a necessary inference. It demands:

- A plurality of premises.
- The premises being “laid down”, that is not just taken as a hypothesis or a postulate.
- A conclusion different from the premises (thereby excluding *petitio principis*).
- The conclusion being obtained in virtue of what has been put in the premises, nothing less (thereby excluding insufficiency), nothing more (thereby excluding redundancy)—this last aspect is seen in the rejection of the false proof (*non causa ut causa/non propter hoc*, *Prior Analytics*, II, 17).

It should also be mentioned that demonstrative proof is its final destination—this can be seen in the opening sentence of the *Prior Analytics* where the subject of the treatise is explicitly “demonstration”.

All the clauses previously mentioned were quite uncontroversial⁴ and accurately detailed by all medieval logicians.

No mention is made of the moods and figures in the definition of the *Prior Analytics* that just repeats the *Topics* and the *Sophistici Elenchi*. This probably means that moods and figure are not part of the essence of the syllogism,⁵ but are parts of the right formula of it, the one that will always guaranty that a syllogism have been really built—a formula precisely discovered by Aristotle at the time when he wrote the *Prior Analytics*.

Yet the status of moods and figures is not equally understood: some commentators of the *Sophistici Elenchi* and of the *Prior Analytics*, but not all, did identify them in some portion of the definition as understated, namely in the “posited” within the phrase “some things posited”: “posited” is then understood as “disposed”. The very same portion of phrase is sometimes seen as signifying the matter of the syllogism.

The syllogism is generally recognized as a paradigm in reference to which other types of arguments traditionally listed (example, induction, enthymeme) find their “focal unit”. A heavy trend in the thirteenth century, inspired by Boethius’s conception of enthymemes and Abelard’s ideas, was to view topical

⁴ Though some variances are expressed, as shown by Thom ([35] chapter “the syllogism”).

⁵ Ockham’s definition of the syllogism by modes and figures is not to be considered as standard for Middle Ages (see [37]).

inferences such as “it is man, so it is an animal” as enthymemes that could be transformed into syllogisms by the addition of the non-expressed premise, an idea suggested by *Prior Analytics* II, 27. The same holds for the possible reduction of induction to syllogism. Yet, not all deductions are syllogisms and not all syllogisms follow modes and figures for medieval logicians. Boethius’s *Topics* are full of many-step and informal arguments that certainly are non reducible to syllogisms, but are necessary inferences all the same. Careful readers of the whole *Prior Analytics* and the *Sophistici Elenchi* as they were, medieval logicians from the end of the twelfth century also knew that Aristotle acknowledged other necessary inferences than the syllogisms listed in the *Prior Analytics*, (besides the well known case of conversions): the blunt fact is acknowledged in chapter 32 of book I of the *Prior Analytics*. Induction can be a necessary inference at least if starting from a complete set of individual cases, contrary to example (69a17-18). The *Sophistici Elenchi* is peopled with bad arguments that are “apparent syllogisms” without displaying the beginning of a syllogistic combination. The *Sophistici Elenchi* distinguishes between sophistic reasonings that do not absolutely “syllogise” and those that are not syllogisms—which implies that you can syllogise without being a syllogism. Because of a strange translation of the Greek “asylogizatoi” (non-syllogistic) by “immodificati” (non-conform), the Latin tradition of the *Sophistici Elenchi* distinguishes between not being a syllogism and not being “conformed” (i.e. put in syllogistic moods and figures), which implies, once again, that you can be a syllogism without being canonically “syllogistic”. This is also why it is not necessary to be a “conformed” syllogism to be a good refutation (though it obviously takes to be a syllogism, since refutation is defined by the use of a syllogism for contradiction). Eventually, Aristotle’s syllogistic teaches non-syllogistic deductions, such as the *proof per impossibile*, that contains a syllogism, but is not straightforwardly a syllogism (this is why some commentators tried to reduce it to a syllogistic process).⁶ He relies on non deductive inferential processes, such as analysis, whether understood in the mathematical sense, the one explicitly found in the *Posterior Analytics* (and implicitly in the *Prior Analytics*: the search for the appropriate premises of a desired conclusion) or in the sense proper to the *Prior Analytics*, i.e. the reduction of non syllogistic deductions into syllogistic deductions and of imperfect syllogisms to perfect ones.

Last but not least, inferences that display the fallacy of begging the question and of false proof are recognized as perfectly all right necessary inferences by many medieval logicians, but not as syllogisms: *they are just not good argument for the conclusion to be proved, something that a syllogism must perform.*

They are nevertheless often formulated according to syllogistic moods and figures, as are many of other paralogisms of the *Sophistici Elenchi*, but are not judged good syllogisms for that. How come?

⁶ See Avicenna and Kilwardby’s solutions as detailed by Thom in [37]. The same could probably be said about the so-called “expository syllogism” (*ecthesis*), the other device used for the reduction of imperfect syllogisms, together with conversion and *proof per absurdum*.

4. Syllogistic Matter and Form at the Turn of the Thirteenth Century

As seen, the tradition of Alexander soon introduced after the rediscovery of the *Sophistici Elenchi* the idea that syllogisms were a compound of matter and form. In the period here studied, the syllogism was considered as the paradigmatic reasoning, contrary to what will be observed in the fourteenth century, when it was just one among other formally good consequences. But this does not mean that medieval logicians had at their disposal in the *Prior Analytics* a ready-made, obvious, definition of logical form. On the contrary, syllogistic form became a problem in itself. The role of figure and mood and the relationship between syllogistic form and logical necessity were highly debatable topics.

The problem of syllogistic form was first addressed by logicians who commented on the *Sophistici Elenchi* and had an acquaintance with the *Prior Analytics*. It was then directly dealt with in commentaries on the *Prior Analytics*. All the authors here studied had inherited from “Alexander” the form/matter distinction, where two main senses of “matter” co-existed.

