Aristotle's modal logic

Essence and entailment in the *Organon*

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Chapter 1

Introduction

1.1. BACKGROUND TO THE PRINCIPAL ISSUES

The chapters of the *Prior Analytics* devoted to modal arguments are notoriously difficult, controversial, and, according to numerous weighty authorities, deeply confused. Accordingly, one major aim of this study will be to examine in detail the internal workings of Aristotle's modal logic – his logic not just of statements simply asserting the application of a predicate to a subject but also of those asserting a necessary or possible or contingent relation between subject and predicate – in order to understand and assess its strengths and its weaknesses. A second aim will be to establish a fundamental connection between Aristotle's metaphysical essentialism (along with his theory of scientific demonstration) on the one hand and his modal logic on the other. These two goals are closely connected, or so it will be argued here, in that the logical system itself must be understood from the start in the light of basic points of syntax and semantics deriving from Aristotle's views on what there is and on the various ways in which we can speak and reason about what there is.

There has always been healthy interest in Aristotle's metaphysical essentialism – interest heightened recently by work on essentialism as such, and especially by work deriving, like Aristotelian essentialism, from intuitions about the natures or essences of things.[1] Such developments have contributed at least indirectly to the study of Aristotle by provoking careful thought about how essentialism might be formulated and how different objects (individual living things, the "natural kinds" of chemistry or physics or biology, sets, numbers) might involve very different sorts of essential properties, discoverable only through a variety of approaches. It has not, however, led to a broad interest in the details of Aristotle's modal syllogistic. This apparently can be attributed, in some quarters, to lack of interest in this more formal side of things, in others to an assumption that

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Aristotle's modal logic can be perfectly well formulated using now-familiar modal systems based on non-categorical logic, and in still others to a supposition that Aristotle's own system is either too weak or too confused to be worth disinterring at this late date.

Some of the slack has been taken up by scholars more directly interested in modal logic. Here, too, contemporary work – in particular the recent emergence and wide appeal of "possible-worlds" modal semantics,[2] along with the extensive development of modal logic from a purely formal point of view – has led at least a few commentators to apply these modern means of formalization to Aristotle's modal syllogistic.[3] But generally speaking, these commentators have not taken a comparably detailed interest in Aristotle's metaphysics. This may be due, again, to simple lack of interest, or perhaps to the idea that in Aristotle's work there is no significant dependence of logic on metaphysics, or perhaps to a suspicion that consorting with metaphysics can only lead to the corruption of logic. Thus, even Günther Patzig, who has given us important work on both the metaphysics and logic of Aristotle, is noticeably grudging in his admission of any conscious, fundamental dependence of the latter on the former. He views with a jaundiced eye the tendencies of several earlier German commentators (e.g., Prantle, Waitz, Maier, Trendelenburg) to see Aristotle's logic as a kind of "philosophical logic" or a "conceptual metaphysics" or the like, and he concludes that

> the validity of the propositions in Aristotle's syllogistic can, neither in fact nor in Aristotle's opinion, be thought dependent on the *truth* of certain ontological propositions. It is consistent with this view both that Aristotle's *presentation* of his syllogistic is unconsciously influenced in many ways by his ontological predilections, and also that the marrow of Aristotle's ontology contains views which mirror his logical tenets. If a causal connection between Aristotle's logic and his ontology must be found, it seems to me more correct to base his ontology on his logic than the other way about.[4]

By contrast, I shall argue that even the most basic formal aspects of the modal system of the *Prior Analytics* cannot be accurately understood – except by luck, as in the case of Aristotle's fellow who chanced upon buried treasure while digging in the garden – without serious consideration of his essentialist metaphysics, along with his related views on scientific demonstration. More specifically, Aristotle believed in a distinction between the essential and accidental properties of a thing. He held also that there were only a few ways in which a property could be related predicatively to a subject [i.e., as its genus, differentia, species, *idion* (proprium), or accident] and that all these relations were either necessary or

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accidental. Both points were related, in turn, to his view that scientific demonstrations proceeded from *per se* predications in their premises to a *per se* conclusion.

