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# Was Aristotle a non-classical logician?

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**ABSTRACT.** This paper discusses the possible classification of Aristotle's syllogistic as a non-classical logical system, positing Aristotle himself as a non-classical logician. Initially, we find compelling arguments for this thesis, particularly regarding the expressive power and the rules governing logical inference inherent in Aristotle's approach. My analysis nevertheless addresses two significant counterarguments. The first, the *special case objection*, posits that Aristotle's syllogistic can be framed as a classical logic which deals with canonical syllogistic forms. I argue that this objection is insufficient, as it is possible to point cases in which his system seems to differ from classical logic. The second counterargument, the *formalisation gap objection*, highlights that Aristotle's syllogistic resists straightforward modern logical interpretations. This latter objection is evaluated as more compelling and substantial. In particular, a distinction between two concepts is proposed which could help us understand what Aristotle was aiming at in his theory of inference: the notions of 'to follow from' and 'to be a conclusion of'. While the former aligns with the usual sense formal validity, the second requires an inferential structure connecting the premises to the conclusion, explaining why Aristotle excluded inferences like $A \vdash A$ from syllogisms despite acknowledging that $A$ follows from $A$.

***Keywords:*** *history of logic, logical system, syllogistic, paraconsistent logics, connexive logics.*

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## Introduction

Was Aristotle a classical logician? Answering this question calls for a comparison between the classical (or standard) logical system and Aristotle's syllogistic to evaluate whether they coincide or not. If they do, then Aristotle was a classical logician; if they do not, then he was not. But Aristotle's syllogistic differs from the standard system at least in terms of expressive structure. For instance, as De Morgan[1] argued, inferences such as 'man is an animal, therefore, the head of a man is the head of an animal', which are easily representable in polyadic first-order logic[2], are not syllogisms in Aristotle's system. Therefore, Aristotle was not a classical logician and, hence, he was a non-classical logician.

But is it correct to conclude that Aristotle was a non-classical logician from the fact that his system is not equivalent to the classical logical system? It would seem so, as non-classical logic seems to be just the complement of classical logic. That is, a logical system which is not classical is non-classical. Moreover, a logician who proposes a logical system which is classical or non-classical is, accordingly, a classical or a non-classical logician. Hence, if we accept that Aristotle was a logician, and that his system is not equivalent to the classical one, then we should accept that he was a non-classical logician.

There is nevertheless more to the distinction between classical and non-classical logic than this. In this paper, I will discuss two objections that can be made against classifying Aristotle as either a classical or as a non-classical logician.

The first counterargument, which I will call the *special case objection*, states that Aristotle's syllogistic, as a logical system, is not different from classical logic, but is just a special case of it. Thus, for example, standard sentential logic and standard first-order logic are the cases of classical logic dealing sentential and first-order forms. In the same way, Aristotle's syllogistic would be, according to this objection, the case of classical logic dealing with the syllogistic forms systematised by Aristotle.

The second counterargument, which I will call the *formalisation gap objection*, states that Aristotle's syllogistic does not qualify as a logical system in the modern

[1] Augustus De Morgan, *Formal Logic*, p. 114. De Morgan did not intend to undermine syllogistic with this example. Rather, he used it as a motivation to extend its power. For an engaging discussion on his approach, see Sun-Joo Shin, 'Logic of relations by De Morgan and Peirce'.

[2] See R. G. Wengert, 'Schematizing De Morgan's argument'.

sense of the term. The main reason for asserting this is that Aristotle's system does not contain some concepts (e.g., a distinction between the conditional and the entailment relation) which are crucial for defining modern logical systems.

Each of these objections are discussed and assessed in Sections 2 and 3, respectively. Section 4 builds on Section 3, outlining a distinction that suggests a different perspective on Aristotle's syllogistic. Section 1 provides the conceptual framework of this paper.

## 1. Definitions

I will call 'inference' any sequence of statements, some of which are its premises and one of which is its conclusion. An inference is *valid* if it is correct to infer its conclusion from its premises, and *invalid* otherwise. The precise meaning of 'correct' here depends on the philosophical conception of logical validity adopted. A detailed discussion of this concept is beyond the scope of this paper. It suffices to note that correctness, for our purposes, is related to the transmission truth from premises to conclusion. Now, a 'syllogism', in the Aristotelian sense, is a valid inference, but there may be more to its definition as we will see in Section 4.