The matter in sense 1 is the “matter of propositions”, according to the testimony of Ammonius.⁷ Those are necessary, possible and impossible matters. They are “material modalities” or “modal states of affairs” about assertoric (*de inesse*) propositions. They were often associated with alethic modalities in the late ancient and Arabic divisions of syllogisms: propositions in necessary/impossible matters are always true/false, propositions in contingent matter are sometimes true, sometimes false propositions. Necessary matter is the scientific matter, whereas contingent matter is the dialectical matter. Sophistic matter (generally seen as an imitation of dialectical matter) corresponds to sophistic syllogisms.⁸ In the discussions about the classification of defective arguments only the truth-values of propositions is understood as the “matter”: sophistic propositions are false, though apparently true, propositions. In this sense the matter can fail if one premise is false. It can fail in such a way that the argument is materially eristic, that is, deceptive, if the premise is false but appears to be admitted as true because of a hidden fallacy. This sense of matter is also used when commenting on *Prior Analytics* II, 2 and 4, which deals with “quoniam” syllogisms: those that conclude the true from the false. Here also the matter is said to “fail” (*peccare*).

⁷ “Those who are interested in the technical study (*technologias*) of these things call the relations [between terms] the matters of the sentences, and they say that they are either necessary or impossible or possible. The explanation of the latter names is evident; and they determined to call the relations in general (*holós*) matters because they appear together with the object (*pragmata*) which underlie the sentences and they are taken not from our thinking or predicating them but from the very nature of the object,” Ammonius, *In Int.* 88.17–20, transl. by Barnes [4, p. 44].

⁸ In the long *Organon* developed by late Alexandrian commentators, rhetoric propositions are true or false, but more false than true, and poetic propositions are obviously false propositions.

The other sense of “matter” is the matter of the syllogism proper, the matter of the syllogism in sense 2. It is just the premises the syllogism is made of,⁹ a sense sometimes extended to the conclusion. One can talk about the matter of the syllogism without any reference to the matter of the isolated propositions. Matter in sense 2 is seen as part of the definition, and so, in a way, of the “form” understood as the “essence” of the syllogism.

As we shall see, a third sense of matter emerges within medieval discussions.

“Anonymus Aurelianensis II”¹⁰ (AAII) is the anonymous author of a treatise on fallacies from the end of the twelfth century who extensively uses the form-matter distinction. His theory is not entirely clear but it is nonetheless possible to reconstruct some important thesis. Since only begging the question and false cause are explicitly excluded by the definition of the syllogism, one can think that the other eleven fallacies, when put in syllogistic moods and figures, are pure and simple syllogisms (syllogisms *simpliciter*) notwithstanding the internal ambiguity they contain. This is because AAII considers that syllogistic form is composed of mood, figure, and conclusion. More importantly he considers that inferential necessity is the direct result of syllogistic disposition: when there is a disposition according to useful moods and figure there is necessity, and conversely.¹¹ As a consequence the eleven fallacies are “materially” defective—because there is something wrong with the terms with which the form is filled up—not formally. As for formally defective arguments, they are arguments following non-useful combinations.

“Anonymus Aurelianensis III” (AAIII) is the first Latin commentator of the *Prior Analytics* so far identified, who probably worked at the end of the twelfth century. He offers a similar general framework, as can be seen in the following passage of his introduction:

The study of any compound pays attention to two elements: its matter and its form.

The form of the syllogism is double: the disposition of the terms that is called figure and the disposition of the propositions, that is called the mode, and there is only one [set of] both of them for all the genera of syllogisms. Figures and modes of the syllogism are common to dialectical demonstrative and sophistic syllogisms. Because there is only one form of the syllogisms for all the genera,

⁹ The different syllogisms (scientific, topical and sophistic) are described by Alexander of Aphrodisias as species of the syllogisms, the differences coming from the “matter”, *i.e.* the premises, whether they are themselves necessary, dialectical or eristic: see [3, p. 1, 3, p. 7, 5–11, p. 8, 19–29, p. 12, 5–13, 25, p. 27, 27–28, 2].

¹⁰ These names for anonymous authors have been coined by scholars from the manuscript in which the text is contained: Orléans for AAII et AAIII; Cambridge for AC. These anonymous texts have been edited by Ebbesen in [17, 18]; the edition of the AC is forthcoming.

¹¹ “There is necessity of the combination where there is a useful mode and figure, and there is always a syllogism ... where there is a necessity of the combination”, Anonymus Aurelianensis II, [17, p. 25].

Aristotle has given a unitary and general teaching about the form of the syllogisms in the *Prior Analytics*.

The matters of the syllogisms are different according to their genera: the matter of demonstrative syllogisms is the immediate propositions, the matter of the dialectical is probable propositions and the matter of the sophistic sometimes a sophistic matter, sometimes the same matter as the dialectical and the demonstrative. The sophist sometimes imitates the dialectician or the scientific logician regarding the matter employed but fails according to the form, sometimes he imitates the form, but fails according to the matter.

[...]

In the same manner as the form of the syllogism is double, the matter is double, i.e. terms and propositions.

[...]

As the study of the syllogisms is the study of their matter and their form, and since logic as a whole considers the form and the matter of syllogisms, it is obvious that the syllogism is the subject matter of logic.