All of those tenets motivated Aristotle's modal logic and shaped its foundations. At a basic level, because on Aristotle's view modal propositions differed from non-modal ones in asserting one or another special *connection* between predicate and subject, Aristotle's modal syntax incorporated modal *copulae* or linking expressions ('necessarily applies to all of', 'possibly applies to all of'), rather than today's more familiar sentence or predicate operators, to express the various possible connections between predicate and subject. Extra-logical considerations also determined the sorts of propositions – plain (assertoric), necessary, one-way possible, two-way possible (problematic, contingent) – whose logical relations were to be investigated, for although he was interested in determining what followed from what in a general sense, Aristotle investigated systematically only syllogisms containing various possible combinations of plain, necessary, and contingent categorical premises.[5] Why just those, and not also syllogisms with one-way possibility premises – the kind of possibility so central to contemporary modal logic? Evidently because the former were the sorts of propositions he thought could exhaustively express the necessary and accidental connections of subject to predicate constituting everything that might be the case. Within that framework, and given his views on science, he needed to investigate syllogisms involving necessary or two-way possible premises and conclusions, for those (speaking very roughly for the moment) were the sorts of propositions he thought could be used in constructing scientific demonstrations. Again, Aristotle failed to take up syllogisms with premises involving one-way possibility: Unlike two-way possibility, it reflects neither any of the primary ways a predicate can relate to a subject nor any kind of scientific proposition.[6]

Other, more local connections between Aristotle's metaphysics and logic will emerge as we proceed.[7] However, we can say that the influence of his metaphysics on his logic is pervasive, in that it decisively influences the basic structure of his modal propositions and the kinds of propositions whose logical relations are to be studied. And because the question of the internal structure of premises and conclusions is crucial for any study of his logic, whether from a logical or more philosophical point of view, it is necessary to consult those metaphysical views in order to establish the very starting points of Aristotle's modal syllogistic.

On the other hand, once the starting points have been fixed, the investigation becomes more purely logical. Indeed, Aristotle pursues the properly logical question of what follows from what with characteristic alacrity

and perseverance. So it should not be imagined that we shall find Aristotle constantly doing logic by way of metaphysics; on the contrary, most of the *Prior Analytics* is concerned with strictly logical questions. Thus the extra-logical background will be consulted extensively in the laying of the foundations, but much less frequently, and for more narrowly prescribed reasons, thereafter. Exactly how this is so is a long story; in the following pages I shall try to convey briefly the essentials of the tale through a preliminary discussion of three traditional approaches to modality.

In the *Prior Analytics*, Aristotle recognizes four modally distinct types of propositions: plain, or assertoric (e.g., '*A* applies to every *B*'); necessity ('*A* necessarily applies to every *B*'); possibility ('*A* possibly applies to every *B*'); and two-way possibility – sometimes called "contingent" or "problematic" or "two-sided" propositions ('*A* possibly applies and possibly does not apply to every *B*').[8] Within each type there obtains a fourfold distinction according to quantity (universal or particular) and quality (affirmative or negative), so as to give universal and particular affirmatives, and universal and particular negatives, of each modality. [These four types will be represented here, as in "traditional" syllogistic, by the letters *A*, *I*, *E*, and *O* – or, within a given proposition, by their lowercase counterparts, respectively (as in '*A a B*', '*A i B*', etc.). Lowercase subscript letters will indicate modality: A_n for a universal affirmative necessity proposition, A_{pp} for a universal affirmative two-way possibility proposition, and so on. Plain *A* without a subscript will then stand for an assertoric universal affirmative, e.g., '*B* applies to all *C*'.] Thus, the basic propositions of each modality – putting aside some important complications to be indicated as we proceed – will be written as follows:

Assertoric	*A:* *A a B*	*(A* applies to every *B)*
	E: *A e B*	*(A* applies to no *B)*
	I: *A i B*	*(A* applies to some *B)*
	O: *A o B*	*(A* does not apply to some *B;* i.e., there is some *B* to which *A* does not apply)
Necessity	A_n*:* *A N a B*	*(A* necessarily applies to every *B)*
	E_n*:* *A N e B*	*(A* necessarily fails to apply to every *B;* i.e., of every *B* it is true that *A* necessarily fails to apply to it)*[9]