A *logical system* is a framework that enables us to differentiate between valid and invalid inferences, at least with respect to inferences of a specific form. Modern logical systems are usually defined as pairs $\mathrm{S} = \langle \mathcal{L}, \vdash \rangle$, where $\mathcal{L}$ is a set of sentences of a formal language and $\vdash : \wp\mathcal{L} \times \mathcal{L}$ is a relation of logical consequence relating sentences $A \in \mathcal{L}$ with the sets of sentences $\mathcal{A} \subseteq \mathcal{L}$ of which they are a logical consequence. The sentences of $\mathcal{L}$ are closed formulae of a sentential language (i.e., formulae with sentential connectives and sentential variables) or a first-order language (i.e., formulae with sentential connectives, predicates, individual variables, individual constants, and quantifiers)[3]. Thus, $\mathcal{A} \vdash A$ means that sentence $A$ is a logical consequence of the set of sentences $\mathcal{A}$. If our inference has a finite number of premises, then we may abbreviate $\{A_1, \dots, A_n\} \vdash B$ with $A_1, \dots, A_n \vdash B$. Finally, $\vdash A$ denotes that $A$ is a logical consequence of the empty set of premises or, as some might say, that $A$ is a logical truth.

[3] There are logical systems with other kinds of languages, notably, modal and second-order languages. However, in this paper we will not need to pay attention to those.

A special class of logical systems are *standard* or *classical logics*, which are those logical systems satisfying the standard rules of logic. For example, sentential classical logic enables us to differentiate between valid and invalid inferences in sentential languages according to the rules of standard deductive bases; first-order classical logic does the same in first-order languages.

*Non-classical logics* are logical systems which do not satisfy some of the standard rules of logic. For instance, *paraconsistent logics* are logical systems in which the rule *ex contradictione sequitur quodlibet* (ECQ) does not hold in general.[4] This rule, which has held a central place in mathematical logic, posits that, from contradictory sentences or sequences of sentences, any conclusion can be derived; in symbolic notation, $A, \neg A \vdash B$ or $A \wedge \neg A \vdash B$, among other options.

*Contra-classical logics* are special kinds of non-classical logics which not only restrict the generality of some classical rule (like paraconsistent logics do with the ECQ), but rather assert the generality of principles which are not present in classical logic. For instance, *connexive logics* feature a rule known as 'Aristotle's thesis', which I will hereafter call the 'connexive principle'.[5] This principle is often formalised with the rules $\vdash \neg(A \to \neg A)$ or $\nvdash A \to \neg A$, none of which are featured by classical logic.

While it is widely accepted Aristotle's syllogistic was the first logical system ever devised, it is uncertain whether it can be formalised as a modern logical system. In order to bypass the potential ambiguity of the term 'formalise'[6], let us rephrase the idea. It is uncertain whether we can construct a formal system $\mathrm{S} = \langle \mathcal{L}, \vdash \rangle$ such that: (a) $\mathcal{L}$ includes precisely the types of expressions that Aristotle would recognise as possible premises or conclusions of a syllogism; and (b) $\vdash$ captures precisely the series of expressions of $\mathcal{L}$ which Aristotle would recognise as valid inferences. I will argue that this uncertainty complicates any meaningful discussion on whether Aristotle's syllogistic should be classified as classical or non-classical.

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4 On paraconsistent logics and the ECQ, see: Ayda I. Arruda, 'A survey of paraconsistent logic'; Evandro L. Gomes and Itala M. L. D'Ottaviano, *Para além das Colunas de Hércules*; and Graham Priest, Koji Tanaka, and Zach Weber, 'Paraconsistent logic'. For a historical document on the coining of the name 'paraconsistent logic', see Francisco Miró Quesada C., 'In the name of paraconsistency'.

5 On connexive logics and the connexive principle, see: Storrs McCall, 'A history of connexivity'; Hitoshi Omori and Heinrich Wansing, 'Connexive logics'; and Heinrich Wansing, 'Connexive logic'.

6 See John MacFarlane, 'What does it mean to say that logic is formal?'; and Catarina Dutilh Novaes, 'The different ways in which logic is (said to be) formal'.