Aristotle aims at showing the syllogistic form in general. What is the form and in which way it is double or general have yet been said. But Aristotle deals with this form in the purpose supplying the reader with an abundance of “syllogistications” in a dialectical or a demonstrative way. But the main purpose of this work, as well as logic as a whole is nevertheless the abundance of “syllogistications” in a demonstrative way.¹²

The comment of the definition of the syllogism shows that insufficiency and redundancy are explicitly rejected with the expression: “from their being so” in the definition of the syllogism. “Certain things being posited” corresponds to the matter (propositions and terms), “something other than what is laid down” corresponds to the conclusion as disposed according to moods and figures. The conclusion is the form of the syllogism in respect to the premises, the matter. “Something other” excludes “ridiculous syllogisms” (where the conclusion is the same as the premises). It also excludes arguments where something in doubt is concluded from something in doubt, where something sure is concluded from something in doubt and something sure is concluded from something sure. The only acceptable combination is when something in doubt is concluded from something sure.¹³ “Something” is understood as “some thing” and means the rejection of arguments that are not put in the right disposition (*immodificati*: a term borrowed from the *Sophistici Elenchi*, as seen). Those are arguments with only particular or only indefinite propositions. “Follows of necessity” concerns the necessity of the composition, not the necessity of things.

¹² See [16, 38].

¹³ This means that a feature of demonstrative syllogisms (the premises must be more known than the conclusion) is introduced for the syllogism in general.

The syllogism is for the AAIH an argument based upon a necessary inference by which something must be epistemologically gained (from what is sure to what is in doubt). The same idea is clearly conveyed by the notion that the finality is proof, and, more specifically, scientific proof.

“Anonymous Cantabrigiensis” (AC), wrote a commentary on the *Sophistici Elenchi* at the beginning of the thirteenth century. He has a completely different theory. For him, the thirteen fallacies of the *Sophistici elenchi* are formally defective arguments. Even when put in correct syllogistic moods and figures, they are apparent syllogisms because the hidden fallacies “are an impediment to syllogistic form [form=essence]”. They are distinguished from materially [matter sense 1 = alethic modality] defective syllogisms that are perfectly all right syllogisms, even though they start from fallacious premises. The definition of the syllogism is composed of parts that correspond to the matter of the syllogism and parts concerned with the form of the syllogism. The form of the syllogism includes the notion of syllogistic necessity, the third aspect of the form, and not only the presence of moods and figures. Terms and propositions are the two first aspects of the matter of the syllogism, the conclusion being the third part of the matter [matter sense 2 = propositions and their components]. One fallacy is defective by its matter [matter sense 2]: this is begging the question, because the conclusion is put in the premises. The others are defective according to their form. The *non causa ut causa* is a perfectly necessary inference but defective as a syllogism because of its redundancy. The eleven other fallacies are formally defective because they lack the third aspect of the form, i.e. necessity. This is because they do not display semantic and predicative uniformity from premises to conclusion. A stock example is the metallic statue, first introduced by the AC (to my knowledge). It will be systematically used afterwards:

Every metal is natural
 Every statue is [in] metal
 Every statue is natural
 (omne aes naturale, omnis statua aes, omnis statua naturalis)

The example of the metal statue raises some problems that one cannot get rid off just by an initial stipulation of non-homonymy in uniform substitution, as would be the case if the sole case of the fallacy of equivocation was adduced. AC’s interpretation of Aristotle’s definition of the syllogism means that syllogistic necessity and syllogistic moods and figures are a priori independent features since there are fallacies that do follow syllogistic moods and figures without being necessary inferences. As a consequence, checking that the criteria of semantic unity and predicative uniformity (some content-related, “material,” aspects of the matter of the syllogism) is satisfied is part of the judgment about the syllogistic form. Here a third sense of “matter” emerges. It corresponds to the general (as opposed to individual) features of the semantic content of terms and propositions.

This sense of “matter” is perfectly in line with the idea that Aristotle’s letters in the *Prior Analytics* are neither variables, nor symbolic letters, nor

holes to be filled, but just “dummy letters”. These are terms endowed with a signification, though a general one, or, rather, a “not-yet-determined” signification (see [22, 23]). This general signification is just part of syllogistic form. The idea will also perfectly fit the Avicennian notion generally adopted in the first decades of the thirteenth century that general matter (as opposed to individual matter), not just form, is part of the definition, in the case of realities that are a compounds of matter and form the form of which cannot be separated from its matter, such as men, animals, artefacts—recall that syllogisms are artefacts.

Important differences between AAI, AC and AAII are to be underlined. First, the conclusion is part of the form of the syllogism for the AAII and the AAI, not of the matter, as in the AC. More importantly, necessity is not part of the form of the syllogism, which is only constituted by moods and figures for AAI, necessity being the immediate consequence of the syllogistic combination. Necessity is an additional feature of the aggregate of form and matter for AAII. By contrast, it is part of the form of the syllogism for the AC. The prologue of the AAII says that the reason why sophistic syllogisms are not mentioned in the division of syllogisms offered by Aristotle at the beginning of the *Prior Analytics* is because the *Sophistici Elenchi* plays no part in the teaching of logic, but only belongs to the prophylactic part of logic. This is because it “deals neither with the form nor with the matter of the syllogism”. On the contrary, AC considers that some aspects of the matter of the syllogism (sense 2 and 3) bear on the form of the syllogism, especially necessity. These aspects are dealt with by the *Sophistici Elenchi* as a study on formally defective arguments, and this is the reason why the treatise also belongs to the judgmental part of logic according to him.¹⁴ This is also the reason why all the thirteen fallacies are not syllogisms.

An initial split (see [9]) in the logical tradition is here observed between a purely syntactical conception of syllogistic form, represented by AAI and AAII, and a rich conception of syllogistic form, represented by the AC, where some content-related aspects of the syllogisms (“matter” in sense 3) enters syllogistic form, which is not exhausted by mood and figure. The first approach can be found in Robert Kilwardby’s *Notule*, whereas the second one is adopted by Kilwardby’s immediate followers, especially Albert the Great. This distinction is connected to the ontology of the syllogism *simpliciter*, whether conceived as an entity of its own, a compound of form and general matter, or as an abstract object underlying concrete syllogisms in actual discourses.