	I_n: A N i B	*(A necessarily applies to some B)*
	O_n: A N o B	*(A necessarily fails to apply to some B; i.e., there is some B to which A necessarily fails to apply)*
Two-way possibility	A_{pp}: A PP a B	*(A two-way possibly applies to every B; i.e., A possibly applies and possibly does not apply to every B)*
	E_{pp}: A PP e B	*(A two-way possibly fails to apply to every B)*
	I_{pp}: A PP i B	*(A two-way possibly applies to some B)*
	O_{pp}: A PP o B	*(A two-way possibly fails to apply to some B)*

One-way possibility propositions will parallel those given here. As various complications arise, we shall find the varieties of modal formulae multiplying, sometimes thick and fast. For convenient reference, all the formulations used in this study, along with the traditional nicknames ("Barbara," "Celarent," etc.) of Aristotle's syllogisms, are collected in the Appendix.

Roughly put, then, Aristotle's general aim in *Prior Analytics* (*Pr. An.*) A.1–22 was to specify which pairs of propositions logically implied which conclusions, where the two premises might both be plain (as in *Pr. An.* A.4–7), both necessary (A.8), one plain and one necessary (A.9–11), both two-way possible (A.14, 17, 20), and so on, inexorably, through the various sorts of premise pairs involving plain, necessary, or contingent propositions.

Aristotle's plain syllogistic (*Pr. An.* A.4–6), having been worked out with great clarity and, in the metalogical remarks of chapter 7, much elegance as well, went on to become, until recently, *the* logic of the West and much of the East.[10] Meanwhile, his modal syllogistic suffered the opposite fate: Theophrastus and Eudemus immediately challenged Aristotle on basic points. In later centuries, those chapters of the *Prior Analytics* were not routinely studied even by the learned, and in some quarters

that pernicious subject was banned altogether.[11] In our own time, at least one distinguished logician has concluded that "Aristotle's modal syllogistic is almost incomprehensible because of its many faults and inconsistencies."[12]

Still, some order was introduced into modern commentary on the subject by Albrecht Becker, who, writing in 1933, saw most of those apparent faults and inconsistencies as the results of an unwitting vacillation on Aristotle's part between two sorts of modalities, or two ways of understanding modal propositions.[13] If one says, for example, that all lions are necessarily animals, one might mean either (1) it is a *necessary truth* that all lions be animals or (2) it is true, *of* each and every lion, that being an animal necessarily applies to *it*. Both these statements are true (let us suppose, for the moment). On the other hand, given that everything lying down in a given place is in fact a lion, one could say that it is true, *of each and everything lying down there*, that being a lion necessarily applies to it. But it is not a *necessary truth* that all things lying down in said place be lions: It is entirely possible that the lion and the lamb lie down there together. So in this case, one reading of our modal statement ("everything lying down . . . is necessarily a lion") comes out true, and the other false.

From as least as far back as Abelard the contrast between these two ways of interpreting modal statements has been framed in terms of *de dicto* vs. *de re* modality.[14] On the former, modalities are regarded as modes of truth of entire statements, so that necessity, for example (or, being necessarily true), is a property not of things or of their properties but of linguistic statements or of the propositions they express (*dicta*).[15] On the latter, necessity is supposed to apply to the *things* about which some *dictum* is asserted (as in "It is true, of each thing now reading this manuscript, that it is necessarily rational"), and this will explain any necessary truth there may be. More precisely, the *res* in question is the subject(s) signified by the subject term of a given statement; the statement attributes, say, a necessary property to that *res*, or asserts that some property necessarily belongs to it.[16] Among various other ways of describing this distinction, one of the most useful for our purposes will be that the modality of *de dicto* modal statements depends on assigning a property to a subject only as that subject is considered under one description or another. So, adapting Quine's example slightly, it is necessarily true that a certain bicycling mathematician, *qua* mathematician, is rational, but equally – and with equal necessity – true that *qua* bicyclist he is an exerciser. Here necessary truth derives from a direct connection between the descriptions involved (or between the concepts or universals or natures signified by those descriptions). By contrast, a *de re* ascription assigns essential prop-