Notwithstanding this point, it is still the case that Aristotle's syllogistic has rules which enable us to differentiate between valid inferences, or *syllogisms*, and invalid inferences of a specific kind: the canonical syllogistic figures. It seems that Aristotle did not regard such figures as the only possible forms of admissible inferences. However, as we will later see, he discarded some forms of inferences which are currently accepted, such as inferences with a single premise[7]. Thus, Aristotle's syllogistic is applied to a domain of inferences which does not exactly match that of sentential and first-order languages. I will call this the domain of 'canonical syllogistic forms' or 'syllogistic forms' for short.

There is some discussion about whether Aristotle's syllogistic should be regarded as a classical or as non-classical logic[8]. In particular, there have been arguments for classifying it as paraconsistent[9] and as connexive[10]. An argument can also be made that, since this system does not deal with proper sentential or first-order forms, then it lacks the expressive power of classical logical systems. Hence, it should not be considered as some kind of rival of classical logic since, in the domain of syllogistic forms, the theses of both logical systems would coincide. This is what I have called the special case objection, which I discuss in the next section.

## 2. The Special Case Objection

The fact that a logical system is not isomorphic to some of the usual systems of classical logic does not necessarily mean that it is non-classical. The system in question could be a special case or an extension of classical logic, in which case it would still be entirely reasonable to consider it classical.

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[7] As will become clear in Section 4, I am not claiming that Aristotle denied the possibility of individual statements having logical consequences. Rather, my point is that sequences of two statements (hence, with only one premise) did not, for Aristotle, qualify as inferences, even if the would-be conclusion logically follows from the would-be premise.

[8] Among the authors who defend the 'classicality' of Aristotelian syllogistic are: Susan Haack, *Philosophy of Logics*; and Francisco Miró Quesada C., 'Las lógicas heterodoxas y el problema de la unidad de la Lógica'. Among those who question it are: Graham Priest, 'Paraconsistency and dialetheism'; and Storrs McCall, 'A history of connexivity'. Finally, there are those authors who think that no straightforward answer can be given to such question, including: Graham Priest and Richard Routley (eds.), *Paraconsistent Logics*; Evandro Luís Gomes and Itala M. L. D'Ottaviano, 'Aristotle's theory of deduction and paraconsistency'; and Jean-Yves Béziau, 'Is modern logic non-Aristotelian?'

[9] See Graham Priest, 'Paraconsistency and dialetheism'.

[10] See Storrs McCall, 'A history of connexivity'.

Thus, some authors have considered that classical logic is just an enhancement of Aristotle's syllogistic, the latter being a *special case* of it. The idea is that the basic conceptions about logical inference and logical truth of Aristotle's syllogistic find their most accomplished form in standard logic. Susan Haack made a very explicit statement in this sense, noting in parentheses that 'modern "classical" logic is an extension [of] traditional Aristotelian logic'[11]. Similarly, Francisco Miró Quesada stated that classical logic is 'a development of Aristotelian and medieval *assertoric logic*' and follows the 'three classical principles': non-contradiction, excluded third, and identity[12]. These principles, also known as 'the three Aristotelian principles', are also featured in classical logic – and they arguably have a special place in it. Consequently, it might be fair to say that classical logic is just a more formalised and complete expression of Aristotle's syllogistic.

So, what is the main difference between Aristotle's syllogistic and classical systems? In terms of modern logical systems, Aristotle's syllogistic would differ from the usual systems of classical logic with respect to the language $\mathcal{L}$ but not with respect to the consequence relation $\vdash$. In general, it could be said that classical first-order logic has more expressive power than Aristotle's syllogistic, which would be a special case of it. As it is commonly agreed, any first-order logical system with monadic predicates could represent all the canonical syllogistic forms[13]. Thus, any inference rule of Aristotle's syllogistic would correspond to some inference rule in classical first-order logic – but not the other way around. (Our translation would have to take into account some special features of Aristotle's logic, e.g., those related to existential import.)

This was not the way in which some of the founders of modern logic regarded their relation to Aristotle's system. In fact, if we conceive classical logic – following the suggestion above – as an inference system based on Aristotle's conceptions, then we should probably say that the first explicit – though *avant la lettre* – non-classical logician was no other than George Boole:

[11] Susan Haack, *Philosophy of Logics*, p. 5.

[12] Francisco Miró Quesada C., 'Las lógicas heterodoxas y el problema de la unidad de la Lógica', pp. 18–9.