¹⁴ “This tract (i.e. the *Sophistici Elenchi*) mainly belongs to the science of discovery (*inventiva scientia*) but it secondarily belongs to the judicative science (*iudicativa scientia*) because he makes clear what are the defects that prevent the syllogistic form from being realized and how many they are, which belongs to judgment (*iudicium*)”, Anonymus Cantabrigiensis, ed. Ebbesen, Prooemium 3.4.2.

5. Robert Kilwardby and Logical Hylomorphism in the Thirteenth Century

5.1. Logical Hylomorphism

The form/matter distinction was not allotted a strong philosophical signification in logical contexts during the period so far considered. By contrast, it received a robust hylomorphic interpretation in the first decades of the thirteenth century. Aristotle's hylomorphism in metaphysics, physics, biology and psychology is progressively rediscovered in Western universities with the arrival of the "New Aristotle" (i.e. *Metaphysics*, *Physics*, *On generation and Corruption*, *On soul*, *Meteorological*, *Animals Parts*, *Parva naturalia*, etc.) and becomes philosophically pervasive. Some of the principles then formulated are applied to logical form and matter.

To put it in a nutshell, hylomorphism, together with the potency/act couple, allowed Aristotle a multi-layered metaphysical and physical description of natural beings in their increasing complexity, from being considered just as substances, plain bodies in movement just considered as such, to the most sophisticate of animals, man, doted with an intellective soul. Since prime matter is just an abstraction, several degrees of matters and forms were fitted together, the lower aggregates of form and matter becoming the proximate substrate, i.e., the matter, of the next degree, in a finalized process of generation: elements are the matter of composite bodies, composites are the matter of instrumental parts, instrumental parts are completing living beings as whole entities. Hylomorphism was certainly a device for isolating formal components, but also for rejecting any Platonic conception of form as an independently existing separate reality. When hylomorphism was applied to the soul/matter distinction, this aspect of the theory creates deep tensions with the Christian conception of soul as a spiritual immortal substance. Compromises were first attempted (the soul as a substance as and a form), where the idea of the plurality of substantial forms seemed part of the best solutions at hand,¹⁵ until challenged by Thomas Aquinas.

"Logical hylomorphism" is a term coined by MacFarlane [24] to describe theories that define logicity by delimitating logical form—generally through the demarcation of logical constants. It suggests that the delineation of logical form is an instrument for the rejection of matter out of logical theory. This is obviously not the conception of medieval logicians when they applied hylomorphism to the syllogism, an artificial compound of form and matter. On the contrary, syllogistic form had an essential counter-part, syllogistic matter, itself understood in various ways. These various possible approaches to syllogistic matter made the very demarcation of syllogistic form a philosophical problem of its own.

Medieval logical hylomorphism brought about new notions that were not found in the previous period: the description of terms and propositions as remote and proximate matters, the introduction of the Aristotelian theory of

¹⁵ See [31] about Robert Kilwardby's position on that topic.

the four causes (material, formal, efficient, final), the idea that the logical form had a substrate without which it could not “survive”, and even a proper substrate, this immediate substrate being “in potency” of the form it receives, etc. All these are to be found in Robert Kilwardby. The syllogism, like any other hylomorphic reality, has a plurality of forms, as shown by Thom [35]. In its ultimate stage, it has a material cause (the matter of the syllogism), a formal cause (the form of the syllogism), an efficient cause (the agent actually reasoning), and a final cause. This is double, corresponding to the way the syllogism is considered. As a reasoning, its final cause is the conclusion as necessarily obtained, towards which the premises are oriented. As an argument, its final cause is the production of science and belief.¹⁶

It should also be added that Kilwardby explicitly defends a “hylomorphic principle” in logic, i.e. the idea that a syllogism is a compound that cannot exist without one or the other of its essential components (form *and* matter), and that syllogistic form has a precise type of matter as its proper substrate, without which it “cannot remain”. The passage quoted shows a connection between eristic syllogisms (from false though seemingly true premises) and “quoniam syllogisms” of the *Prior Analytics* II, 2-4:¹⁷

A question is raised about what he [Aristotle] lets understand, i.e. that the eristic syllogism would be a syllogism notwithstanding the fact that it is defective according to its matter. This seems to be false since any compound of form and matter is such that if either its matter or its form is defective, the compound would also be defective. This is because it is not the case that any kind of form is attracted by any kind of matter, but it is attracted by its proper matter [...] so that a syllogism that would start from a false premise or from false premises would not be a syllogism because it is defective according to its matter.

One must say that the essential matter in the syllogism is the three terms and the two propositions: if this matter fails, the syllogism does not remain.

In another sense, the matter is incidental to the syllogism: it is the three terms and the two propositions under the circumstances that they are generally admitted (*probabilis*) or true and necessary propositions. If this matter fails the syllogism can very well remain, since this matter is incidental.¹⁸

Kilwardby’s solution is that the syllogism keeps its matter as long as it has syllogistic terms and proposition (matter in sense 1) even if a false proposition is formed, since matter in sense 1 is essential to any syllogism as a syllogism, whereas matter in sense 2 (matter of the propositions as connected to truth-values) is accidental.

¹⁶ See [35] chapter “the syllogism”.

¹⁷ A similar “hylomorphic principle” is found in the discussion about “quoniam syllogisms” in Kilwardby’s *Notule on the Prior Analytics*.

¹⁸ [39, p. 132–133].

A final remark: logical hylomorphism is not just an interesting philosophical notion: it was also a “hot topic” in the Middle Ages. The idea that “a syllogism that fails according to the matter is not a syllogism” was not just considered as a non-sense, as it could appear today. It was judged a dangerous proposition, worth being condemned in Oxford 1277, together with five other logical propositions, among which one about existential import of universal necessary propositions (“every man is of necessity an animal, no man existing”). Robert Kilwardby is known to be behind those condemnations.