erties to a subject independently of whatever description one may happen to use in picking it out. Thus the cycling mathematician, being human, is essentially (and necessarily) rational, whether described by anyone as a mathematician or not: It is simply true *of this subject* – this cyclist, or this person wearing striped pantaloons – that he is necessarily rational. But the same person is only accidentally or contingently a cyclist or a wearer of striped pantaloons, and this will be true of that person no matter how he is picked out or described. So on a *de re* reading 'This cyclist is necessarily rational' is true, and 'This bicyclist is necessarily an exerciser' is false.

The distinction makes a great deal of difference as to what follows from what. For example, from the premises

Necessarily: Every human is rational

and

Everything standing in the conference room on Monday morning is human

it does not follow that

Necessarily: Everything standing in the conference room on Monday morning is rational

It may be a (*de dicto*) necessary truth that every human is rational, and true simply as a matter of fact that everything standing in the conference room on Monday morning is a human, so that both premises are true. But these would not entail that it is necessarily, as opposed to contingently, true that everything standing in the conference room on Monday morning be rational.

By contrast, from the premises

Rational necessarily applies to every *human*

and

Everything *standing in the conference room on Monday morning* is *human*

it does follow that

Rational necessarily applies to everything *standing in the conference room on Monday morning*

The conclusion does not say it is *necessarily true* that all such standing things are rational; it now says only that it is true, of each thing that happens to be standing in the room on Monday morning, that that thing

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is necessarily rational. And this will be true in any situation in which all humans are necessarily rational and it happens that everything standing in the room is a human. But these were precisely the premises laid down. (Actually, the interpretation of this particular syllogism is hotly contested; see Chapter 4, Section 4.1.[17])

Commentators on Aristotle have long been aware that even after putting aside a few Aristotelian slips, no single formulation, whether *de dicto* or *de re*, can give all the logical results Aristotle propounds in *Pr. An.* A. Some sections, such as the one on conversion of necessity propositions,[18] seem to require a *de dicto* reading; others, such as chapter 9 on "complete" or "perfect"[19] syllogisms with one plain and one necessity proposition, including the example just surveyed, seem to require a *de re* reading. In some cases a syllogism that is valid only when read *de re* is shown valid by a proof that is itself valid only on a *de dicto* reading.[20]

Consequently, one often reads of a fundamental inconsistency, or of vacillation on Aristotle's part, between *de dicto* and *de re* modalities.[21] Indeed, the single largest issue dividing modern commentators has been whether one must rest content with recording the fact that Aristotle alternates between *de dicto* and *de re* readings of necessity – and with the project of recording where the one reading must be invoked, and where the other – or whether there is a different way of regarding the entire system such that a single, unambiguous reading will suffice to give (more or less all of) Aristotle's results.

I have already suggested that resolution of the issue depends on establishing the relation between Aristotle's modal syllogistic and the essentialism of the *Organon*. More specifically, I would like to propose, as a first step toward the interpretation of Aristotle's modal logic and its place in his philosophy as a whole – and at the same time toward understanding why Aristotle *appears* to vacillate in the way just mentioned – a revision of the terms in which the topic is today ordinarily framed. Notice first that *de re* propositions are nowadays usually treated, by those commentators who remain at least in part within a categorical framework, as involving modalized predicates, as in '*Being necessarily an animal* belongs to all *human*'. In fact, one frequently encounters a hyphenated modal predicate, as in '*necessary-human* applies . . . '.[22] The disquieting fact about any approach based on a dichotomy of modalized *dictum* vs. modalized predicate is that Aristotle himself speaks in a third way, on which modality attaches neither to predicate nor to *dictum*, but rather to *the manner of the predicate's applying* to the subject. It is the copula or linking expression between the terms to which Aristotle, in the *Prior Analytics*, ordinarily

attaches his modal operators, as in 'Animal applies to all Human' (plain), 'Animal *necessarily* applies to all Human', 'Animal *possibly* applies to all Human', and so on. Commentators, too, frequently speak in this way, at least when expressing themselves in a natural language rather than in the more technical terms of a proposed interpretation or formalization. Abelard himself, for example, along with several other major medieval figures (William of Sherwood, Albert the Great, Thomas Aquinas), took this ''modalized copula'' interpretation as fundamental. So I am not, thus far, proposing anything at all new.[23] Nonetheless, this reading, insofar as it receives any particular attention, is nowadays regularly identified, either explicitly or implicitly, with a *de dicto* or (modal predicate) *de re* reading.