[13] For an exhaustive reconstruction of Aristotle's syllogistic forms in classical logic, see Jan Łukasiewicz, *Aristotle's Syllogistic*. For a less exhaustive yet interesting reconstruction in paraconsistent logic, see Newton C. A. da Costa and Otávio Bueno, 'Paraconsistência: Esboço de uma interpretação'.

> The aim of these investigations *was in the first instance confined to the expression of the received logic, and to the forms of the Aristotelian arrangement*, but it soon became apparent that restrictions were thus introduced, which were purely arbitrary and had no foundation in the nature of things. … When it became necessary to consider the subject of hypothetical propositions (in which comparatively less has been done), and still more when an interpretation was demanded for the general theorems of the Calculus, it was found to be imperative *to dismiss all regard for precedent authority, and to interrogate the method itself* for an expression of the just limits of its application.[14]

We must nevertheless note that Boole did not explicitly point any flaw in Aristotle's system, nor in its inference rules; he rather said that its aims were not broad enough to serve as a scientific theory of inference[15]. Thus, regarding conceptions about inference, it would seem that modern standard logic (that is, classical logic as we understand it today) is compatible with Aristotle's syllogistic. Hence, if we restrict our language to syllogistic forms, both systems should be considered equivalent (again, doing the necessary adjustments).

Furthermore, one might speculate that, had Aristotle been able to expand the expressive structure of his system to a full first-order language, he would have proposed an inference system equivalent to standard first-order logic. This conclusion may seem inevitable if we believe that the rules of logic (or at least a subset of them sufficient to infer the other ones) are necessary and intuitive, and that classical logic correctly accounts for those rules. Hence, nobody, let alone Aristotle, could be wrong nor have divergent views about the rules of logic! We can only be confused about what is the logical form of some expressions, but once we find it, we should be able to recognise how those forms are logically related. Had Aristotle seen a way to formalise De Morgan's head-of-a-man inference, he would have certainly found it to be valid within the resulting system. Hence, Aristotle's inability to propose a full classical first-order logic was just his inability to see (or, rather, to systematise) some logical forms, and not an inability to see the inferential relations among them.

The problem, of course, is that disagreements about inference rules exist among logic experts. Non-classical logics exist, some of which are proposed as replacements of classical logic. More importantly for our question, Aristotle seemingly defended rules which would be at odds with classical logic and in favour of some non-classical ones. Let us see two examples.

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[14] George Boole, *The Mathematical Analysis of Logic*, pp. 7–8, my emphases.

[15] Cf. David E. Dunning, 'George Boole and the "pure analysis" of the syllogism', pp. 85–6.

The first example concerns paraconsistent logics: those logical systems in which the ECQ does not hold in general. It seems that Aristotle, while defending the principle of non-contradiction, nonetheless regarded as invalid some inferences with opposite premises which would be valid according to the ECQ. Priest[16] provides as an example the inference below, which is not a (valid) syllogism in Aristotle's system:

Some men are animals.
No animals are men.
—
All men are men

This means that, in Aristotle's syllogistic, some propositions cannot appear as conclusions of (valid) syllogisms. This has led Priest to state that 'syllogistic is, in the only way in which it makes sense to interpret the term, paraconsistent'[17]. It would seem, according to this argument, that Aristotle's syllogistic was the first paraconsistent system – and Aristotle the first non-classical logician.

The second example concerns connexive logics: those logical systems in which the connexive principle holds in general. Since Aristotle expressed that it is impossible that something be not-$A$ if it is $A$ (*Analytica Priora II* 4 57b14), then it would seem that a logical system expressing his views would have to be connexive and, thus, contra-classical. Now it would seem that Aristotle's syllogistic was also the first connexive system – and Aristotle the first contra-classical logician.

No wonder Aristotle was called *the philosopher*! Not only did he create a whole discipline (logic), but also inspire its standard system (classical logic) and some of its rivals (non-classical and contra-classical systems). This makes it seem as if Aristotle's syllogistic was indeed non-classical. The special case objection seems now to be unsubstantiated, for it seems that Aristotle's syllogistic cannot be construed as a special case of first-order logic. But what about the second objection?

## 3. The Formalisation Gap Objection

Consider the question: was Plato a classical or a non-classical logician? I think the only possible answer – to both alternatives – is, 'no'. Why? Because, although Plato was arguably 'the first great thinker in the field of the philosophy of logic'[18], he was no logician at all.

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[16] Graham Priest, 'Paraconsistency and dialetheism', p. 132.