5.2. Robert Kilwardby on Syllogistic Form and Matter

Robert Kilwardby’s commentary on the *Prior Analytics* was written around 1230; it benefits from an important manuscript diffusion. Its huge influence makes it a classic in the Latin world. Kilwardby’s conception of logical form has been extensively studied by Paul Thom. He has shown that the syllogism was not for him an inference since the conclusion is not part of it, even though syllogisms are based upon a necessary inference. The syllogism is “more essentially” a reasoning than an argument; the object of the *Prior Analytics* is not the form of the syllogism, contrary to the AAIII’s assertion, but the syllogism *simpliciter*, which form is the mood and figure and which matter is the dummy letters, the “transcendent term” (*terminus transcendans*) as medieval logicians puts it, by which they probably meant trans-category terms. As shown by Paul Thom, the formula “AaB, BaC, AaC” is not what would be today called the logical form of all syllogisms in Barbara, but an aggregate of form and matter, which is itself the form of these concrete syllogisms. The definition of the syllogism explicitly excludes the fallacies of begging the question (*petitio principii*) and false cause (*non causa ut causa*). Paul Thom insists on the way perfectibility (i.e. reduction of imperfect syllogisms to syllogisms of the first figure) is a criteria for being a syllogism, and details seven principles that are “filling-out the notion of syllogistic form as figure and mood” in assertoric syllogistic. Fourteen other principles are added for modal syllogistic.

Paul Thom has also shown that some modal mixed combinations rejected as non syllogistic by Aristotle (Co La Mo in the second figure) can be proved *per impossibile* by a syllogism in the third figure (La, Li, Li). Robert Kilwardby acknowledges that in some cases the consequence holds in virtue of its matter (the topical relationships between terms) without being entirely clear about the syllogistic status of the argument under scrutiny. The conclusion is that “we see Kilwardby operating with a concept of syllogistic form different from the modern concept of logical form” [36, p. 161]. Paul Thom’s last remarks are the following:

Kilwardby’s commentary presents a comprehensive and coherent account of the syllogism from the standpoint of a culture that regarded Aristotle’s theories on the subject as authoritative. That culture had a concept of syllogistic form that, while it was helpful for understanding Aristotle’s logic, would soon be forgotten” [36, p. 161].

Maybe the sense of history is not so straightforward. Modern discussions about the possibility of defining logical form, whether on the basis of the demarcation of logical constants or on other ones, shows that an uncontroversial conception of logical form is far from being reached. The fourteenth century conceptions of logical form were not necessarily an improvement. Ockham's views on logical form are notoriously difficult to catch. The idea is that a formal consequence is always validated by "extrinsic" rules, i.e. rules that are independent of the individual content of the consequence at hand, such as syllogistic rules. This is quite opposed to Buridan's conception, based upon a grammatical distinction between categorematic and syncategorematic terms. Buridan's definition of logical form is negative: the form is all what matter, the categorematic terms (subject and predicate terms), is not. Alternatively, it is based upon a list of features where sentential position (order of terms) or modes of references (*suppositio*) sit together with "logical constants", syncategorematic terms: a list "à la Buridan" as Jonathan Barnes puts it [4]. Other conceptions of logical form have been identified for the fourteenth century, especially one that included a relevance criterion, that is not fulfilled by the existence of "shared variables", but by a shared semantic content.¹⁹ In addition, Kilwardby's theory of logical form long survived²⁰ and was not the most "exotic" production of logicians at the time, as shown by the logical condemnation of Oxford in 1277 against the proposition: "a syllogism that fails according to the matter is not a syllogism", which suggests that the distinction between validity and truth was far from being clear at the time. I have elsewhere [11] identified Albert the Great in the final stage of his career as an Aristotelian commentator (in the 1270s) as the probable author of the condemned idea: in the paraphrase on the *Sophistici Elenchi* fallacies are "corpses" of syllogism while "figure" as "external configuration" (*schema/figura*) is contrasted with substantial syllogistic form (*eidōs/forma*). This intriguing episode of the history of logic is left out here, though probably to be understood partially as the result of what could be called Albert's "extreme logical hylomorphism", and as a reaction to the difficulties raised by the Kilwardbian theory Albert the Great first followed when paraphrasing on the *Prior Analytics* in the 1250s.

A last concern is indeed the fact that Robert Kilwardby's views on syllogistic form seem neither "comprehensive" nor utterly "coherent", especially if seen from the point of view of his analysis of fallacies.

6. Some Noises on the Line

As underlined by Paul Thom, Robert Kilwardby entertains an ontological position about the pure and simple syllogism. It is not just the formal principle of

¹⁹ See [15].

²⁰ He influenced the interpretation of the *Prior Analytics* for the next century and his ideas still have echoes late in the sixteenth century traditional logic, as can be seen in a late edition of the influential *Dialectica* of Coimbra, which defines the object of the *Prior Analytics* as "the syllogism according to the form and the matter appropriate for proof, but in general, without any application to particulars" ([12], col 236).

real arguments. It is an “abstract” aggregate reality that exists in its own right before its realization in this or that concrete syllogism. The model here taken by Kilwardby is the contrast between the geometrical circle, that has a general matter according to Aristotle’s *Metaphysics* (the “intelligible matter”) and the concrete circles, made of metal or wood. As also emphasized by Paul Thom, notwithstanding its being itself an aggregate, the syllogism *simpliciter* is the form of the concrete syllogisms. This does not come as a surprise at a time when the distinction between the form of the part (*forma partis*), such as the soul to the body, and the form of the whole (*forma totius*), such as the essence to the individual aggregate, was quite pervading in natural philosophy and metaphysics.²¹ The form as an essence, the object of the definition, contains matter, though a general one (man is a rational mortal *corporal* substance) according to the then generally adopted Avicennian notion. Only individual matter (with individual accidents: white skin, brown hair, etc.) is abstracted, left apart.