Neither identification is by any means arbitrary. On the one hand, it is natural enough to suppose that the *plain* copula indicates a *combination* of subject(s) and predicate and that the assertion of such a combination is simply the content or sense of the *dictum* taken as a whole. Thus the sense of the *dictum* would be *that* one thing *is predicated of* some subject. So it would be easy to view the modalization of the copula as, in effect, a modalization of the content of the original sentence as a whole: Subject and predicate are not simply conjoined, but *necessarily conjoined.* And because what one intends to express is the necessity of the content of the original assertoric proposition as a whole, the modal operator might very sensibly stand at the front of the original sentence, with appropriate notation to indicate that its scope is the entire sentence, as in 'nec: *A* all *B*' or '$\Box$(*A* all *B*)'.[24] (Here the grammatically internal modal operator of '*A* necessarily applies to all *B*' is similar in scope to an internal negation – as in 'Socrates is not a Satyr' – wherein the ''not'' serves to negate an entire proposition, or the content of the *dictum* taken as a whole, by grammatically negating the copula. And, of course, in modern propositional and predicate logic, negations then find expression in an external sign of negation whose scope is the whole of the proposition to which it is prefixed.) Thus does the modal *copula* come to be expressed as a sentential operator indicating the modality of a given *dictum*. This would not be objectionable except that the label ''*de dicto* necessity'' is sometimes used rather vaguely, without due notice of the fact that it can cover a variety of underlying conceptions, including the now familiar approach on which the ground-level explanation of necessary truth is a matter of the truth at all times, or in all possible worlds, or the like, of the relevant assertoric proposition, as well as any approach based simply on a primitive notion of necessary truth, or the more properly copulative approach on which the primary explanation of necessary truth is a matter of the essential con-

nection between predicate and subject (as, for example, when they are related as genus to species). Some of these ways of looking at necessary truth are more appropriate to Aristotle than others.

On the other hand, the modal copula is often taken up into the predicate, as opposed to the subject, of the initial proposition. This is entirely harmonious with the ancient and modern idea of the "sign of predication" being included in the predicate [cf. *De Interpretatione* (*De Int.*) 3, 16b6–25), and also with the practice of including everything but the ontological subject (the kitchen sink, say) in the predicate, so that the subject term serves simply to designate those items to which the predicate applies. It is then a short step, especially within an essentialist context, to the familiar idea of "necessary properties" being predicated of subjects, where modality now becomes a part of the predicate term proper.[25] Of course, there is at the very least a syntactic distinction between a modal predicate term ('necessary-Animal') used with a plain copula and a plain predicate term ('Animal') used with a modal copula ('necessarily applies'). But ordinarily neither this distinction nor its possible implications are thought worth pursuing in the literature on Aristotle's modal logic, so that his modal copula winds up in this case as part of a modal predicate.

This is not to say that either of these ways of reading a modal copula is in itself an error. The point is rather that it has become almost standard to approach Aristotle's modal logic in terms of a supposedly exclusive modal *dictum*–modal predicate dichotomy. And this does seem to me an error. In any event, one essential tenet of the interpretation of Aristotle's modal logic offered here is that for a variety of important reasons the modalized copula reading must not be assimilated to either of those approaches. For one thing, the obvious syntactic differences among modal copulae, *dicta*, and predicates are of great importance for revealing how Aristotle represented to himself the structure of his many arguments for the validity of conversion principles and syllogisms. And the aim here is not just to obtain end results that tally with Aristotle's, but to be able to think through Aristote's discussions and arguments from the inside. It will be argued that certain syntactic properties of representations in terms of modal *dicta* or modal predicates preclude that possibility.[26]

At the same time, the importance of the underlying semantics for Aristotle's modal logic hardly needs emphasizing, and it will be a major aim of the reading developed here to show precisely how the background distinction between essence and accident, and the theory of the "four predicables," inform his invention of modal logic in *Pr. An.* A.3 and 8–22. So the "modal copula" approach defended here should be seen as in-

volving both syntactic and semantic components, where the former should reflect the latter.