[17] Ibid.

[18] William C. Kneale and Martha Kneale, *The Development of Logic*, p. 17.

No doubt, he had deep insights about some important logical notions, and some of these insights are still relevant today. For instance, Plato's truth definition deeply resembles Tarski's: 'the [statement] that says what things are is true and the one that says what they are not is false' (*Cratylus* 385b)[19]. He nevertheless proposed no systematic criterion for distinguishing necessarily true statements from necessarily false ones, let alone valid inferences from invalid ones. He proposed no system allowing us to make the distinctions between valid and non-valid inferences (or statements) that logical systems can do.

This is obviously not the case of Aristotle. He did propose one such systematic criterion, albeit a very limited one compared to those that can be formulated using modern logical systems. The basic notions with which he formulated his syllogistic were very different from those of modern logicians, and it is not always easy to interpret them in modern logic. Even the very notion of Aristotelian syllogism is quite difficult to translate. Łukasiewicz, for example, remarks that Aristotle's syllogisms are not construed as inferences, but as 'implications having the conjunction of the premisses as the antecedent and the conclusion as the consequent'[20]. Crivelli, instead, argues against Łukasiewicz that syllogisms 'are inferences of a certain type'[21]. We do not need to get too deep into this discussion in order to see the difficulties of translating the Aristotelian logical notions into modern logical notions.

For instance, the connexive principle mentioned above (it is impossible that something be not-$A$ if it is $A$) could be expressed in at least three ways in sentential logic: (a) $\vdash \neg(A \rightarrow \neg A)$, (b) $\nvdash A \rightarrow \neg A$, and (c) $A \nvdash \neg A$. Current logicians can discuss separately about each of (a–c) and their corresponding variations: (a′) $\vdash \neg(\neg A \rightarrow A)$, (b′) $\nvdash \neg A \rightarrow A$, and (c′) $\neg A \nvdash A$. All this corresponds to the idea that no statement can imply or entail its own negation, opposite, contradictory, or the like. But which one of these would represent Aristotle's own view? Maybe all, maybe some, maybe none. Aristotle did not provide a distinction between what we currently conceptualise as the conditional ($\rightarrow$) and the entailment relation ($\vdash$). And although we might interpret some of his theses as being related to this or that logical system, many of them might simply be intuitions which cannot be represented as inference principles in modern logical systems.

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[19] Translation adapted from Friedrich Schleiermacher's version.
[20] Jan Łukasiewicz, *Aristotle's Syllogistic*, p. 2.
[21] Paolo Crivelli, 'Aristotle's logic', p. 125.

However, let us assume that Aristotle's remarks in the *Analytica Priora II* (4 57b14) should be interpreted in terms of all of (a–c′). Does this mean that he would have maintained this view if faced with the challenge of stating the logical principles for a full first-order language?

I do not think we can tell one way or the other. We do not know whether he would have been able to give up the principles that one must give up in order to assert (a–c′) as generally valid. Moreover, although in Aristotle's syllogistic some inferences with contradictory premises are not valid, we do not know how he would have reacted to modern arguments for the ECQ. Maybe he would have found this rule more compatible with the rest of his system and ideas than any consideration he had about not allowing for the validity of those syllogisms. After all, he did accept the validity of some syllogisms with contradictory premises in the second and third figures (cf. *Analytica Priora II* 15). Moreover, he did seem to have a greater commitment to some of his ideas about logic than to others; e.g., he was more confident about the principle of non-contradiction than about that of excluded third.

This is the essence of the formalisation gap objection[22]. It is not straightforward to interpret Aristotle's logical notions and theses in the framework of modern logical systems. Moreover, if this objection is accepted, then there is now reason to doubt whether the special case objection actually fails. Since we cannot interpret Aristotle's syllogistic one way or the other, we cannot discard for sure that it could be interpreted as a special case of classical logic.

In the next section, we will expand on this objection by introducing a distinction that could offer a new perspective on interpreting Aristotle's syllogistic.

## 4. To Follow from and to Be a Conclusion of

There is another important difference between Aristotle's syllogistic and modern logical systems. Aristotle's syllogistic is not just a system of inference rules like modern logical systems. It can also be regarded as an account about which series of sentences can correctly be considered as premises and conclusions of a given inference. His definition of the concept of syllogism suggests one such interpretation:

[22] Another version of this objection can be found in Jean-Yves Béziau, 'Is modern logic non-Aristotelian?'