But what about the logical relationship between the pure and simple syllogism and the concrete syllogisms formed out of it? What about the syllogistically disposed fallacies also moulded on it?

In the next quotation, Robert Kilwardby tentatively answers this question. He deals with an objection against the usefulness of the Barbara combination. The problem is that there seems to be some arguments in Barbara with a conclusion where the predicate is said of all of the subject (*dici de omni*) as in “Every sensitive being is an animal, every man is a sensitive being, every man is an animal”, and others where you have a predicate said of none of the subject as in the “fallacious Barbara” (“Every metal is natural, Every statue is [in] metal, every statue is natural”). A combination that yields (or is compatible, depending on the interpretation) one conclusion and its opposite is notoriously non useful, as shown for instance in *Prior Analytics* I, 4, with the couple of major in *e* and a minor in *a* in the first figure is discarded for this very same reason. If the “fallacious Barbara” were to be understood as yielding a false conclusion from true premisses and as being an instantiation of Barbara, the Barbara combination should obviously be discarded. Robert Kilwardby’s reply is that a conclusion where the predicate is “said of all” follows also in this case:

A doubt can be raised about the first mood [of the first figure]. It could appear as a non-useful combination since one can find terms for which it yields [conclusions] where [the predicate] is either “said of all”, or “said of none” [...] as in “Every metal is natural, every statue is [in] metal, every statue is natural”. And it must be said that this example is worthless: we are dealing here with the syllogistic form in the most common matter that is taken in abstraction from probable matter as well as from necessary and apparent matters. The form as here dealt with can be found not only in dialectical and demonstrative syllogisms, but in sophistic syllogisms as well. So it

²¹ See [27].

must be said that the conclusion “Every statue is natural” follows according to the craftsman of this book, and that if it was not the case the first [figure] would have to be rejected. The form is good according to this book and it is not excluded from the syllogistic form as dealt with here. In order to prove of it, it must be adduced that the syllogism is double. In the first one the necessity is topical, where the conclusion follows from the major or the minor, and those are the dialectical and demonstrative syllogisms. In the second one the necessity comes from the combination only, as caused by the right internal ordering of terms and propositions: this syllogism is common to dialectical, demonstrative and sophistic syllogisms. It is of the form and the necessity of this syllogism that [this tract] deals with here. The craftsman of the *Prior Analytics* takes the syllogism in abstraction and, in the same manner, the predication of syllogistic propositions, so that he sets aside (*abstrahit*) the fact of being predicated absolutely (*per se*) or incidentally (*per accidens*),²² and consequently accepts incidental predications. So that if one was to argue: “Every metal is natural, every statue is [in] metal etc.”, he would say that the conclusion is true only incidentally but would not disavow the form of arguing.²³

An incidentally true proposition follows from true propositions, and the fact that there is a mix-up of absolute and incidental predications (this is what defines the fallacy of the accident) is not taken into account here. This text shows that the notion of logical form Robert Kilwardby defends is doomed to accept syllogistically-disposed fallacies as well-formed syllogisms. This is not a problem in itself: this position will be defended later on by Boethius of Dacia and by William of Ockham—though not for all the thirteen fallacies.

But it raises a coherence problem since Robert Kilwardby adopts elsewhere the general opinion of the time, the one defended by Anonymus Cantabrigiensis or by the influential treatise, the *Dialectica Monacensis*, according to which the thirteen fallacies of the *Sophistici Elenchi* are all excluded by the definition of the syllogism, i.e. that syllogistically-disposed fallacies are all formally defective. This is because they all fail according to the “real syllogistic disposition”, though not according to the “vocal syllogistic disposition”:

Eristic paralogisms that are formally defective sometimes fail according to the real syllogistic disposition only [such as the “fallacious Barbara”]: here there is no defect in the vocal syllogistic disposition but only in the real one.²⁴

²² Here Aristotle doesn’t speak of accidental predication such as is “Socrates is happy”, but about predications that are incidentally so, as in propositions where an accident is predicated of an accident (“the white is pure”), that should be rephrased in “the white substance is pure”. Here the conclusion is true if understood as signifying something like “every statue is constituted of something natural”.

²³ [29, p. 75].

²⁴ [28, p. 189–190]. This text is a philosophical compendium written by Robert Kilwardby around 1250. It was widely read.

The same idea is met in a commentary on the *Sophistici Elenchi* attributed to Robert Kilwardby:

The mode [i.e. syllogistic disposition] in the syllogism is double: vocal and real. The vocal disposition is present here, I mean in a formally defective syllogism [*i.e.* in the fallacious Barbara] so that the complete combination of the syllogism [is there] according to the vocal sound. It is consequently self-evident that the sophistic syllogism is a species of the syllogism [...]. When Aristotle later on says that the sophistic syllogism is not a syllogism, he means that the syllogism does not have the combination according to the real [syllogistic] disposition.²⁵

But are they still syllogism *simpliciter*? If so, this would mean that the presence of a mere vocal structure would guarantee in itself the fact that a given reasoning has syllogistic form. This opinion has been defended, and criticized, and it might be that of Robert Kilwardby.²⁶

What is even more confusing is that the above text implies that the conclusion of a dialectical and demonstrative syllogism is inferred twice, in two independent ways, once on topical ground from one of the premises, and once on syllogistic ground, from the right combination. As strange as it might sound, the notion that the conclusion of a dialectical and even of a demonstrative syllogism is obtained directly from one premise thanks to a topic is not an incidental assertion or a misspelling, but a common idea, though not universally accepted, which emerged when Boethius's topics began to be confronted with the recently rediscovered *Prior Analytics*.²⁷ As strange as it might also sound, the idea that the topics have an inferential power that is competing with the syllogistic inferential power within syllogistically disposed arguments was also at some point a common idea. It has been identified among several

²⁵ [30, fol. 1vb 19-35].

²⁶ See [10].