1.2. MAIN THEMES OF THIS WORK

As remarked earlier, the idea of a modal copula is far from new. More important, but generally unnoticed, is the fact that the modal copula reading of Aristotelian necessity (and other modalities) is itself already ambiguous between two interpretations. One sort of *de copula* (or *cop*, for short) reading asserts a definitional relation either of entailment or exclusion between its subject and predicate *terms*, where (Aristotelian) definitions are accounts of the natures or essences signified by such terms rather than of the meanings of linguistic subject and predicate. On the other *cop* reading, a necessity proposition asserts a necessary relation between its own predicate term and the items referred to by its subject term, where those two terms themselves may or may not bear anything more than an accidental relation to one another. The latter type of *cop* necessity would include 'Cat necessarily applies to all Things on the Mat', which simply asserts, of whatever things may be on the mat, that they are necessarily feline; no necessary connection is asserted between their being on the mat and their being cats. The former sort of *cop* proposition includes 'Animal necessarily applies to all Human', where (1) the predicate P applies necessarily to whatever falls under the subject term S (as with the cat-on-the-mat case just considered), and (2) being P is entailed by what-it-is-to-be-(an)-S.

The origin of the distinction lies simply in the fact that some properties of a thing apply only accidentally, and others essentially, to it. Thus one might pick out certain objects (Socrates, Coriscus) by reference to one of their accidental properties, then predicate of them some one of their essential properties (as in 'Animal necessarily applies to every White Thing on the Mat'). In the other sort of case, one uses as subject term some essential property of the subject, then predicates of that subject another of its essential properties, as in 'Animal necessarily applies to every Human'. In both cases it is true that the predicate applies necessarily to the designata of the subject term. But in the former case there need be no essential connection between the predicate and subject terms themselves ('Animal', 'White Thing on the Mat'), whereas in the latter there is a connection either of entailment or exclusion between the terms ('Animal', 'Human'). Again, the possibility of two readings of modal propositions –

or of two sorts of truth conditions of such propositions – arises directly from Aristotle's distinction between accidental and essential properties of a thing.

I shall refer to the former sort of statement as "weak *cop*" necessity (written '*A N_w* all *B*') and to the latter as "strong *cop*" necessity (written '*A N_s* all *B*'). '*A N a B*', with no subscript, is neutral among all the possible readings of Aristotle's statement. Thus it results, among other things, that there will be eight basic necessity statements, where before there were four (e.g., instead of just '*A N a B*' we shall have '*A N_w a B*' and '*A N_s a B*'; these are included in the complete list of modal propositions in the Appendix).

The following chapters will defend this weak/strong necessity distinction – and its analogues for other modalities – by showing that both *cop* readings are thoroughly Aristotelian in a way in which modal *dictum* and modal predicate readings are not. By the same token, we shall see that the two *cop* readings give rise to logical results very similar to those for *de dicto* and modal predicate interpretations, which helps explain the persistence of attempts to read Aristotle in one of these two ways, or in terms of a vacillation between them. It will also be argued, however, that there is a fundamental connection (besides the obvious syntactic one) between the two *cop* readings, a connection based on Aristotle's essentialism and one much closer than any evident connection between *de dicto* and *de re* propositions – which will help explain how Aristotle could have unwittingly incorporated two readings of modal propositions.[27]