> 'Syllogism', on the other hand, is a discourse in which, certain things being posited, something other than what is given results of necessity because of those being what they are. When I say 'because of those being what they are' I mean that ⟨it⟩ results because of those, and when I say 'results because of those' I mean that there is no need for any term taken from the outside for the necessity ⟨of the result⟩ to come about. (*Analytica Priora I* 1 24b18–22)[23]

This definition is far more restrictive about what constitutes a syllogism compared to how modern definitions treat valid inferences. In this regard, Crivelli notes:

> [This passage] requires that every syllogism be an inference whose conclusion follows necessarily from the premises, i.e., a valid inference ('invalid syllogism' is an oxymoron). The plural clause 'certain things having been posited' indicates that only inferences with two or more premises are syllogisms. The requirement that the syllogism's conclusion be 'different from the things laid down' intends to banish *petitio principii*: a syllogism must not assume what it sets out to establish. Aristotle therefore applies 'syllogism' to some (but not all) of the inferences that modern logicians usually regard as valid.[24]

By treating syllogisms as inferences, the closest translation we have of 'syllogism' into modern logical notions is 'valid inference'. (We do not need to restrict the domain of valid inferences to those conforming to Aristotle's syllogistic figures since, at this point, he was not yet focusing on this kind of syllogisms which he treats systematically.) In this understanding, it is clear that some inferences which are valid in modern logic do not satisfy this definition, since modern logic allows for valid inferences with only one premise, including the *petitio principii* (i.e., $A \vdash A$).

Modern standard logic, unlike Aristotle's syllogistic, is unrestricted with respect to the relation between the premises and conclusion of an inference. Any sequence of statements or well-formed formulae, one of which is marked as the conclusion, is a candidate for a valid inference. All that matters is that the intended conclusion follows from the (possibly empty) set of premises according to the account of inference being assumed.

This suggests that Aristotle's syllogistic not only provided a criterion for demarcating between valid and non-valid inferences. It seems to also contain a criterion for demarcating between proper inferences (that is, sequences of statements

[23] All my translations of Aristotle are adapted from Lucia Palpacelli's version.
[24] Paolo Crivelli, 'Aristotle's logic', p. 125.

which are somehow argumentative) and mere sequences of statements. Such a distinction is not made in modern logical systems. Thus, if a sequence of statements has only one premise, then it could never be regarded as an inference, even if the intended conclusion does follow from the intended premise. The next passage sheds significant light on this matter:

> Postulating, or assuming, what was originally to be proved falls … among the cases in which one does not prove what one sets out to prove. If anything, since some things are of such a nature that they are known by themselves and some things are known by means of others (i.e. principles by means of themselves and instead what is subordinate to principles by means of something else), when one tries to prove by means of oneself what is not known by itself, it is at that moment that one postulates what originally had to be proved. … Think of the case in which $A$ is proved by means of $B$ and $B$ by means of $C$, and $C$ is of such a nature that it is proved by means of $A$: those who draw conclusions in this way are in fact proving $A$ by means of $A$ itself. … [T]hose who draw conclusions in this way turn out to say of each thing that it is if it is: but then each thing will be known by itself, which is impossible. (*Analytica Priora II* 16)

Aristotle is not saying here that $A$ does not follow from itself. Quite the opposite. He admits that this is a very trivial way of reasoning, which nevertheless is not sufficient to prove the truth of something. (Also recall that he uses conversion procedures[25], which enable us to obtain a proposition from another, by swapping the subject and predicate of the latter. For instance, if 'some $S$ is $P$' can be inferred from two premises, then 'some $P$ is $S$' can also be inferred from them.) Moreover, he also says that 'some things are of such a nature that they are known by themselves', in which case $A$ could be proven from itself. But for the things which have a different nature, we cannot *prove* them from themselves, even though they obviously *follow* from themselves.[26]

[25] *Analytica Priora II* 2; cf. Paolo Crivelli, 'Aristotle's logic', pp. 131–2.

[26] I am here intentionally not addressing the distinction that Aristotle makes between syllogisms and proofs. Aristotle did not think that all valid syllogisms constituted proofs or demonstrations. A *syllogism* roughly corresponds to a valid inference in modern logic – but normally with the restriction that it has to fit the syllogistic form. A *proof* or *demonstration*, instead, corresponds to a sound inference; more precisely, to a (valid) syllogism whose premises are true or, rather, necessarily true. The reason I am glossing over this distinction, despite it being relevant in this quote, is that, as we have seen, Aristotle does forbid syllogisms with the structure of the *petitio principii*, and not only demonstrations with that structure.