²⁷ As far as demonstrative syllogisms are concerned, this is the result of Boethius' notion that "axiomatic topics" are instrumental for the inference of the conclusion of syllogisms. Boethius even says in the *De Differentiis Topicis* that there are topics specialized in demonstrative syllogisms, namely the topics of the cause, of the genus and of the definition. This idea was common to all the late ancient and medieval tradition of the topics and can be explicitly found in the Arabic logical tradition, also influenced by Themistius. The conclusion can be inferred directly from the one premise because Boethius allows both argumentations where the axiomatic topic is explicitly put inside of the argument, thereby becoming an additional premise, or outside the argumentation, thereby validating it from the outside. For instance the syllogism "Every animal is a substance, every man is an animal, every man is a substance" is validated from outside by the axiomatic proposition in the topic of the genus according to which "every thing that is predicated of a genus is also predicated of the species of that genus". But one could rephrase it and say: "Every animal is a substance, every thing that is predicated of a genus is also predicated of the species of that genus, every man is a substance" or just express it in an enthymematic way: "Every animal is a substance, so every man is a substance".

masters from the mid-thirteenth century who went as far as saying that the topics represented in syllogisms *an additional form*.²⁸

The idea conveyed by Robert Kilwardby's formulation is not just that the conclusion is syllogistically obtained as a conclusion, and that its being this or that kind of conclusion is the result of the nature of the premises. It states that the conclusion, already obtained syllogistically, is also obtained *as a conclusion* thanks to a topic directly from one premise. There are ontologically two syllogisms in any concrete syllogism, which fit together like Russian dolls. They correspond to two distinct inferences, two necessities of the consequence (*necessitas consequentiae*), and not to the traditional distinction between necessity of the consequence and necessity of what is inferred (*necessitas consequentis*).

This problem and that of the “fallacious Barbara” have been tentatively solved by challenging the ontology of the syllogism *simpliciter*. This is the track followed by Albert the Great in his last logical paraphrases, on the *Topics* and the *Sophistici Elenchi*. The subject-matter of the *Prior Analytics* is not the syllogism *simpliciter*, an abstract aggregate of form and matter, but rather the form *conceptually isolated* in the treatise, but always ontologically “saved” in concrete syllogisms (dialectical, demonstrative).²⁹ It is not an abstract independent reality that would be subsequently “realized” in various syllogisms, but a form as a relational being that cannot exist on its own without any matter. On this point, Robert Kilwardby would agree, as seen. But for Albert the matter of the syllogism *simpliciter* is the very same matter as the one of concrete syllogisms. As for sophistic arguments, they are not syllogisms. All fallacies following syllogistic moods and figures are formally defective, for similar reasons as those adduced by the AC, that is because matter in sense 3 fails and is, in a way or another, part of the form. Even dialectical syllogisms are not fully syllogistic for Albert since the additional form of the topics debilitates syllogistic form. The only concrete syllogisms that utterly save syllogistic form are demonstrative syllogisms.³⁰ This suggests that the syllogism studied in the *Prior Analytics* independently of any individual content (but

²⁸ This is because topical rules of inferences that are axiomatic topics can be formalized like any other general rule.

²⁹ “Syllogistic form in relation to mood, figure and middle term's ordering, as well as syllogistic power as caused by these according to the form and the order—order is indeed part of power—are dealt with in the *Prior Analytics* [...]. This form can only be saved in necessary matter, that contains in itself the cause of the inference (*causa consequentiae*) and the cause of what is inferred (*causa consequentis*), or in admitted (*probabilis*) matter that contains in itself the cause of the inference thanks to topical relationship that are called topics [...] or in the matter that seems to have the cause of the inference and the cause of what is inferred but does not have it or does not enough have it [...]. This matter is the proximate matter of the syllogism from a vocal point of view. Even if it is not [a syllogism] but seems to be one, the sophistic syllogism has this matter as long as this matter, which consists in the propositions, is disposed according to the figure. Since, according to the vocal sound, it has a matter in which the form of the syllogism can be saved, the enquiry must bear on the way syllogistic form is referred to this matter” [1, p. 525B-526A]. The final answer will be that it is not saved at all.

³⁰ For a detailed analysis, see [11].

not independently of any general content) is just the same syllogism studied in the *Posterior Analytics*, but seen from the point of view of its formal inferential process. The *Prior Analytics* would just be the study of the formal deductions within actual proofs, and, more precisely, demonstrative proof, an idea quite in accordance with Aristotle's own words at the beginning of the *Prior Analytics*.

7. Conclusion

We have so far seen that a syllogism was not conceived in ancient and medieval periods solely as a consequence but also as an argumentative process based upon a necessary inference whereby something is epistemologically gained. Even Robert Kilwardby considers that the syllogism *simpliciter* does not have a complete optimal realization and functionality (*bonitas*) in itself, since it cannot provide belief and knowledge: it finds it only when it “enters” a concrete syllogism, when terms are put instead of letters. It is realized in the more perfect manner in demonstrative syllogisms (see [34]). This notion in turn has deep consequences on the way logic is defined both as a universal method for all sciences and as a science in itself.

Logic is a normative discipline because human reason (at least since original sin) is naturally bound to err. Logic has a “curative” dimension; in this sense it is a prophylactic art, just like medicine. Many texts distinguished between the teaching part and the prophylactic part of logic. Now even the “teaching” part of logic is normative, in the same way as ancient and medieval grammars were normative, not descriptive: they prescribed the morphology and the syntax of language as they should be followed—or have been originally designed—if one wants to get a complete sentence minimally constituted of a name and a verb, with all their possible substitutes, determinants and complements—i.e. with the six other parts of speech.