With regard to that basic division among commentators ("vacillates between *de dicto* and *de re*" versus "uses consistently only one reading of modality"), this means that the view to be developed here has something important in common with both camps. Like the first, it finds a basic ambiguity in Aristotle's modal propositions; like the second, it finds a strong underlying unity in the system. It differs from most representatives of both in basing itself from the start on connections between Aristotle's logic and his metaphysics and also in denying that the inclusion of two readings of modal propositions is in itself a defect in the system (an "inconsistency" or a "vacillation," and a blot on the good name of the Master). This is not to deny either that Aristotle ought to have recognized the ambiguity and worked out its implications or that the presence of semantically ambiguous propositional forms is a defect in the system as it stands. The point I wish to emphasize is rather that his system *should* include both sorts of readings if it is to express what *he* wants to express, given his metaphysical essentialism and the dialectical, philosophical, and scientific purposes for which he devised the system. As we just saw, there

are two basic types of situation in which, say, a universal affirmative necessity proposition ('*A* necessarily applies to all *B*') will be true, two situations in which the predicate does apply necessarily to the subject: one in which subject and predicate themselves stand in some essential relation to one another, and one in which they do not. The crucial point is that Aristotle formulates and reasons about both sorts of cases in *Prior Analytics* A not because he negligently failed to hold on to any one reading (as if he ought to have devised a system that, like modern propositional modal logic, and, apparently, like Theophrastus' system, used only one sort of necessity proposition) or because his necessity propositions, like their counterparts in modern English, simply are in fact open to two kinds of readings, but rather because his essentialism already implies two important types of truth conditions for propositions of necessity. And these require in turn two distinct, if closely related, ways of asserting a necessary connection between subject and predicate. Thus the inclusion of necessity propositions of two different types, or the reading of such propositions in two ways, is not in itself a mistake from which interpreters should try their best to rescue Aristotle, but is entirely correct and even necessary if all the essentialist facts of life are to be expressed and reasoned about.

But this means that even those who do correctly find a basic ambiguity in Aristotle's modal propositions may yet be faulted on other important grounds. First, they have tended too quickly to identify those readings with traditional *de dicto* and *de re* conceptions of modality. Second, they have often concerned themselves too narrowly with the project of identifying where one reading or the other is required to make things work out as Aristotle wants, rather than demanding to know *why* two readings – and why *these two in particular* – show up in an Aristotelian modal logic, and how they are at bottom related to one another.

In sum, the interpretation to be developed here holds that (1) Aristotle's modal propositions utilized modal copulae rather than modal predicates or modally qualified *dicta*; (2) the *cop* reading represents an alternative distinct not only syntactically but also semantically from both of these now more familiar conceptions; (3) neither the modal predicate reading nor modal *dictum* reading represents a genuinely Aristotelian understanding of propositions of necessity, nor is the more general contrast between predication of *dicta* and of *things* appropriate to the Aristotelian modalities; (4) the *cop* reading lends itself naturally to two genuinely Aristotelian readings in a way that helps reveal their underlying unity even as it explains the appearance of vacillation between *de re* and *de dicto* modality; (5) the *cop* reading, in both its Aristotelian versions, arises from facts about Aristotle's essentialism – above all, the basic contrast between es-

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sential and accidental properties – and is closely tied to leading ideas of
the *Categories* (in particular, about the ten kinds of things there are and
the main types of relations among them), the *Topics* (the ten categories
of predication and the "four predicables"), and the *Posterior Analytics*
(the theory of scientific demonstration and of *per se* predication).

The task in the following chapters is to work out and defend these
claims in detail, specifically in relation to Aristotle's treatments of con-
version (both "term" and "qualitative" conversions[28]), of modal syllo-
gisms of all sorts (including the celebrated two Barbaras[29]), of
"ampliation,"[30] of scientific demonstration (in its relation both to neces-
sity and to two-way possibility propositions), of the temporality of modal
propositions, of the "completeness" or "perfection" of modal syllogisms,
and a host of more local curiosities. In the end it will be possible to lay
out more formally a consistent modal system incorporating both weak and
strong *cop* necessity and their counterparts for the other modalities. But
my goal is not so much to produce a formal model of the system as to
determine why Aristotle devised a modal logic in the first place; how, in
full detail, this logic is built up and how it works; how and why his
treatment in the *Prior Analytics* fell short of realizing some of his own
larger aims; and how the principles and insights there introduced might
yet provide an adequate basis for the essentialist logic of the *Categories*,
the *Topics*, the *Sophistical Refutations*, and the *Posterior Analytics*.