In the same line of reasoning, it would be possible to interpret that Aristotle thought (or could have thought) that sequences of statements with contradictory or opposing premises would be valid inferences – for the same reasons that they are in classical logic – if they were proper inferences. However, since they are not, we cannot assign them validity at all. That is, maybe anything does follow from contradictions, but this does not allow us to make syllogistic inferences using this fact.

Rather than trying to ascribe a classical conception of validity to Aristotle, I would like to propose a distinction between two concepts which, though not present in Aristotle, might help us better understand what he was probably aiming at: the concepts of 'to follow from' and 'to be a conclusion of'. The senses I give to these terms are somewhat arbitrarily chosen, and the way I will define them is not necessarily aligned to how Aristotle (or anyone) might have used them.

We define the first notion: $B$ follows from $A_1, \dots, A_n$, in this sense, iff the inference $A_1, \dots, A_n \vdash B$ is valid according to classical logic (or whatever conception on the rules of logic we want to ascribe to Aristotle).

For instance, the inferences $A \vdash A$ and $A, \neg A \vdash B$, express the relation of 'to follow from' in this sense. We nevertheless know that Aristotle excluded $A \vdash A$ from syllogisms. In fact, as we have seen above, he excluded any inference with only one premise. And yet, it does not seem that Aristotle thought that $A$ does not follow from $A$. So why did he not consider it as a (valid) syllogism?

This brings us to the definition of our second notion: $B$ is a conclusion of $A_1, \dots, A_n$ iff (a) $B$ follows from $A_1, \dots, A_n$ (in the sense above) and that (b) there is an accepted inferential structure by which $B$ can appear as a conclusion of $A_1, \dots, A_n$.

In order to illustrate condition (b), I will provide an analogy with modern logic. Depending on the logical system we are using, open formulae – that is, formulae with free variables such as $Px$ – can or cannot be part of an inference. Let us consider a system of the latter kind. In this case, such conventional rules as the *modus ponendo ponens* ($A \to B, A \vdash B$) or the hypothetical syllogism ($A \to B, B \to C \vdash A \to C$) or reiteration ($A \vdash A$) cannot be instantiated with such formulae. This does not mean that those logical systems have restrictions on the generality of those rules. It is just that those logical systems do not allow us to apply their rules to such formulae. Thus, while it could be said that $Qx$ follows from $Px \to Qx$ and $Px$ in those systems, in the sense above, it would not be a conclusion of them, for the structure $Px \to Qx, Px \vdash Qx$ is not an accepted inferential structure in those systems.

In the case of Aristotle's syllogistic, we can see that, not only there are some conditions on the validity of syllogisms, but there are also restrictions as to the form of syllogisms. Aristotle placed other restrictions to the kind syllogisms that he systematically developed: the need of two premises, a middle term, among others. Neither the *modus ponens* nor reiteration conform to those restrictions. Nor does the inference $A \vdash \neg A$, which is the contradictory of one of the interpretations we can make of the connexive principle, as it only has one premise. This could mean that this principle might have been accepted by Aristotle himself because of this restriction, and not so much because he did not think that there were no cases (perhaps absurd cases) in which $\neg A$ could follow from $A$ in the sense defined above.

It seems that Aristotle did not think that these restrictions had to be placed on all syllogisms. However, it seems that he did believe that there can be no syllogism with only one premise, not even in a more exhaustive theory of syllogisms. As previously mentioned, the quote where he establishes that condition appears very early in his *Analytica Priora*, before he placed further restrictions leading to the canonical syllogistic forms.

The distinction between 'to follow from' and 'to be a consequence of' can provide a framework to understand the function of those restrictions in Aristotle's theory of inference and the relation of this theory with modern logic. In particular, a key question would be whether the modern notion of *logical consequence* should be understood as a sharpening of 'to follow from' or of 'to be a conclusion of'.

At this point, the question becomes highly speculative, for I have provided no justification that this distinction represents any relevant aspect of Aristotelian syllogistic – nor have I intended to. The question has nevertheless relevance for contemporary discussions about what *non-classicality* means in logic, and whether we can classify Aristotle's syllogistic as a classical or as a non-classical system.