Syllogistic as studied in the *Prior Analytics* is the underlying logic of proof in the sense that it gives the pattern an argument must follow in order to be the proof of something, together with further requirements concerned with the content of the premises which are dealt with by the *Topics* and the *Posterior Analytics*. Logic is then called “logica utens”, as contrasted with “logica docens”, the discipline that teaches logical processes as such, taken in isolation from the content brought in by this or that type of knowledge: it is the disciple that teaches them formally. Robert Kilwardby describes logic a “general science” for special sciences: “it is common because it informs (*informando*) all [sciences]”.³¹ Logic is thus formal because it is general, topic-neutral, not the other way round. This also means that matter plays a part even in arguments that we would today call formally valid.

Those notions can be observed in the most explicit way in theories such as that of Albert the Great, who doesn't reify the syllogism *simpliciter* as a

³¹ [28, p. 200–201].

distinct reality that would be the subject matter of syllogistic. As a consequence, the proofs other sciences are made of are the very same objects that logic studies, though logic sees them from a different point of view, that is: as syllogisms and proofs, regardless of their individual content.

A brief comparison with the way John Corcoran [13] describes Aristotelian syllogistic as the underlying logic of sciences can be enlightening. He offers a description of the “Master language” of syllogistic as an underlying logic. It is composed of four logical constants (a/e/i/o) and an indefinite number of concrete terms. By contrast, the “regional” language of a particular science is not composed of an indefinite number of terms, but just of the set of concepts out of which the theory is built at the time considered. The number of terms of the underlying logic, i.e. the *logica utens* in the medieval terminology, is “indefinite” because it gathered all the existing and possible terms of all the existing and possible sciences. This is because logical form is not seen as an existing “abstract” syllogism, the equivalent of the syllogism *simpliciter* in Robert Kilwardby, a separately existing logical entity, but just as the co-formality of all well-formed reasonings.

These ideas can be considered as very near to Albert the Great’s last interpretation of Aristotle’s syllogistic, but with some important differences. John Corcoran thinks that syllogistic as underlying logic cannot be a science because it should be to itself its own underlying logic. As for the discourse that describes this underlying logic (i.e. the *Prior Analytics*) it can at most be seen as a rational construction based upon meta-linguistic formulations. The whole account also suggests that the way the agent of the scientific discourse follows the underlying logic is not to be taken into account, provided that he follows it or should follow it. On both points Albert disagreed, as would probably many medieval logicians.

We touch here a very important feature of medieval logic, linked to the relationships between *logica utens* and *logica docens*, to the double definition of logic as science and an art, and, ultimately to the reflexive dimension of logic, be it for the construction of its object or for its use once built as a science.

Just as Jan Lukasiewicz, many medieval thinkers believed not only that syllogistic as *docens* was a science, but that it could be built demonstratively and axiomatically, following a strong concept of science: it has an initial set of basic concepts, definitions and axioms out of which all the subsequent rules of syllogistic are derived. Even if not understood in such a strong way, logic would be called a science because it has an object of its own, a crucial point in Aristotelian philosophy, which doesn’t mean that this object has to exist separately from the objects of other sciences. This object is the reasoning underlying actual rational discourses, taken in isolation from these actual discourses. The fact that this object is constituted through reflexion on something else is not a problem, since “secondary intentions”—such are called the objects of logic after the pervasive influence of Avicenna’s ideas—have properties of their own. As a consequence, logic can be an art as *utens* and a science as *docens*, its proper object being the actual reasonings of other sciences seen as demonstrative proofs in general (be it the

case), as in the *Posterior Analytics*, just as proofs (in fields of knowledge where demonstration is not possible, as in the *Topics*) or from the point of view of their common structures, as in the *Prior Analytics*. Logic is fundamentally a reflexive discursive activity, whether bearing on other discourses or on itself: this is the reason why it can be to itself its own underlying logic.

But logic is not just an underlying logic, whether consciously used or just recognizable in actual scientific discourses, whatever be the cognitive state of the rational agent actually performing a proof. Reflexivity is required: the scientist does not just produce a discourse that happen to actually fulfil the requirements of what a demonstrative proof is. He must know that it is doing a demonstration while demonstrating, knowing what a demonstration is. Logic as a discipline (*logica docens*) that studies actually underlying logical processes (*logica utens*) in philosophical discourses, but logical rules are used (*logica utens*) in such a way that a general knowledge of what they are (*logica docens*) is implied. For Albert the Great, the one who demonstrates without knowing what he is doing is like the fire that is consuming the wood:

Logic is not only useful and helpful for all sciences but it is also necessary to them. This is because they who have no knowledge of logic, even what they seem to know, don't know that they know it because they don't know in which way each thing is to be known and in which way it is to be proved or disproved. [...]. So that he who has no knowledge of logic, even if he knows something, doesn't know the reason of its being known, and he has the same relationship to what is known and to the act of knowing as the fire to its combustion of wood.³²

The fact that a given discourse proceeds logically is what makes this discourse a philosophical and scientific discourse. Methodological reflexivity, the knowledge of which is universally provided by logic, is what properly differentiates philosophical and scientific discourses from any other type of discourses—not the topic addressed: immortal soul, celestial movements, generation and corruption etc. Without this knowledge we are just consumer, be it of cultural objects or science. This explains what precisely ancient and medieval philosophers meant by “art of arts”, “discipline of disciplines”, and “science of sciences”³³ when defining logic, and why these are not just slogans to promote logic. It also enlightens the reason why the very same formulae have been also traditionally applied to philosophy itself.³⁴

³² [2, p. 5, 40-6,15].

³³ See Augustine, *De Ordine*, II, XIII, 38, and then Abelard, John of Salisbury, Peter of Spain, Albert the Great, Thomas Aquinas etc.

³⁴ See Ammonius, Philoponus, Elias, David, Eustratus of Nicaea, Damascius, for the Greek tradition; Macrobius, Cassiodorus, Isidore of Seville, Hugues of Saint Victor and many others for the Latin tradition.

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