Suppose we consider non-classicality to be related only to the possible deductive relations between formulae, and not to language or the logical form of statements and inferences. In such case, if we want to answer the question which titles this paper, we need to understand whether Aristotle excluded some syllogisms because of their logical form rather than because of their conclusion not *following* from the premises. And we need to know in which of these cases we would be entitled to characterise Aristotle's syllogistic as non-classical. Clarifying what is logical consequence a sharpening of would help us in solving this puzzle.

But answering all these questions requires much more scholarly knowledge than I currently possess. My intention in this paper was not so much to really answer whether Aristotle was or was not a classical or a non-classical logician. I am sorry for the clickbait. My intention was rather to show the complications that such a question generates.

Of course, Aristotle was in many ways a forerunner of classical and a few non-classical logics, in this latter group including paraconsistent, connexive, and, perhaps most importantly, relevant logics – the latter of which I have not addressed in this paper. But it will not be easy to ever classify him as classical or non-classical logician, for his syllogistic and other logical theses are hard to interpret within a mathematical formalism isomorphic with a modern logical system. This explains Priest's and Routley's early view regarding the possible paraconsistency of Aristotle's syllogistic:

> Though Aristotelians held that a contradiction cannot be true, Aristotle's syllogistic is not explosive. However, like a purely positive logic it is not paraconsistent either. The point is that the poverty of the forms of syllogistic inference and its associated grammatical forms makes it impossible to ask the question of what follows from a contradiction.[27]

Priest later changed his view and stated that 'syllogistic is, in the only way in which it makes sense to interpret the term, paraconsistent'[28], arguing the non-validity of some inferences with contradictory premises in Aristotle's syllogistic.

I do not want to imply that there can never be a sufficiently good argument for interpreting Aristotle's syllogistic as representing some class of modern logical systems, including paraconsistent systems. I nevertheless wanted to show that the fact that a given rule was or was not explicitly subscribed by Aristotle in his syllogistic is not enough to do the job.

## 5. Concluding Remarks

In this paper, I have considered the question about whether Aristotle's syllogistic can be classified as a non-classical logical system and Aristotle as a non-classical logician. At first glance, there seemed to be good arguments for this possibility, since his syllogistic seems to differ from classical logical systems both in terms of expressive capabilities and of logical rules. I have nevertheless considered two possible objections against this interpretation.

[27] Graham Priest and Richard Routley, *Paraconsistent Logics*, p. 5.
[28] Graham Priest, 'Paraconsistency and dialetheism', p. 132.

The special case objection states that Aristotle's syllogistic can be construed as a classical logic which deals with syllogistic forms. We saw that that this objection was not good enough, as there are some inferences of syllogistic form which are possible in classical logic but impossible in Aristotle's syllogistic. As to the formalisation gap objection, we have that Aristotle's syllogistic cannot be straightforwardly interpreted in terms of modern logical systems. I argued that this objection was much more solid and that, if accepted, we also have reasons to doubt whether the special case objection actually fails.

Moreover, I proposed a distinction between the concepts of 'to follow from' and 'to be a conclusion of', which could lead to a better understanding of Aristotle's syllogistic. The former refers to the idea that a conclusion is logically connected to the premises according to the rules of some logical system. The latter, instead, requires not only this logical connection but also that the inference conforms to an accepted inferential structure. Thus, the difference lies in the structure required for something to count as a proper inference.

Let us close by stating that, although Aristotle would agree – perhaps on connexive grounds – that his syllogistic cannot be non-classical if it is classical, he would probably not be so sure that it has to be either classical or non-classical. This question, much like the sea battle he once contemplated, lies in uncharted waters beyond his conceptual reach.

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I want to thank Evandro Gomes, Itala D'Ottaviano for pointing me to the pertinent literature on this topic, much of which I could not reference here. Their paper on the relation between Aristotle's syllogistic and paraconsistency[29] is a much more thorough investigation on the matter. They distinguish between two senses of 'paraconsistent' and conclude that only one of them may be ascribed to Aristotle's syllogistic. Discussing their arguments in detail would have made this paper much larger, and would have escaped to its aims. I nevertheless strongly encourage the readers to consult it.

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[29] Evandro Luís Gomes and Itala Maria Loffredo D'Ottaviano, 'Aristotle's theory of deduction and paraconsistency'.

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